Status and New Beginnings; Archaeozoological research into the Early Medieval rural settlements of Northwest Switzerland

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CONTENTS

Abstract
The Early Medieval period in Europe sees the start of the formation of the land boundaries which are today considered modern Europe. This is a period of great change throughout Europe. Most significantly the Roman Empire is collapsing (Drack, 1979).

The 'Romanisation' of the region is heavily studied and relatively well understood as it appears to be for the rest of Europe (Flutsch et al. 2002). However the withdrawal of the roman administration of the region is less well studied, until recently, very little in the way of evidence for early medieval period settlements were available. Settlement sites were largely unknown until the work of Marti (1996, 2000) and Windler et al. (2005). This was in part perhaps to do with the less visible archaeological finds, wooden buildings, small and disparate settlements. This lack of information was further hindered by the paucity in historical sources in the region. Although, a large body of evidence of the early medieval peoples in the region of North West Switzerland exists, data mostly derives from the excavation of grave finds and burial sites (Martin 1991).

This study looks at rural life from the hinterland of Basel in the Late Roman and early Middle Ages (4th – 12th Centuries) through the archaeozoological data. The main points to take from my study are firstly that different site types; urban, rural and castle (high status) seem to have consistently different patterns of the three main domestic species through time and across a wide geographical range.

The changing stature of cattle from the late Iron Age to high medieval is also something that has an interesting progression with increases in stature during the Roman period and a decrease thereafter. Previous work by Breuer et al. (1999) touched on the subject when comparing Roman material to that of later sixth/seventh Century material from Scheitheim. Whilst these results showed a decline from the Roman cattle to the early medieval, the results produced here suggest a more complex stepwise decrease in the cattle size from the fourth Century onwards. Each step can be accounted for by a major change in the structure of society at the time. Firstly, the departure of the Roman administration and military from the area, the second change occurs with the influx of Frankish and Alammanic tribes from the Eastern banks of the Rhine. The last change observed in the data in the eighth/ninth Century which could coincide with the uptake of the manorial system.

The third topic is the attempt to follow meat supply in an urban context, namely Basel which during the later periods of the study has material from low status areas, craftsmen and high status areas. These show interesting patterns although this part was no more than a first step.

This work then clearly shows that there are differences both between and within the different site types and archaeozoology can clearly help in the understanding of settlement dynamics in complex societies, even with the absence of written sources within many of the periods and places studied in this work. This can occur through the study of husbandry and agricultural practices but also the social history of a site or region.

1. Introduction

1.1. Brief historical setting

The Early Medieval period is a time of great change throughout Europe especially considering this is the beginning of the formation of the land boundaries, which are today modern Europe. The most significant agent of this is the collapse of the Roman Empire. What was once stable and regulated during the years of the Empire revert back to the years of instability and independence due to the Military and high level administrative personnel, probably the rich landowners are being returned to Italy. This is to help, respectively, protect and serve the country from internal struggles for power and also from the 401 AD invasion from the East by Visigoths led by Theoderich, king of the Ostrogoths and official governor for the eastern Roman emperors. During which time he also took the Alamannii under his protectorate against the expanding Frank realm (Drack, 1979; Marti 2000, 299-303 Windler *et al.*, 41-54). This early medieval period is also a time of migration of people from the East to the West. For example the Franks and Alamannii are moving across the Rhine into modern day France and Switzerland respectively. The Angles, Saxons and Jutes are moving from Northern Germany and Scandinavia into the eastern parts of Great Britain. The movement of these peoples also transported with them their own cultural identity. In North-western Switzerland this migration is observed through the changing of place names (Marti 2000, 308-360) and grave goods (Martin, 1976 and 1991).

Another important transformation was the development of Manorialism or Seigneurialism. This caused major changes to the structure of early medieval rural organization. It was an essential ingredient of feudal society, and was the organizing principle of rural economy that probably originated in the Mediterranean villa system of the Late Roman Empire (Sarris, 2004). Manorialism was characterised by the vesting of legal and economic power in a lord, supported economically from his own direct landholding and from the obligatory contributions of a legally subject part of the peasant population under his jurisdiction. These obligations could be payable in several ways, in labour, in kind, or, on rare occasions, in coin. It was widely practiced in medieval western and parts of central Europe, and was slowly replaced by the advent of a money-based market economy and new forms of agrarian contract.

In examining the origins of the monastic cloister, Walter Horn (1975, 41) found that "as a manorial entity the Carolingian monastery... differed little from the fabric of a feudal estate, save that the corporate community of men for whose sustenance this organization was maintained consisted of monks who served God in chant and spent much of their time in reading and writing." Nor did lay lords rendering military service or again, cash in lieu to their superior necessarily hold manors. In England, according to the Doomsday book in 1086, a substantial share belonged directly to the king, and religious institutions, such as monasteries, held an even larger proportion.

It also saw advances in agriculture such as the open field system. This was in part due to the re-introduction of the heavy plough, used in Roman agriculture to turn heavy soils, the likes of which are found in many areas of Northern Europe. This instrument also improved agriculture by allowing ditch and furrows to be formed in the field and this allowed deeper planting of crops and better aeration of the soil. Alongside these changes a move from a two-field system of agriculture to a three-field system was instigated, thus allowing for a yield of greater quantities from existing areas of land.

Manorialism died slowly and piecemeal, along with its most vivid feature in the landscape, the open field system. The last feudal dues in France were abolished at the French Revolution. In parts of Eastern Germany, the *Rittergut* manors of Junkers remained until World War II (Spenkuch 1999, 375-403).

Medieval settlements were densely populated, with large zones of unpopulated countryside in between. In the eleventh century, people began to move outward into the unused areas of countryside, in what is known as the 'great clearances'. During the High Middle Ages, forests and marshes were cleared and cultivated. Crusaders expanded to the Crusader states, parts of the Iberian Peninsula were re-conquered from the Moors, and the Normans colonized southern Italy. These movements and conquests are part of a larger pattern of population expansion and resettlement that occurred in Europe at this time (Bartlett, 1994).

Reasons for this expansion and colonization include an improving climate known as the medieval warm period allowing longer and more productive growing seasons. The end to the raids by Vikings, Arabs, and Magyars resulting in greater political stability and reforms of the Church in the eleventh century further increasing social stability also contributed. Whilst the advancements in medieval technology such as better ploughs allowing more land to be farmed. The bonds of serfdom that tied peasants to the land began to weaken with the rise of a money economy. Able to attract peasants with the promise of freedom, urban centres began to grow in size. Population naturally increased as new regions were settled, both internally and externally.

1.1.1. North-west Switzerland: an Overview

The 'Romanisation' of the North western Switzerland region is widely studied and relatively well understood similarly to other areas in North Western Europe (Drack and Fellmann 1988; Flutsch *et al.*, 2000). The archaeozoological view of 'Romanisation' tends to be consistent throughout the empire from as disparate a places as the United Kingdom, France and Switzerland. In Northern Europe changes include an increase in cattle, horse and chicken proportions of the represented domestic fauna (Deschler-Erb *et al.* 2000; Luff, 1982). Frequently an increase in the stature of livestock is also observed (Albarella *et al.* 2008; Audouin-Rouzeau, 1991; Breuer *et al.* 1999, 2001; Dobney, 2001; Maltby 1981 and Peters, 1998). Intensification and specialisation in butchery techniques are also noted (Deschler-Erb 2007; Lignereux and Peters 1996; Maltby 1984). The archaeozoological data from the Roman period of the region show a species representation that is typical of large Roman conurbations, a high proportion of cattle, and a relatively high proportion of chicken remains (Deschler-Erb 1991; Schibler and Furger 1988). The Roman agricultural and trade systems were reliant on large numbers of cattle for draughting both on farms and within the cities. These changes are brought about by the more complex society structure of the Roman world which needs a greater degree of centralisation and standardisation in administering the effective running of large urban centres (Albarella 2007; Furger, 1996). These types of large urban conurbations had rarely been seen previously in Northern Europe.

The dissolution of the Roman Empire in North-western Switzerland is less well studied, until recently, very little in the way of evidence for early medieval period settlements were available for investigation. Although a large body of evidence of the early medieval peoples in the region of North West Switzerland existed, this relied mostly on the analysis of grave finds and burial sites (Fellman-Brogli 1992, Martin 1976 and 1991). Settlement sites remained largely unanalysed until the work of Marti (2000) and Windler *et al.* (2005). This was in part perhaps to do with the less visible archaeological finds, wooden structures, small and disparate settlements. This lack of information was further hindered by the paucity in historical sources after 401 AD in the region. These aforementioned works though show that there has been continuity of settlement in the region from the late Antiquity and into the early medieval period, probably by the indigenous Gallo-roman population. This is evidenced through the archaeological finds and pre- and non- Germanic place names. The influx of the Frankish population and establishment of Frankish settlements can be observed through the re-introduction of the interment of grave goods (Martin 1991, 114-115) and changing place and field names (Marti 2000, 324-327). The cemetery at Basel Bernering contained many graves that allowed a chronological and cultural classification of the grave goods, in which the high status grave goods suggest that the inhabitants of the cemetery had a great deal of influence on the surrounding countryside (Martin, 1976). The grave goods show that these people or the ancestors of the people had arrived in the region sometime in the sixth Century (Marti 2000, fig. 237) and probably lived in close proximity to the local population. Some of the rural settlements and villa farmsteads that made up the organised provisioning of *Augusta Raurica* and later the *Castrum Rauracense* remained working despite the upheaval around them (Marti 2004, 192, 204). Manufacturing processes, such as glass and pottery production from the *Castrum* at Kaiseraugst also suggest that there is a continuation in practices from earlier times (Marti 1996 and Fünfschilling, 1996). This also alludes to a continuation of Romance lifestyle and cultural identity. This then makes for a complicated picture of settlement dynamics with both continuity and transformation taking place in a similar time frame and perhaps even in the same places at the same time. There is evidence from the ceramic data that other Germanic populations are also colonising the area as in the latter part of the sixth Century. The Franks continue to colonise the region with numerous grave finds of Frankish influence found around Basel (Martin 1991, 49-50, 114-115 and 148). The influences in the grave goods suggest that the people have migrated from the right banks of the upper Rhine valleys probably the countryside north of Mains (Martin 1976, 181). Marti (2004, 191) suggests that this points to Frankish groups from Thuringia and Saxon being the likely instigators. Although close contact with Burgundy and Rhone valley is also intimated, by the three 'bein' buckles from early sixth century in the burial ground at Kaiseraugst, and a comparable piece from Basel-Aeschenvorstadt (Martin 1991, 114-15). This colonisation continued in to the seventh Century and many places were re-settled that last showed signs of inhabitancy during the second and third Centuries.

There is very little evidence of the early phases of the manorial system in North-west Switzerland. However, in the middle of eighth Century a classic bipartite manor is fully operational in St Gallen Urkunden (Goetz, 1989, 197-246). There is a relative lack of literary evidence from this time period to be able to form an understanding of the changes that are occurring in the social hierarchy. However there is archaeological evidence of more intensive use of the countryside and an increase in the clearing of the landscape. This generally involves the clearing of woods and unused landscapes in an attempt to exploit it for agricultural purposes.

1.1.2. Studied sites and their contemporary counterparts

The sites that have been studied here date from the late roman period at Kaiseraugst through the early medieval of Kaiseraugst, Reinach and Lausen in to the high medieval at Reinach and Lausen. The major cultural changes through this time have been outlined above and to a greater or lesser degree are observable in the archaeological finds in the sites analysed. There is a relative paucity of archaeological data from the early medieval period of the region and with it archaeozoological data. This then places the results presented for these sites in an important position in being an initial step in to understanding the economies and diet of the people from the area during the fifth to twelfth Centuries. Figure .1.1.2-1 shows the location of the studied sites (1 Kaiseraugst, 6 Reinach, and 7 Lausen Bettenach) alongside the contemporary sites from the third Century AD through to the late twelfth Century in Northwest Switzerland. Sites, of the same date as above, that fall outside of this region can be found in figure 1.1.2-2, these include sites in France and Germany. Table 1.1.2-3 holds the information and references for these sites. Many of the sites have multiple periods of habitation, however these are presented later in an archaeozoological context (c.f. §8.2 and table 8.2-1).

1.1.2.1. Kaiseraugst (Canton AG)

Kaiseraugst, formerly the *Colonia Augusta Raurica* and then *Castrum Rauracense*, was one of the most important places of the former Roman province *Maxima Sequanorum* and lies approximately 10 km east of Basel on the Western bank of the Rhine. Located on the border of the empire, *Augusta Raurica* was a prosperous urban settlement that increased in population from the first to the third Century AD. At its peak it is estimated that *Augusta Raurica* housed approximately 10,000 people (Schwarz *et al.*, 2006). Large networks of villa farmsteads (*villae rusticae*) from around the region were probably able to provision a settlement of this size. The city prospered for two centuries. The settlement was a major force in the region. Local and international trade can be observed with Spain and amphorae coming from North Africa (Asal 2005, 92). In the late third Century times became more violent with raids from across the Rhine becoming increasingly more frequent. This led to the construction of the *Castrum Rauracense*.

The fortified settlement *Castrum Rauracense* was built in the early part of the fourth Century. This 3.5 hectare garrison housed troops up until the winter of 401AD and probably housed the Roman authority and administration too. The *Castrum* succeeds *Augusta Raurica* as the major focus of the region. The insecure nature of the times, with raiding from Germanic tribes and civil war meant that the *Castrum* also protected the Romance population. New research suggests that there was an intensive settlement (*suburbium*) outside the walls of the *Castrum* (Berger 2005, 52). This alongside the collapse of the large villa farmstead system suggests that the population does not consider the everyday life of the region to be safe. Settlement also congregated along the travel routes over the Jura as these were protected by the military (Schwarz 2010, 13).

The *Castrum* was also the seat of the bishop of Raurici (Marti 2000, 295). Windler *et al.* (2005) also states that the important medieval towns in the Upper Rhine region are formed around the Episcopal seats of the Early Medieval period and earlier. Thus the settlement held a prominent place in the landscape. Then its importance started to wane. The documentary evidence of the time suggests that the Episcopal seat moved to Basel sometime between the fifth and eighth Centuries (Marti, 2000 295-298; Marti, 2004 32; Marti and Fellner 2005; Meier, 2005 132, Schwarz 2010, 26-34). This is probably due to the rise in status of the city of Basel helped by its orientation to the region of the Alsace, and with the development of the Birstalstrasse, thus profiting from a favourable communication and geographical location. This movement of trade and industry away from Kaiseraugst to Basel further causes Kaiseraugst to go from being the manufacturing hub of the region to a small village. Settlement and economic activity in the *Castrum* are still observed in the seventh Century and the political power probably is maintained too (Schwarz 2010, 35). However in following periods evidence becomes more meagre (Marti, 2000 266-271) and by the twelfth century, the *Castrum* was reduced to no more than a village.

The excavations were carried out in three areas of the *Castrum Rauracense* at Kaiseraugst (Fig. 1.1.2.1-1). Two areas are contained within the *Castrum* walls and a third smaller area from outside the walls. The two areas within the *Castrum* known as ‘Gasthof Adler’ and

‘Jakobli-Haus’ were excavated in 1989-1990 (Müller 1990, 87-91 and 1991) and 1994-1995 (Müller 1995, 71-77 and 1996, 95-105) respectively (Fig. 1.1.2.1-1(2)). The archaeological information from the ‘Gasthof Adler’ site was collected over two excavations and as many years. Müller (1991, 251-258) presents a more detailed report of the structures and finds mentioned here are mostly contained within settlement layers of mid fourth century to the late sixth Century date. Most of the faunal remains in the Jakobli-Haus site, as with the ‘Gasthof Adler’ site, are derived from settlement layers dated to the fifth and early seventh Century, using ceramic and coin finds (Marti, 1996). In the ‘Jakobli-Haus’ site, there is again a great deal of inter-mixing of material from Roman, medieval and modern periods so care needs to be taken with interpretation of the faunal remains. Müller (1995, 71-77 and 1996, 95-105) presents a more through analysis of the finds, structures and contexts than is needed here.

The third area that falls outside the *Castrum* ‘Fabrikstrasse’ was also excavated in 1990 (Müller 1991, 249). The ‘Fabrikstrasse’ excavation covered an area of approximately 370m^2. The relevant structures that correspond with the period studied here are 'grubenhäuser' that are dated to the twelfth Century much later than the studied structures inside the *Castrum*. These ‘grubenhäuser’ are dated to the period in which the settlement at Kaiseraugst has been reduced to a rural village. Again, Müller (1991, 249) presents a fuller analysis of the archaeological material and contexts than can be presented here

All the areas inside the *Castrum* are layered dark earth (fig. 1.1.2.1-2), which is often seen in many Roman and medieval urban contexts throughout Europe (Evans and Millet 1992, 225 and Siddell 2000, 35). This type of sediment and contained structures are very often very difficult to distinguish from each other. The residual finds and interwoven and overlayed structures from Roman, medieval and modern periods make dating of these contexts an extremely difficult proposal which is exacerbated by this dark earth phenomenon. The residuality observed must be taken in to account when discussion of individual fragments or small numbers of fragments takes place.

It should be noted here that dating of archaeological evidence from these excavations produce dates ranging from the late Roman period to early modern times within given single contexts (Müller, 1991 and pers. comms.). Dating within this paper is based on the dating produced by ceramic finds (Marti, 1996 and 2000). Whilst artefacts such as ceramic and coins, to a certain extent date themselves, the same cannot be said for faunal material and thus can be a problem in a context exhibiting residuality.

Residuality is a problem that occurs across most sites and all but the most securely sealed contexts. The problems and potential with residuality are discussed in detail by Evans and Millett (1992), and can be applied to the contexts within this study, most prominently the material from the sites at Kaiseraugst and Lausen. The problems with mixing of layers and thus residual material are small for Lausen and cannot be considered a problem. However, at Kaiseraugst with the dark earth, that is common in urban settlements across Europe, causing problems with elucidation of the stratigraphy and then further to this the mixing of the material makes it difficult to place contexts within a timeframe. For example, the 'Unterer humusbereich' from the 'Jakobli-Haus' excavation carries a ceramic dating of fifth to seventh Centuries but within this there is a proportion of almost twenty percent that is older material (Marti 1996, fig. 2 and 2000, fig 131). However it is hoped in later sections (§8.3.1) to show through the comparison of the faunal remains with more securely dated contexts is at least in terms of the faunal complexes similar to those of a similar dating (fifth to seventh Century). This would allow the use of this data in discussing the economy and husbandry of the region at least in terms of averages and descriptive statistics of the material as a whole, although the in depth analysis of single fragments and information from them cannot securely be employed.

1.1.2.2. Reinach (Canton Bl)

The excavation at Reinach unearthed a rural settlement that is about eight kilometres south of Basel in the Birs valley. The site has been occupied from the Roman period until today. There is evidence that the name of the settlement has its origins in late antiquity. The Roman villa estate was from inhabited the first Century AD but for a period during the third and fourth Centuries in intermittent use and until the fifth Century when there is brief period with very few finds, perhaps with the site being abandoned and then there is a resurgence of the settlement in the late sixth Century (Marti, 2004 194-195). The site also saw the construction of four kilns within the confines of the settlement. Marti (2004, 191-215) suggests that this could make the settlement part of a major pottery manufacturing network in the region alongside other settlements such as Oberwil and Therwil.

The Reinach excavation is split in to four areas, which are all distinct entities but all overlap to varying degrees chronologically (Fig. 1.1.2.2-1). The earliest re-settlement of the site occurs in the sixth Century and is located in the 'Gemeindezentrum' area of the excavation. A century or so later, the Stadthof and Altebrauerei areas are also re-settled. The Stadthof (including the Kirchgasse area) and 'Gemeindezentrum' areas run from their respective foundation points through until the twelfth Century. The Altebrauerei area is more fleeting, as the evidence of habitation is found only through to the latter part of the eighth Century. In the analysis here the Kirchegasse material will be include in the Stadthof area material unless specifically studying the areas by structure. All the material derived from the filling of pits most of which are thought to be 'grubenhaus' with domestic food remains. The expansion of the settlement radiates outwards thus negating the problem of residuality as differing structures rarely overlapped.

1.1.2.3. Lausen (Canton Bl)

Lausen is almost twenty kilometres South-East of Basel and was established as a Roman villa estate and showed continuous settlement from that time onwards. The site has a rural setting like that of Reinach. However, Lausen was a special site, from its inception, being firstly a terminal of a Roman aqueduct that few the city of *Augusta raurica* followed by the presence of Merovingian and Carolingian stone buildings, and a fifth/sixth Century sepulchral church. Lausen becomes perhaps even more prominent in the eleventh Century as at this time the settlement is thought to be one of the royal courts of Rudolph von Rheinfelden, duke of Swabia and the anti-king at the time of the investiture controversy (Marti 2000, 259). In the 13th Century the settlement was abandoned with the foundation of nearby Liestal.

The plan (Fig. 1.1.2.3-1) shows the location of the excavation in relationship to the modern village. The oldest remaining structures are levelled layers and track ways that can only be roughly dated to the late fourth to fifth Centuries. In the later sixth Century the construction of 'grubenhäuser' can be detected (Fig.1.1.2.3-2), as with Reinach the material derived from the fillings of these disused 'grubenhäuser' was domestic refuse. Some of these 'grubenhäuser' appear to have been filled relatively quickly after falling into disuse and can therefore be considered sealed contexts. However, the later 'grubenhaus' often overlap with the older structures and due to the restricted nature of the settlement a degree of residuality is observed in the ceramic remains unlike Reinach (Marti 2004, fig.5).

1.1.3. Contemporary sites

The contemporary sites to those at Kaiseraugst, Reinach and Lausen have been split into the settlement type, rural, urban and castle, in the figures above. The Roman cities have been included in the urban settlements here despite the definition of Roman urban settlements and medieval urban settlements being fundamentally different in the way that they would have been provisioned. The comparative data runs from the third Century through to the beginning of the thirteenth Century so that there should be sites that occur before and after the material studied here. This allows an idea to be formed of what occurs before and after the material in this study.

It has been previously mentioned that there is a scarcity of faunal data for rural sites in the region, with work from, Pratteln (Marti, in prep), Courtedoux-Creugenat (Putelat, 2005) and Develier-Courtételle (Olive, 2008) alongside the work from Reinach and Lausen presented here representing the Jura and the Northwest Switzerland. Outside of the region work in Berslingen (Rehazek, 2000), Schiers (Hartmann-Frick, 1975), Schleitheim (Rehazek, 2002) and Winterthur (Stopp, 2010) are rural sites in Switzerland, whilst outside the modern borders the sites from Karlburg in Germany and Lac de Paladru (Olive, 1993) and Potiers de Portout (Olive, 1990) in France are also presented here. The sites of Lausen, Lac de Paladru and Potiers de Portout are thought to be important points in the landscape and thus under the control of important landlords. Schiers is found in the mountainous canton of Graubünden and thus would be expected to have results that were not synonymous with those from the lowland regions.

The city of Basel is well represented by various areas of the city although there is no all inclusive literature about the changes in the faunal remains that are observed from the different area and different time periods. The different areas that have been studied have different social statuses and thus the composition of the faunal remains change accordingly. The sites from the Basel Munsterhügel is the site of the more important people of the region since the early medieval indicated by the Reischacherhof site (Morel n.d.), although it has been shown by Stopp (2009) that the site was probably the site was inhabited by the upper strata of late iron age society, before then. The sites that are found along the river Birs that ran through the centre of the medieval city, namely Barfüsserkirche (Schibler and Stopp, 1987) and Schneidergasse (Reich, 1995). These are thought to be the areas that are home to the craftsmen and poorer levels of inhabitants, this can be observed through amongst other things the evidence for a horner's workshop. There are also urban sites from further a field, with Zurich, Zug, Winterthur and Schaffhausen. Again these can be stratified by status.

There are also data points from many of the castle found in the region and further a field, again as with the urban settlements different castles have a different social status. Pasda (2004) studied this in here work on the castles of the Bayern region and differences observed in the high and low status castles. In Switzerland this can also be observed with the castle sites at Riedfluh and Oedenburg, which are situated in more marginal areas and thus the finds are not so fine as those that are compared to Altenberg and Frohburg.

1.2. Reasoning behind the project.

The study of the faunal assemblages from the settlements in the hinterland of Basel and Kaiseraugst contributes to a better understanding of these communities through:

i) Identifying changes in the economy and environment through time.
ii) Socio-economic and cultural changes through abundance of wild and domestic species, changes in carcass composition (varying quality of meat cuts) or systematic refuse deposition.
iii) Manufacturing and craft activities through specialist waste disposal as seen by horn, antler, leather and bone working activities.

With regards to specific questions for the all sites and time periods studied here. Evidence for changes occurring in the faunal remains with fall of the Roman Empire will be looked for. The introduction of the manorial system and intensification of agriculture could also affect the collection of osseous material in the seventh and eighth Centuries onward. The relative paucity of faunal reports from the early medieval in the region also means that it will provide first steps in understanding this period in terms of what people were eating and possible agricultural processes and husbandry. The rural sites of Reinach and Lausen also present results on the sites that would have been part of the supply network that provided the urban sites of Kaiseraugst and later Basel. These are not an extensive list of the topics that could be of interest with regards to the faunal remains recorded here. The site-specific questions that could be interesting to the study here include the changes in pottery at Reinach in the sixth and seventh Centuries. The building of stone structures and general investment of money in to the settlement at Lausen can also have an important bearing on the composition of the faunal remains at the site. The highlighting of new and relevant topics will be made as and when necessary within the following study.

However it must be borne in mind that there are important limitations when considering the results and discussions of this work. Firstly, many of the assemblages are small and therefore may not be considered representative of the actual activities that occurred at the site. Secondly, nearly all the material considered in this project is hand collected thus making direct comparison of data unreliable. Thirdly, these assemblages are part of ongoing work, which over time and geography has seen the involvement of many people and probably the use of varying excavation techniques.

2. Methods and Materials

2.1. Methodology

2.1.1. Recovery

Most of the faunal material recovered from the three excavation sites was hand collected. The exception to this was a small sample from the Reinach excavation. The context (B03263s) comes from the earliest material from the 'Gemeindezentrum' area and was recovered using standard flotation procedures. The sieved material is a small proportion of the total material and derives from a specific context, therefore is of limited value except in interpretation of the context from which this material came. Although this is also comparable in the sense that it will show what is missing from the hand collected assemblages and the survivorship of some of the small bones that are deposited in settlements.

Sieving from a single context allows a view into what maybe missing from the hand collected material but when it is carried out so sparsely, it permits no further detailed quantitative analysis on the data. This material is discussed at the very end of the results section, thus allowing the future interpretation of the data, when and if possible. The relative insecurity of the dating from Kaiseraugst also puts a question mark over the validity of analysing such a context other than to observe that which may be missed through hand collection.

Nearly all assemblages from this project are wholly biased by the collecting method towards larger species and elements. The remains of birds, fish and small mammals are likely to be under represented. This bias towards larger, more resilient bones makes comparisons between frequencies of major animal species challenging and in some cases may limit the value of the quantitative data. A detailed analysis of the small mammal and fish remains can only really be undertaken from the single sieved context at Reinach.

2.1.2. Electronic recording

The data from this project were recorded using two systems. Data were initially recorded into the Ossobook database system (Schibler, 1998), where a more detailed record was needed, i.e. taphonomy, butchery, pathology and tooth wear then paper *proformas* were employed and then manually typed into an access database that also incorporated the Ossobook data.

The manual entry of data into any system is always fraught with human error. Where possible in this project, error was reduced to a minimum, using systematic recording protocols but it is unlikely that such mistakes have been totally eradicated.

Archaeological and stratigraphic data supplied by Reto Marti (Kantonsarchäolog Kanton Baselland) was similarly stored in this Access database, thus allowing associated information such as dating, context type and other important archaeological information to be directly related to the faunal material.

2.1.3. Recording protocols

The partially subjective, qualitative data were recorded for each individual fragment regarding state of preservation, colour and the appearance of the broken surfaces (for example new/old, rounded/sharp). Additionally gnawing, burning and butchery marks were also recorded in a qualitative manor. Species identification was carried out using the reference collection of the Institute for Prehistory and Archaeological Science (IPAS), Basel University. The methodology related to the identification of specific fauna is discussed in greater detail below (§4.1.1). With respect to species counts, analysis concentrates on those structures, which have at least 150 identified bones, although others with lower values will be mentioned alongside these but will be marked with an asterisk (*) where appropriate. Similarly when referring to material grouped by date then 200 bones will be set as the level considered large enough to provide statistically safe samples.

Cattle, ovicaprid and pig tooth wear stages were recorded as designated in the Ossobook recoding manual (available at http://pages.unibas.ch/arch/archbiol/methodik/index.html under altersbestimmungen, 27th May 2010). Tooth wear stages of mandibular teeth of the above mentioned domesticates were also recorded according to the work of Grant (1982) to allow a comparison of methodologies. The methodology of Armitage (1982) was used to compile age groups of cattle horn cores. Dog tooth wear was also recorded following the scheme of Horard-Herbin (1997). Ageing of horse teeth used the data presented by Levine (1982). Mammal bones were given age categories dependant on the state of fusion of the epiphyses and also the porosity of the shaft (found in the altersbestimmungen table on the webpage mention above). Age data which are represented by more than thirty data points are considered statistically sound within the paper, in some cases those that are lower have been represented although marked with an asterisk in the relevant place to show that this is a small sample.

Measurements followed that of von den Driesch (1976), additional measurements for ovicaprids followed the work of Davis (1996 and 2000). Pig cheek teeth measurements followed those of Payne and Bull (1988). Withers height calculations followed those detailed in Matolcsi (1970) for cattle, ovicaprids by Teichert (1975), Kieswalter for horse (in Boessneck and von den Driesch 1974), and Harcourt (1974) for dog withers height.

The log ratio methodology used in this paper follows that of Breuer *et al.* (1999), thus allowing comparison with the previously published data. The highly fragmented nature of the faunal assemblages reported is such that large sample sizes for individual elements were not obtainable. These, already small samples were then divided by spatial and chronological sections to discern differentiation in either disposal or preparation practices of carcasses. This resulted in even smaller sample sizes. Once these samples become too small, sampling error may affect the results. In order to maximise the amount of information from these small samples, the log ratio technique as proposed by Simpson *et al.* (1960) was used to study the size variation of domesticates where there was insufficient numbers of individual measurements. Breadth and depth measurements were combined, again to increase the sample size and to follow the methodology outlined above and despite the suggestions of Davis (1996). The standards used for the log ratio measurements are taken from individuals housed in the reference collection at the IPNA in Basel (cattle: catalogue No.BS2431; Pig: catalogue No. 1446; and Ovicaprids catalogue No. 2266). The study of chicken size variation used the methodology as put forward by Clavel *et al.* (1996). The statistical significance of the biometrical differences were observed where relevant using the Mann Witney *U*-test. Only samples of greater than 20 data points were employed in the analysis.

Butchery marks were recorded for each element using a method designed to give the most precise description possible. The strength of mark, repetition, position and angle were recorded. The position was recorded using three dimensions, so the area of the bone (e.g. proximal, distal or midshaft) surface (e.g. anterior, posterior) and the position on that surface (e.g. lateral, medial, central) were recorded. Where marks were difficult to describe with just one term combinations of terms were used. This methodology removes the need for large numbers of diagrams on which to record the butchery marks, whilst still trying to keep the precision and accuracy of the diagrams. It also allows a more quantitative approach to the analysis of butchery methods than in the past. Statistically the number of marks recorded per site and time period is low and thus it is hard to get a statistically robust sample for comparative purposes and also the elucidation of butchery practices through time. A sample size similar to that of the represented body parts would be needed for this kind of analysis. A sample size of two hundred butchery marks has been set as a guide to be able to analyse change in butchery techniques over time.

Pathology was recorded as descriptively as possible and differential diagnoses were suggested where possible. The descriptive language was kept as close as possible to that used in skeletal morphology, as this tends to give a much more thorough and consistent description. Although the diagnosis of pathology avoids using anthropological terms as this can cause confusion within a zoological framework. Often the same terms that are used in both anthropology and veterinary medicine describe different diseases. The discussion of pathology in the terms of changes through time is not possible here as the numbers recorded of specific types of pathology are so low that the statistical representation of these will not bear up to analysis.

2.2. Materials

The animal bone assemblages recorded and analysed in this project are to be found in the following places: Kaiseraugst material will be stored with Augst/Kaiseraugst Kantonarchäologie department. The Reinach and Lausen material will both be both stored in the Kartonarchäologie Baselland store in Liestal.

The sites to be studied here have been referred to in terms of the archaeological information that is known about them in the introduction. Here the bone assemblages will be introduced. The information here will expand on that from the introduction to be more relevant to the faunal remains that have been found within each site. The tables of structures and the numbers of bones show all bone material that has been recovered. Later species analysis concentrates on those structures, which have at least 150 identified bones, although others with lower values will be mentioned alongside these but will be marked with an asterisk (*) where appropriate. Similarly when referring to material grouped by date then 200 bones will be set as the level considered large enough to provide statistically safe samples. The total bone material from all sites consists of 31772 fragments of osseous material weighing 509.82kgs. The material in most cases appears to be from food waste although the analysis in this work will shed further light on the different processes and crafts that may have contributed to the accumulations of bone.

2.2.1. Kaiseraugst

The faunal remains analysed here, 7833 fragments weighing 160.16kg, are from excavations that were carried out in three areas of the *Castrum Rauracense* at Kaiseraugst. Two areas are contained within the *Castrum* walls and a third smaller area from outside the walls. The two areas within the Castrum known as 'Gasthof Adler' and 'Jakobli-Haus' were excavated in 1989-1990 (Müller 1990, 87-91 and 1991, 251-258) and 1994-1995 (Müller 1995, 71-77 and 1996, 95-105) respectively.

2.2.2. Lausen

The material from Lausen is by far the greatest proportion of the total bone fragments and weight. There were 14328 fragments recorded at a total weight of 296.04kg (table 2.2.2-1). The material analysed here is only part of the extensive bone deposits excavated at the site. However the most accurately dated and largest datasets have been recorded and analysed here, this then allows for the retrieval of the maximum information from the material in the shortest times, as time constraints meant that it was impossible to record all the bone material. At Lausen there are no discernible separate areas of the settlement either through time or contemporaneously thus horizontal analysis can only be carried out using the different structures within a single time period (Fig. 1.1.2.3-1)

2.2.3. Reinach

The majority of the material derived from the filling of the excavated pits, thought to be 'grubenhaus' with domestic food remains. The faunal remains from all three sites comprises of 9561 fragments (53.62 kg), of this over 2000 are derived from the sieved remains from 'grubenhaus G2' from the ''Gemeindezentrum' area and a further 84 from a partial cattle skeleton from 'Grubenhaus S6' in the 'Stadthof' area (table 2.2.3-1).

There are three areas to the excavation, as mentioned previously. The 'Altebrauerei' area is the smallest and shortest enduring part of the settlement. However there are 1507 fragments (6.26 kg) of bone analysed from five main structures (Fig. 2.2.3-2). The material from the 'Gemeindezentrum' area of the Reinach excavation spans a six hundred year time period with

26 different structures of varying size and use (Fig. 2.2.3-2). The total material from this area weighs 22.86kg and consists of 6352 fragments including those from the sieved material. Finally the 'Stadthof' area, which includes the material from the Kirchgasse excavations, contains 1702 fragments (24.50kg). This area of the excavation has twenty-one structures in six time periods and covering 500 years, although there is sparse or no information from the eighth and tenth Centuries in this area of the excavation (Fig. 2.2.3-3).

The expansion of the settlement radiates outwards thus negating the problem of residuality as differing structures rarely overlapped. The dating of the structures is provided thanks to the work of Reto Marti and is published in several works (Marti; 2000; 2004).

- *Partial skeleton*

The partial cattle skeleton, mentioned above, consists of a section of the vertebral column from the thoracic region to the sacrum, a large number of ribs and fragments of pelvis. There were also parts of the head, both skull and mandible. Although it appears that the limbs were missing except fragments of humerus and some phalanges (table 2.2.3-4). This data has not been included in the analysis of the rest of this work such a large proportion of cattle bones can bias the data, especially considering the small sample sizes that are being worked with at the Reinach excavation. There are possibly other partial skeletons within the assemblages here that have not been recognised. It is also highly likely that the assemblages contain numerous fragments from single elements and numerous elements from a single skeleton, however it is difficult to ascertain these in such fragmented assemblages and as is argued in a later chapter (§4.2) that this is an accepted flaw in archaeozoological statistical analysis.

This chapter then sets out the general recording methodology that has been employed in the identification portion of the project and also the general information about the osseous material that has been handled in the course of the project. In the following chapters the analysis of this recorded data is presented. Firstly the taphonomic processes, the forces that alter the composition of the material, post deposition is discussed, and then once these biasing factors can be taken in to account, analysis of the material in terms of species, husbandry and food remains can be considered.

3. Taphonomy

Taphonomy considers the alteration of bone assemblages in order to make inferences about processes and modifying agents during the transition from the living animal to the desk of the researcher. Much archaeozoological analysis relies on the assumption that the assemblage being examined is the product of past cultural activities and not secondary factors, such as trampling, weathering, gnawing and re-deposition. These processes tend to distort the assemblage frequencies. However, some of these alterations tend to happen in a more or less predictable fashion (c.f. Ioannadou, 2003; Nielson-Marsh *et al.* 2007, fig.7).

Those bones with a greater structural density tend to survive better than those elements with a low structural density in assemblages affected by destructive taphonomic processes (Smith *et al.*, 2007). This density related distortion will be affected by among other things; the soil's chemical and physical composition on to and into which the faunal assemblage is placed, the age structure of an assemblage, the degree to which scavenging occurs and soil surface disturbances (e.g. re-deposition and trampling). Sex, nutrition and breed can also have an effect on the elements that survive. The density of bone material is affected as males, females and castrates often exhibit differing body proportions and as such the same elements can have differing structural properties. Females also undergo lactation and gestation, which can reduce the calcium content of bones (Horowitz and Smith, 1990). The age structure of a species in an assemblage will affect which bones survive and which do not as immature bone is structurally less dense than adult bone although this not a linear relationship (Symmons 2002). It is also proposed that older animals also have less structurally dense bones due to there being reduced amounts of calcium in the bones (Perzigan, 1973).Winter periods with diminished resources also means that animals will have reduced fat supplies and fat plays an important role in the absorption of calcium and thus will also affect bone density. So, in an assemblage that is predominantly made up of those high structural density elements, the investigator must be aware that post-depositional forces are at work and tailor the conclusions accordingly.

Cultural changes that occur to the bones must also be taken in to account. Butchery, cooking and burning all lead to changes either to the structure or composition of the bone thus making it more susceptible to diagenesis. Digestion and gnawing can leave distinctive marks on the bone whilst also removing parts of some of the bones from the assemblage or leaving distinctive patterns of skeletal elements remaining. Tanning horn working, tool and ornament manufacture from bone raw material can also affect the skeletal elements that find their way in to the earth.

Environmental factors must also be considered at this point, weathering of bones that lay on the surface of a soil level leads to progressive cracking, splitting and exfoliation which have a definite influence on the survivability and the identification of the elements in a heavily weathered assemblage (Denys 2002, 474). These exposed bones are also more likely to be trampled. This will cause further fragmentation and to some extent bone loss, whilst the movement of the bone must be considered both in a horizontal and vertical plane depending on the substrate (Fiorillo, 1984).Transport by water is a further influence as a sorting factor, the movement of bones in water is dependant on both size and density (Denys 2002, 477). Alongside this water transport of bone can also cause abrasive damage.

Post mortem degradation of bone is dominated by the loss of structural collagen, this can occur through either chemical means i.e. hydrolysis, or biological means, through lytic enzymes. Although the latter appear to be rare in many soil micro-organisms, both fungal and microbial, if the results of Child (1995) are to be believed. The soil chemistry can also influence the degradation or preservation of bone. At both ends of the pH scale bone changes occur. Highly acid soils produce etched bones and teeth; the reaction time is almost immediate too. Highly alkaline soils also produce changes to teeth and bones but this process tends to occur over a longer period (both experiments in Fernández-Jarvo *et al.*2002). Soil composition varies greatly over small areas and as such it is difficult to understand the underlying mechanisms that cause taphonomic changes to the faunal material due to the soil chemistry and physical make-up. .Bioturbation by small burrowing animals and earthworms has been shown to move bones in an archaeological context as well as the former destroying the soil levels. It has been shown by Armour-Chelu and Andrews (1994) that earthworms can move some bones up to 30cm deeper. The diagenesis of buried bone is made up of a complex network of interactions between among other things; water exchanges, soil pH and pressure in early diagenesis. Previous modifications to the bones open them up to increased probability of future changes in the structure and composition of the bone. Time was thought to be an important factor in bone diagenesis (Von Endt and Ortner, 1984), however experimental evidence (Fernández-Jarvo *et al.*2002) suggests this is not necessarily the case.

3.1. General Analysis of preservation

The preservation of the numerous assemblages studied here proved variable, as might be expected in a project with such diverse contexts chronologically, geographically and structurally. However, the general analysis by site was remarkably consistent across the three sites. The majority of the bone fragments were recorded as well preserved (84.12%), with 14.64% recorded as poorly preserved, the remaining proportion was recorded as very poor (1.24%). Analysis by site (table 3.1-1) shows that the Kaiseraugst and Reinach assemblages had very similar proportions in all categories of preservation. Whilst the Lausen material has higher proportions of well preserved bone fragments than the other two sites. This result suggests that other inter-site taphonomic processes are more important than the structure type from which the material is recovered within these sites as the Lausen and Reinach material are recovered from similar infill of pit structures and Kaiseraugst material is derived solely from settlement layers. So it would perhaps be expected that the material from Kaiseraugst showed a differing degree of preservation to the two sites with similar circumstances of deposition and concealment. Within site variation is also observable, although in most cases is difficult to elucidate. It could be due to the different areas of the sites having varying functions and thus creating a heterogeneous mixture with respect to the differing states of preservation between different areas and structures. The agglomeration of refuse from different areas and differing crafts, in to communal waste pits or heaps will obscure different deposition processes and waste products produced from these differing areas and functions of the bones. However, these differing functions are often difficult, if not impossible, to see archaeologically.

3.1.1. Kaiseraugst

An analysis by date (table 3.1.1-1) suggests that the most poorly preserved assemblages occur in the mid fourth Century, fifth to sixth Century and twelfth Century periods. The reason these differences are seen can be explained by firstly, during the twelfth Century the intra-site taphonomy at Kaiseraugst tends to suggest that the material from outside the *Castrum* (48.57% well preserved) is far worse preserved than that material from within the *Castrum* walls (61.29%). Secondly in the earlier periods mentioned above there is also a degree of differential preservation within the two sites in the *Castrum* walls. The 'Jakobli-Haus' material shows better preservation in the comparable period (fifth-late sixth Century) when compared to that of the 'Gasthof Adler'. The reason for this difference is not readily recognisable from the archaeological and faunal data. However, the use of the area during this time period could be one of the factors. The 'Gasthof Adler' area was thought to have been an area of manufacture during the early medieval period of the Kaiseraugst settlement (c.f. Fünfschilling 1996; Marti 1996), whilst the 'Jakobli-Haus' area was derelict thus it is possible that there was less disturbance of the deposited material in the latter area as opposed to the inhabited 'Gasthof Adler' site.

3.1.2. Lausen

On the whole the material from the Lausen excavation is very well preserved (table 3.1.2-1). The well preserved material represents between 85-95% in any given period. The only exceptions to this are the twelfth Century material which has a lower proportion of well preserved bones (83.53%) and the eleventh Century material from 'Grube 19/52' (78.94%). However as stated above, this can still be considered a well preserved assemblage when compared to the proportions of well preserved material from the other sites. Comparison within a given time period is also possible for most periods but as mentioned previously the data is very consistent throughout. The one factor that could be important is that the majority of the contexts with poorer preservation are concentrated in towards the South-eastern corner of the excavation (with the exception of 'Grube 8'). Conversely this could just be an artefact of the statistical analysis carried out, as archaeologically there is nothing to suggest poor preservation in this region.

3.1.3. Reinach

Analysis of the intra-site taphonomic variation at Reinach on a purely geographical level tends to suggest that all three areas of the excavation are preserved similarly, the degree of well-preserved bones remains between 77-81% of the recorded material (Table 3.1.3-1).

However there is some degree of variation when considering the chronological aspect alongside the geographical position. For example, the ninth Century at the 'GMZ' site has a high proportion of well preserved bones (87.16%) whilst in the same time period the 'Stadthof' excavation has a proportion of well preserved bones of 72.25%. The converse is seen at the same sites in the eleventh Century where the 'GMZ site has a low proportion of well preserved bones (63.84%) compared to 83.97% at the 'Stadthof' site. The factors behind this variation are difficult to clarify. The most likely factor is fluctuating soil chemistry within small areas. This would account for variation in the preservation within different structures over relatively small distances. Having stated these examples it is also possible to see a degree of uniformity within the three different excavation areas too. The material throughout all periods of time does not differ hugely with well preserved material representing between 71% and 81% not including those exceptions stated above. For example, the seventh Century preservation data is very consistent, all data ranges between 71-75% of well preserved material. Also of note is the material the sixth century from the 'GMZ' excavation, here the material is remarkably well preserved (88.89% well preserved material) although there is no equivalent data from the other areas for comparison purposes.

These results from all three locations suggest that there is no evidence of strong diagenetic factors influencing the assemblages. Other factors, perhaps anthropogenic, are the more influential, when preservation is considered at the sites.

3.2. Fragmentation

The bone assemblages from all three sites are highly fragmented, probably due to a mixture of anthropogenic and taphonomic forces. A large amount of information about these forces can be gathered by studying the fragmentation of the bones, not only from what is present but also from what is absent. In this section, fragmentation is viewed from a taphonomic perspective, the anthropogenic factors, such as butchery (§5.2) and working of bone (§7.2) will be discussed in later sections.

Considering the fragmentation irrespective of species and date, it can be seen that small fragments from the shaft of long bones constitute the majority of fragments in the material (table 3.2-1). Although whole bones are well represented, here it is due to the fact that small cuboid bones are included in the material. These bones are dense and rarely broken down further by cultural practices or taphonomic forces i.e. phalanges, carpals and tarsals. Once the osseous material becomes broken down, either by taphonomic or anthropogenic forces certain elements of the material are more stable and thus better preserved than others. Small shaft fragments tend to be highly stable and thus better represented in many archaeological assemblages (Lyman 1994). Density also plays a large part in the survival of areas of the skeleton in an assemblage. Larger species with their relatively dense and more robust bones also tend to survive better in archaeological contexts that are ravaged by taphonomic forces (Ioannadou, 2003).

3.2.1. Cattle

Splitting the data by site, species and element shows interesting patterns of fragmentation. Cattle are the best represented of the larger domestic species at Kaiseraugst (c.f. table 4.2-1). Observation of the cattle data by element shows that density and stability influences which elements or parts of elements survive (table 3.2.1-1). Less than one per cent of the cattle humerii are complete. The humerus displays better survival of the denser distal end compared to that of the proximal, which is often poorly represented in archaeological contexts due to its fragile nature. However, both proximal and distal ends are less well represented than shaft fragments. The proximal end of the radius, which articulates with the distal humerus, has a similarly dense nature, and so also survives well compared to the less dense distal end. The shaft fragments are less dominant than seen in humerus but still better represented than other parts of the bone. There are also more whole radii than humerii although still only approximately three per cent are complete. Femur shows a predominance of shaft fragments as observed in the previously mentioned elements. None of the femur are complete, distal and proximal ends are both similarly represented again this appears to be density related. The shaft fragments are the best represented portion of the tibiae. There are also high proportions of distal articulations, again in relation to the areas of greatest density in this element. The metapodials show a different representation to other elements. There are higher proportions of whole elements in both metacarpals (12.86%) and metatarsals (8.79%). This is probably due to the fact that there is little meat value in these elements, thus are not so regularly butchered. Shaft fragments are less well represented than in other elements and the proximal and distal ends are similarly represented. The fact that similar proportions of all the part of the elements are present suggests that these elements may be broken down to extract marrow or that post depositional influences are causing the fragmentation of whole or partial elements discarded as waste. However the high proportions of whole bone would counter this argument. So the main taphonomic factor behind these patterns tends to be density mediated. The girdle bones, scapula and pelvis show similar density mediated survival as the long bones, although sample sizes are not sufficient to study these elements with any degree of certainty. The glenoid, spine, and the margins of the blade of the scapula survive better (Lyman 1984). The denser illium and to a lesser degree ischium of the pelvis also survive better than the less dense pubis and acetabulum (table 3.2.1-4).

The cattle data from Reinach shows a very similar density mediated pattern of fragmentation to that seen at Kaiseraugst (table 3.2.1-2 and table 3.2.1-4). The cattle elements from Lausen also show density mediated fragmentation of the assemblage (table 3.2.1-3 table 3.2.1-4). However, the higher percentages of shaft fragments for long bones compared to the previously mentioned sites and almost no complete elements, even with regards to metapodials suggests that a greater degree of fragmentation occurs. Possible causes of this could be greater amount of butchery, canid gnawing and also greater influence of destructive taphonomic forces. This later cause seems to have little influence as the state of preservation at Lausen is better than that at either Kaiseraugst or Reinach. Canid gnawing (§3.4) and butchery (§5.2) are discussed in later sections**.** However, due to the reduced size of samples it was not possible to observe changes in patterns of fragmentation through time and across excavations for individual elements.

3.2.2. Ovicaprids

Ovicaprid data has much reduced sample sizes than the comparable cattle data, and so interpretations may not be as solid as those for cattle. Although the ovicaprid data from Kaiseraugst with respect to fragmentation shows a similar pattern to that which is observed in cattle (table 3.2.2-1). The smaller stature of ovicaprids tends to mean that any destructive taphonomic forces have a larger effect on the bones than compared to cattle. This can be seen with the higher proportions of small shaft fragments of long bones when compared to cattle. Shaft fragments and the dense distal articulation dominate humerus fragmentation, the proximal articulation is all but absent. Ovicaprid radius fragmentation shows a large proportion of shaft fragments followed by the denser proximal articulation. Femur is again mostly shaft fragment, with a preponderance of proximal articulations also recorded. This is slightly different to the pattern seen in cattle, where distal and proximal articulations followed the density patterns and showed similar proportions of each articulation. The greater proportion of proximal articulations may display the greater proportions of meat from the hip joint compared to the knee, thus there is a greater economic value on the amount of meat from this joint when compared to the lower joint. Alternatively, this could also be an artefact of sample size. The tibiae show a high proportion of shaft fragments and a greater proportion of distal articulations compared to the proximal, again this fits well with the density gradient in the bone. The metapodials show a greater proportion of whole elements as with cattle. Although in the ovicaprids the proximal articulation is more predominant than the distal. This could be due to the affect of breaking the bone for marrow extraction. Also these elements are ideal raw material in the manufacture of bone tools and ornaments and have resulted in the removal of distal part of the bone for such processes. The flat bones also show similar density mediated patterns to those seen in cattle. Lausen shows similar patterns of fragmentation in all ovicaprid long bones when compared to those at Kaiseraugst (table 3.2.2-2), although fewer whole metapodials are observed here, again this probably relates to the increased fragmentation observed at Lausen.

The ovicaprids at Reinach show a much higher degree of fragmentation than is seen at Kaiseraugst, thus many more, small shaft fragments are observed in all long bones (table 3.2.2-3). The humerus shows that alongside large numbers of shaft fragments distal articulations are next best represented, again fitting with a density mediated pattern. Again shaft fragments dominate the radii fragmentation, although equal numbers of distal and proximal articulations suggests that density is possibly not a factor here, thus fragmentation may be caused by anthropogenic factors. The femur is highly fragmented and mainly shaft fragments are present. There is no evidence of proximal articulations although distal articulations are present. This may be an artefact of sample size or perhaps an anthropogenic factor, such as the butchered rump of ovicaprids are being dressed and sold to other markets. Conceivably this could be the reason for a greater number of proximal femur at Lausen, however this supposition remains purely speculative. Tibiae at Reinach show large proportions of shaft fragments with more proximal articulations than distal, this is the reverse pattern that would be expected from a density mediated survival, this again suggests that sampling error is involved or that anthropogenic factors are at work. This could be related to the preponderance of distal femur, seen previously and related to the butchering of the knee joint, here at Reinach. Metapodials display little sign in the way of whole bones and subsequent to shaft fragments, proximal articulations are also better represented. This could suggest similar marrow extraction interpretations to those suggested for Kaiseraugst. Table 3.2.2-4 shows that the ovicaprid girdle bones at Reinach are highly fragmented with almost all parts represented although those with the highest proportions are those which are most dense and thus resisting the forces of destruction post deposition. Again as with cattle fragmentation it is impossible to study these factors over time and through space because of the limited sample sizes for each element.

3.2.3. Pig

Pig humerii, radii, femora and tibiae at Kaiseraugst show a typically density mediated pattern of fragmentation (table 3.2.3-1). The metapodials are small and carry little nutritional value and are discarded as part of the whole foot, the trotter. Discarding of the trotters may take place either after the primary butchery or later after boiling and consumption. Either process causes little fragmentation of the metapodials. Fragmentation, if any, probably occurs after deposition. This is the reason that the metapodials are mostly whole at Kaiseraugst.

Similar patterns of fragmentation of pig long bones, including the metapodials are observed at Reinach (table 3.2.3-2). The degree to which fragmentation occurs is also similar, with analogous proportions of shaft fragments also observed. At Lausen however, a higher degree of fragmentation is recorded alongside the density mediated destruction pattern is observed in the long bones, (table 3.2.3-3). The proportions of shaft fragments noted are much greater than at Kaiseraugst or Reinach. Fewer whole metapodials are recorded because of the greater degree of fragmentation in the metapodials. Similarly to the long bones, the girdle bones also show comparable patterns to those at Reinach (table 3.2.3-4). A high degree of fragmentation, alongside the representation of all areas of the bone in proportion to the structural density, and likewise the various girdle areas is similar to the deposition circumstances at the two rural sites, both being deposited in pit structures rather than in the layers that are recorded at Kaiseraugst.

So in summary it can be noted, at all three sites, at least for the three main domestic species, and therefore the majority of the identified faunal material, that in most cases the degree of fragmentation follows the density gradient of the different areas of the long bones and where observable also the flat bones. Unfortunately, the data cannot be broken down further into chronological periods as sample sizes become smaller and thus prone to sampling error. This means that changes in fragmentation and the taphonomic forces that affect fragmentation cannot be investigated over time.

3.2.4. Proportions of identified versus unidentified fragments

A further way to analyse fragmentation is through the proportion of unidentified bone fragments. As bone elements become broken down to smaller and smaller fragments, either through cultural practices or taphonomic destruction so the number of recognisable landmarks on a given fragment is greatly reduced. Thus it follows that a highly fragmented assemblage will often have a high degree of unidentified bone fragments.

The material from the Kaiseraugst 'Jakobli-Haus' area exhibits similar results through all time periods (table 3.2.4-1). The structures within this area, whilst showing a greater variation, do not deviate so greatly as to indicate a change in the processes that are occurring to create these results (table 3.2.4-2). This then suggests that, at least for the 'Jakobli-Haus' area, similar cultural practices and even taphonomic processes are unchanging through time and space within this restricted area. The material from the 'Gasthof Adler' area is less consistent and thus more difficult to elucidate. However, it does show that the material from the fifth and sixth century levels are consistent with those from the 'Jakobli-Haus' area. Analyses of the structures show that both the levels F2/2 and F3/2 deviate vastly from the other levels, with the unidentified portion making up majority of the assemblages (table 3.2.4-2). The reason for this deviation is not immediately apparent, whilst other fifth and sixth Century levels show a degree of similarity with respect to the proportions of unidentified material. The latter twelfth Century material is different again (* see §2.1.3), most likely it is not due to a change in practices or taphonomic processes. The similarly dated material from outside the *Castrum* shows comparable results to those cotemporary sites within the walls. However, small sample sizes at both areas mean that these observations remain tentative at best.

The Reinach material in the 'Stadthof' area shows a relatively consistent level of unidentified bones throughout all time periods (table 3.2.4-3 and 4). The analysis of the structures is a little harder to elucidate as many of the assemblages contain small samples and thus may not be representative of the influences of taphonomy. The material from the 'Gemeindezentrum' area is a little more complex with the material from the sixth, ninth and tenth Centuries having similar proportions of unidentified bones whilst the seventh, eighth, eleventh and twelfth Centuries also exhibit similar proportions (table 3.2.4-3 and 4). It is difficult to gauge the level of unidentified bones in the 'Altebrauerei' area, as there is conflicting information from the different time periods, this is also reflected in the data from the different structures within this area (table 3.2.4-3 and 4).

The Lausen material appears to split into three different groups (table 3.2.4-5), those that are slightly under fifty percent unidentified, both the late sixth to late seventh and the late eleventh Century periods form this group. Those, which are slight above fifty percent unidentified consists of the eighth, ninth, tenth, eleventh and twelfth Century periods, and thirdly a group that is over sixty five percent unidentified. The early eleventh and second of the late seventh to eighth Century period make up this final group. However this pattern may indeed be an artefact of the data because the differences, at least between the first two groups, are relatively small and statistically no difference can be proven.

Selecting those time periods that have more than two structures shows that there is a considerable amount of consistency within these structures from the selected time periods (table 3.2.4-6). The late sixth and eleventh Century data are both very constant with the exception of 'Grube 7' (* see §2.1.3).

In summary the analysis of the proportions of unidentified bones in the assemblages adds further weight to the conclusions drawn when considering the fragmentation of the long bone elements. Insofar as the predominance of shaft fragments suggested a high degree of fragmentation of the bones, the proportions of unidentified bone fragments also suggest that the degree of fragmentation is relatively high. Kaiseraugst has the more intact bones and thus more identifiable bone elements, whereas Lausen has a greater incidence of fragmentation and thus an increase in the proportions of the unidentified elements. The proportion of unidentified fragments also allows a greater degree of analysis through time, although in most cases there is a consistency throughout these periods and across a given site in many cases and this again adds weight to the above analysis. Therefore it appears that the fragmentation of the bones from the sites analysed here is in the first case down to cultural practices, butchery and marrow extraction, which reduced the elements into a partial of fragmented state. Then once discarded the more important taphonomic forces work on these small parts and thus reduce the fragments further until relative stability is reached.

3.3. Burning

Burned bone is a common component of archaeological deposits traditionally associated with cremations, culinary activities, waste disposal, fuel use and a by-product of naturally occurring fires. Such interpretations assume responsible agents act upon bone prior to deposition or burial. Although, Bennett (1999) has suggested that thermal alteration of osseous material can occur post-deposition.

This section concentrates solely on the bones that have come in to direct contact with an intense heat source, most likely fire. This process leaves traces of carbonisation and calcination on the fragments of bone which are dependant on the temperature of the heat source and the position of the bone within or close to the heat source. Carbonisation and calcination can be observed through changes in colour and structural changes to the surface of the bone. There is a sequential change in the colour of bone with increased intensity of heat and reflects the decomposition of the organic and inorganic components of bone. Fresh bone follows a general progression from brown through black to grey-blue-white to white with increasing temperature of the heat source (Asmussen 2009). Identifying colour with the temperature of the heat source is problematic but as a guide the black colouration of bone (carbonisation) occurs at around 525 to 645°C and the appearance of the white colour of calcination at between 645 and 940°C although there will be the whole gamut of colour changes between these points (Shipman *et al.* 1984, 312-314). However, as noted by Buikstra and Swegle (1989) the measured temperature of the bone and that of the heat source is not always the same. Gross structural changes such as warping, checking and cracking of the bones after burning are also noted but the process surrounding these changes are not completely understood. Bone material is known to have been burnt as fuel and has been used in kilns as the heat produced by burning of osseous material is relatively high, stable and long lasting. Bones would also have likely been burnt with the burning of other domestic waste in refuse heaps.

3.3.1. Kaiseraugst

The burnt material from all areas within the *Castrum* walls shows a remarkable consistency in terms of quantity throughout time (table 3.3.1-1 and 2). This suggests that the taphonomic processes and/or the human activities pertaining to the burning of bone are stable throughout the periods under analysis here. The 'Fabrikstrasse' area outside the *Castrum* walls show a large proportion of burnt bone, however, this sample is quite small (n.=105) and could reflect the statistical uncertainties of small samples.

3.3.2. Lausen

As with the material from Kaiseraugst the burnt remains from the Lausen excavation also show a great deal of consistency, approximately 3% of all bone fragments through time and space (table 3.3.2-1 and 2). The one exception to this is the early eleventh Century material from ‘Grubenhaus 11’. However there appears no discernible archaeological evidence as to why this structure should differ in terms of burnt bone when compared to other structures. This then suggests alongside the relatively low proportion of burnt material, less than ten per cent, that there occurred a single or several deposits of burnt bone but not so frequent that this could be related to a process of any kind.

3.3.3. Reinach

The burnt material from the Reinach site is difficult to interpret, as there is variation in both horizontal and vertical planes (table 3.3.3-1 and 2). However, it must be stated that the variation is within a ten percent bracket that suggests that the variation is perhaps due to the statistical variation that maybe expected with such samples. However it should not be ruled out that the taphonomic complexities or any defined human activities within the settlement have caused this specific pattern of burning. Although the most likely conclusion to draw is that there have been single or few deposits of burnt food waste at various points in the settlement.

From a wider viewpoint, the proportion of burnt bone remains consistent (approximately 5%) not only within the sites but also between sites in all time periods, barring those exceptions mentioned previously. There appears to be no specific areas for specialist activities regarding the burning of bones (e.g. kilns or ritual) in any site or time frame. This low level of burnt bone probably indicates culinary activities that are common to all inhabited buildings or structures at the individual sites although this is very difficult to prove. However it could also indicate that the food waste is being spread evenly throughout the settlement area rather than accumulations being deposited in certain area or structures.

It must also be remembered that other cooking methods would have occurred in past times. Roasting of bones would also cause exposed parts of the bones to be carbonised. This can be observed in the previous work at Lausen by Hüster-plogmann, (1992, fig 38). However the unexposed parts of bone would likely remain unaffected, as Alhaique (1997) showed that the bones within a joint of meat rarely exceed 85°C in an oven of 200°C. This and the relatively short roasting times for joints of meat means that the effects of temperature on roasted bones are minimal. Likewise the boiling of bones either as a cooking process or for fat rendering leaves no visible traces on the bone. However, Roberts *et al.* (2002) have shown that histological changes occur with very long boiling times, much longer than conventional cooking practices. Unfortunately these changes mirror those of bone diagenesis in that loss of collagen, increased porosity and increased crystallinity occur, thus making it almost impossible to observe boiled bones in the archaeological record. Koon *et al.* (2010) recently refined a technique for assigning archaeological material to uncooked and cooked groups through a blind study of collagen fibrils with transition electron microscopy.

3.4. Gnawing

Gnawing traces can be indicative of specific species presence, even though no direct evidence (e.g. faunal remains) is identified with in a studied assemblage. The absence or at least scarcity of canid remains is a complex issue to disentangle. This is an issue that is discussed more fully later in this work (§4.2.3.2). Here only some of the factors will be mentioned with respect to this subject; the differential deposition of kitchen waste and dead house animals, the strength of bond between animal and settlement occupants (e.g. house dogs, stray dogs or feral dogs), ritual, and disease (Stallibrass, 2000).

Research into gnawing patterns shows that gnawing leaves specific traces on particular elements, in terms of fragmentation (e. g. position of fractures, flaking and flake scars), tooth grooves, mouthing marks and puncture marks (Stallibrass, 1996). The shallow markings of mouthing and tooth grooves may not always survive in an archaeological context that shows signs of heavy weathering or erosion. However, typical breakage and flaking patterns with puncture marks informs researchers that scavengers may have modified an assemblage.

3.4.1. Canid

Analysis of the bones recorded with gnawing traces shows that all excavation areas within all sites in any give time period present traces of gnawing (tables 3.4.1-1, 2 and 3). All gnawing traces, except where it is possible to distinguish rodent gnawing, are assumed to be those of canids, although later in this section (§3.4.1.3) the validity of this assumption is discussed. The 'Stadthof' area of the Reinach excavation shows the highest degree of gnawing throughout time and across excavations. The 'Stadthof' data shows throughout the period of the settlement the amount of gnawed material remains between 10-20%, the exception being the ninth Century data. The other recorded sites do not consistently show high values, in fact the only other site to exceed 15% is the 'Fabrikstrasse' excavation at Kaiseraugst (* see

§2.1.3). The high figure probably due to small sample size but possibly also to it being without the *Castrum* walls at a time of relatively low status for the settlement of Kaiseraugst and that dogs were scavenging food from waste heaps.

3.4.1.1. Reinach (table 3.4.1.1-1)

Starting at Reinach and the 'Stadthof' excavation and its consistently high gnawing traces, this could be due to the fact that as mentioned earlier the relatively high percentage of poorly preserved and rounded bones presumably means that the bones were exposed on the surface for long periods thus making it easily accessible to dogs scavenging for food around the settlement. The 'Altebrauerei' area at the same excavation shows very little (less than 3%) in the way of gnawing traces in the seventh Century material yet this increases to just over 12% in the eighth Century. The other taphonomic data that are comparable makes it difficult to find a reason for this change, other than the presence of a greater number of dogs in the later eighth Century material. However the relatively small sample of faunal material that has been excavated from this area may suggest that there is a degree of statistical uncertainty. Finally at the Reinach excavation is the 'Gemeindezentrum' area a relatively low frequency of gnawed bone (no more than 10%) is observed.

3.4.1.2. Kaiseraugst

The Kaiseraugst excavation shows variation in frequency of gnawing traces throughout time and horizontally (table 3.4.1.2-1). These differences are not so considerable but are difficult to clarify. The one discrepancy that could be explained is the difference between the material from outside and inside the *Castrum* walls in the twelfth Century. The other taphonomic data (rounding and state of preservation) suggests that the material inside the *Castrum* in better condition therefore may not have lain exposed on the surface and thus less susceptible to gnawing than those that are found outside the *Castrum* walls. However it must be borne in mind that the material from outside the *Castrum* is only a small sample and thus prone to deviations related to these statistical errors.

3.4.1.3. Lausen

The Lausen material shows a chronological change in the frequency of gnawing marks that have been recorded on the bones (table 3.4.1.3-1). The early periods show relatively low frequencies of gnawing marks however in the eighth to ninth Century there is a sudden increase in the proportion of gnawed bone. The majority of this material is found in the large faunal accumulations from 'grube 28.' This structure occurs at a time of great investment at the site and the finds from this structure shows that it was relatively important structure at the time thus increase in gnawing may indicate hunting dogs or perhaps pets scavenging food from the table of the relatively important people that are settled at the site. The figure then return to a level that is similar to those found before this time period which, given the increasing importance of the site during this period is difficult to put in to context given the above hypothesis. This pattern could suggest that the osseous material was not so available to the canids during the tenth and eleventh century periods but more likely is to be due to the statistical variation that can occur in such data sets.

Observations from the studied sites suggest that there is no direct link between the fragmentation and the frequency of gnawing marks. This is not to say that there is no effect of gnawing on fragmentation but that it is less important than other factors. It may also contribute to the fragmentation pattern that appears to follow the density gradient, as canids tend to gnaw on the softer and less dense portion of bone when given a choice.

Some of the gnawed bones may not be in fact gnawed by dogs as cats, suids, both domestic and wild, ovicaprids, small wild carnivores such as foxes, badgers and mustelids (Stallibrass, 1990) and humans (Landt, 2007) all have an opportunity to gnaw bones. There may also be opportunities for large carnivores such as wolves and bears to create gnawing traces but it is assumed that these will be in relatively very low frequencies within the confines of a settlement. Cat gnawing of bones probably occurs mostly in bones of smaller species up to and including pig sized animals (Moran and O'Connor, 1992). Pig or wild boar gnawing is also difficult to differentiate from canid gnawing, although possible (Greenfield, 1988), as these are omnivorous animals and when scavenging kitchen waste it is highly likely that the bones within that waste will be chewed and eaten. Human chewing of bones as with cat will probably be limited to the bones of smaller species and traces of human gnawing marks are notoriously difficult to differentiate from those of canids or suids. Landt (2007) has shown that the human tooth marks left on bone are identifiable and different patterning is shown. However the signatures left on the bone, i.e. pits and punctures are similar to that of other carnivores.

3.4.2. Rodent

There is evidence of rodent gnawing in low levels in both Kaiseraugst and Reinach, however there is an absence at Lausen (table 3.4.2-1). The higher percentages of gnawing tend to be evident in smaller sized samples and thus their high representation is due to statistical error rather than an increase in the number of incidents of gnawing. The gnawing evidence can show the presence of these animals even though they are absent in the species spectrum due to the hand-collected nature of the material and subsequent bias towards larger elements and thus animals. This is evident when comparing the remains of the sieved material to that which is hand collected. Many more rodent remains are found in the sieved material and attests to the presence within the sites, even though the majority of the data suggests that rodents are not present.

3.5. Other Minor Factors

There are many other minor factors that can cause distortion to the faunal assemblages analysed. Whilst these may not influence the results to a large extent, they cannot be wholly ignored in the interpretation of the data. Many of the effects of the factors listed in the tables (table 3.5-1-3) are not full understood why or how they occur. For example the bones of 'ivoried', greasy or chalky appearance are thought to be related to the cooking of bone material but the cause and affect are not understood. Changes in colouration to the bone are likely to be due to the chemical and physical components of the soil in which the bones are interred, although very often this occurs in an unpredictable fashion.

Kaiseraugst shows different patterns with respect to the area of the excavation is observed (table 3.5-1, 2 and 3). The Kaiseraugst 'Jakobli-Haus' excavation exhibits a large proportion of bones with algal growths and concretions adhering to the fragments (table 3.5-1). This fits well with the archaeological data that suggests this area is disused and many of the buildings had or were collapsing at the time of the disposing of the bone material. Thus once the faunal material was dumped in to this area, damp conditions would promote the growth of algae and also the adherence of rubble to the bone fragments. The 'Gasthof Adler' region of the Kaiseraugst excavation shows less evidence of concretions or algal growth (table 3.5-2). This may be due to the fact that the area was still an inhabited part of the settlement at the time. In fact there are little in the way of these minor factors affecting the faunal material. This deficiency of minor factors is also observed in the 'Fabrikstrasse' material (table 3.5-3).

The minor taphonomic traces at Reinach are also dependant on the position rather than chronological frame (table 3.5-4, 5 and 6). It can be observed that at the 'Stadthof' area there is very little in the way of these taphonomic traces (table 3.5-4). These consist of root damage to the bones, concretions on the bones and algal flora. Those time periods with large samples tend to show less signs of these taphonomic traces than the less substantial samples, thus it is difficult to say whether the proportions of these traces is due to the sample size or an actual taphonomic process. Strangely, there is no occurrence of the 'ivoried' bone that is present in the other areas of the settlement; perhaps the remains from these bones have been disposed of in another area of the settlement as this appearance is thought to occur due to the cooking of bone material. The poor condition of the bone from this area could also contribute too few of these factors being observed as the greater influence of weathering may expunge these minor traces from the material. The 'Gemeindezentrum' site at Reinach exhibits a relatively higher proportion of these traces, which could indicate different soil states between the two sites, different disposal methods or other lifestyle practices that can affect the bone material (table 3.5-5). In the eighth Century and later an increase in the number of bones with concretions can be observed alongside this an increase in the proportions of 'ivoried' bones can also be noted. This increase in the proportion of 'ivoried' bones is also seen in the 'Altebrauerei' area at Reinach, which occurs at roughly the same time period however is not related to an increase in the number of concreted bones so it appears that the two processes are not related (table 3.5-6).

Lausen does not show the large number of the 'ivoried' bone that is observed at some of the areas in Reinach instead there appears to be higher proportions of the 'greasy' type of bone (table 3.5-7). It is thought that these two types of appearance are related, whilst the 'ivoried' bone are at the opposite extreme of the process to fresh bone, the 'greasy' type occur somewhere along this scale. It also appears that only some bones show this greasiness and maybe related to a mix of the proportions of the organic component and the soil composition. Here at Lausen with the much larger sample sizes it appears that the influence of these minor taphonomic forces is much lower than at other sites.

Whilst it is very difficult to understand these much more minor forces that are affecting the assemblage, they should nonetheless be observed in order to try and fully understand the full range of taphonomic processes that are occurring at each site and through time, which will affect the composition of the faunal remains that end up on the desk of the researcher.

3.6. Sieved Material

Finally in this chapter, analysis of the sieved material from context B03263s, part of the infill of the late sixth Century 'grubenhaus G2' in the 'Gemeindezentrum' area of the Reinach excavation will be carried out. The results are presented here, as it is just as relevant to the taphonomic study as to other parts of the forthcoming analysis, perhaps more so as the results from this material and the hand collected material are not directly comparable (table 3.6-1). This can be shown by comparing the material from B03263 and B3263s the hand collected and the sieved remains from the same context. The reason for sieving is also to collect those bones, which are too small to be observed with the naked eye on excavation. So in theory, it should not be expected that samples would be the same. In fact the sieved material shows, to a degree, that which is missing from the hand-collected material. The unidentified remains are a far higher proportion of the total excavated bone in the sieved portion as it is made up of mostly small fragments of bone that are unlikely to have identifying structures on them.

Over forty per cent of the material from the sieved remains exhibit some form of burning to them, and of this proportion at least twenty percent shows sign of calcinations (table 3.6-2). This then suggests this sieved portion has been subjected to intense heat. This is compared to the unsieved remains, which has just ten fragments (2.95%) showing signs of burning. Perhaps this area of burnt material is the reason that this context was sieved rather than random a sieving strategy. This idea is upheld by the fact that there is no other sieving carried out at the site, something that would be seen is a random strategy was in place.

The proportions of wild animals against domesticates is also much higher than in the hand collected remains. This is due to the relatively small sample of identified bone and thus the effect of each extra bone in either category carries a high percentage increase. The nature of the sieved sample will always mean that the wild animals will have an increase proportion in the sieved remains as many of the domesticate elements will not be included in this portion, such as cattle, equids and possibly even pig and ovicaprids, yet there are many microfauna almost all of which will be wild such as rodents, amphibians and other small mammals that will be picked up by sieving and not through hand collection. The list of species presented here shows that pig is dominant in both sets of data. This followed by chicken remains and a single specimen of cattle identified from a small tooth fragment. Ovicaprids are wholly absent but this is likely due to the small fragments and some parts of elements are not identifiable from similar elements of pig. Wild species are represented solely by rodents. These are identified by the teeth morphology, as each species has a slightly different pattern of ridges and furrows on the occlusal surface. Mice and voles are found the species that have been identified. There are also large proportions of unidentifiable fish remains including small fragments of bones and scales, mostly smaller individuals. This then suggests that these animals were part of the diet, the extent to which is not certain based on the evidence here, as the hand collected remains show that very few and large individuals from the comparable context of B03263. Alongside this, larger freshwater fish are found in other contexts at the other excavations studied here. It is also possible that marine fish make up a component of the diet, at least in the higher status sites, as evidence from Marti-Grädel (2008, 224) shows with the fish remains from Altenberg. There, a wider system of sieving was carried out and thus a greater idea of what was missing from the hand collected data has been obtained.

Analysis of the ageing data for pig shows quite surprising results in that both hand collected and sieved material have similar age compositions albeit from less than suitable sample sizes (table 3.6-3). Both show high proportion of foetal or neonatal remains alongside those individuals that are less than subadult age. This represents those individuals that would not have made it through the first winter. In the hand collected remains there is a higher proportion of animals that have been identified as not adult, an assignation designed to distinguish between those individuals that are skeletally mature and those that are around the age of two years but not yet of adult age. This age is the likely age at which pigs would be slaughtered for meat as this age the meat is of its highest quality and other than its fecundity there is little in the way of secondary products from this animals in which to suggest that it should be kept longer. The indeterminate medium sized animals, those a similar size to ovicaprids also show that all representatives from the sieved material are also of less than sub adult age, again this is to be expected from sieved remains due to the collection of such small fragments. Unfortunately there is no comparable data from the hand collected remains with which to compare the results from the pig aging data. However this analysis suggests that this assemblage is something special in terms of age at death of the animals. The chicken ageing data is more difficult to elucidate as it is more difficult to age bird bones as they do not have fusing epiphyses like the mammals but it appears that the majority of individuals are of adult age, and are represented in the sieved material by the small fragments of foot and wing tips that are difficult to find through hand collecting techniques.

Analyses of body part, with respect to pig, shows that mostly present are elements that are small and difficult to see in the soil with the naked eye. The fact that the majority of the bones are from immature individuals suggests that many different areas would be observed although mostly, teeth and trunk proportions are present, with extremities of limbs and skull also represented.

The rodents found here are entirely represented by teeth and no long bones have been found in the sieved material this then suggests that there is a great deal of taphonomic destruction of these small mammal elements.

The unidentified remains were estimated rather than counting every small fragment. It was carried out by first splitting the unidentified portion in to the varying degrees of burning. Then ten fragments from each of these states were taken and weighed, this was repeated ten times and eleven for the partly calcined remains. The whole material from each burnt state was then weighed and an estimate of the total number for the group was calculated. This then gives an estimate for the number of burnt and calcined bones and also the total of the indeterminate sieved remains. This is an isolated portion of burnt remains, as the hand collected remains show little deviation in the way of excessive burnt remains of course this is perhaps also due to the acquiring of larger samples from the sieved remains.

So in summary, it appears from the sites studied here by far the greatest influence on the assemblages appears to be forces that reduce the osseous material along a density related path. In other words, in most cases the relatively denser bones from a species is more likely to be present than the less dense elements or parts of elements. It will also mean that the bones from larger species are more likely to survive than their smaller counterparts. This reduction of the bone material seems to be related to soil composition and the effects of carnivore gnawing on the bones. There is also a degree of anthropogenic factors, such as butchery, burning and other bone and horn trades, affecting the faunal assemblages but these give the impression that they are less important than the other density related destructive forces. This appears to be the case at all the sites although there is variation between the different sites and areas within each site. This would be expected due to variation in the soil composition across such wide areas, various archaeological features, such as the settlement type, type of structure and the use of the structure could also play a role in the taphonomic processes by which the osseous material is modified.

Having studied the role played by outside forces on the faunal material from the three sites studied here, the following chapters will concentrate on the more direct factors that will affect the composition of the these assemblages. The data will first consider species (§4. and later §8.), and then break these down into different categories, for example, body part representation (§5.1), age, sex and pathology (all §6.), which, alongside butchery methods (§5.2) can be used to gleam information about husbandry and economic practices at each site and the role that particular species play in these practices.

4. Species Representation

The presence and relative abundance of a wide range of mammal and bird species provides important and relevant information on the changing nature of animal exploitation throughout the time period studied. For interpretive purposes a wide variety of analyses on various levels can be used alongside the direct comparison between species. For example, the comparison of domestic against wild species can portray the role of hunting and game within a society. Also studying grouped taxa can provide data on the relative importance of mammals, birds and fish on daily life. The species list are presented here (tables 4-1a, 2a and 3a) but with such large amounts of information and the analysis of this data makes it much easier to break the information down from the individual species into groups of related species either simply by classification or through the use to which the animals are put or habitat, this permits the data to be analysed in such a way that allows a better grasp of the information to hand.

However, there are two main assumptions that are made in any statistical analysis of the archaeozoological data. Firstly, that the assemblage on the desk is representative of the original buried sample. Secondly, the treatment and disposal of animals and carcasses within the assemblage is similar. In most cases, it is clear that these assumptions have little basis in reality. Nevertheless, it must be accepted that larger samples tend to diminish the statistical error of individual variables and as such the overall interpretation and the changes observed may still be noteworthy.

The previous chapter indicated possible factors in discrepancy between assemblages due to taphonomic variables. Carcass representation, crafts and butchery practices in the Late Roman and Early Medieval period will discuss the possible biasing factors that can arise from the preparation (§5.6) and representation of the different areas of the carcass (§5.1) from the major domestic species in the following chapter. These results may allow further insight into other specialised activities, e.g. bone working (§5.4), horn working (§5.5) and tanning (§5.6) within and around the settlements under study. Although, it must be borne in mind that these specialised activities will introduce a major bias into the quantification of the species present, as well as the analysis of individual species characteristics. This can be observed in the sample of antler waste at the Kaiseraugst 'Jakobli-Haus' site later in this study (§5.3). Therefore where these specialised waste materials are found it must considered as a potential biasing factor, if not excluded from the calculations wholly. However, here antler has been removed from the analysis as it is not a permanent part of the skeleton and thus can be collected from the surrounding countryside, without ever having encountered the beast itself. However those fragments of antler that are still attached to the skull have been included here as obviously the antlers were still attached to the dead animal. Thus all these biasing factors must be taken in to consideration when quantifying the proportion of each species or group of species with the assemblages presented here.

4.1. Methodology

4.1.1. Species Identification

- *Sheep and Goats*

The most common methodological problem in species identification comes when trying to separate sheep (*Ovis aries*) and goat (*Capra hircus*). These species are known to have domesticated sometime during the Neolithic period and are commonly found in archaeological sites across Europe from that time onwards. The highly fragmentary nature of bone assemblages means that most often differentiation is not possible between the two species. In this study, species separation was carried out using the reference collection at the Institute for Prehistory and Archaeological Science, University Basel, alongside the diagnostic features as set out by Boessneck (1969) and Schmid (1972) for postcranial elements. Some of these diagnostic features are quite variable and show overlap between species, although elements such as distal humerus, distal radius, metapodials, distal tibia, calcaneus, astragalus and phalanges show little variation and are good species indicators. Assigning a fragment to species has only been carried out were all available evidence points to a single species, where there is doubt then the fragment has been assigned to the ovicaprid group. Deciduous and permanent cheek teeth have also been proven to be good indicators of species, using the diagnostic features set out by Davis (1996) for adult specimens, and Payne (1985) for juvenile individuals. All four papers offer diagnostic features that are to a greater or lesser degree variable, and as such all species assignations are based on the experience and preferences of the researcher. Such subjectivity means that there is the possibility of mis-identifications within the data.

- *Horses, mules, hinnies and donkeys*

The separation of the different species of the genus Equus is, in most cases, reliable through the analysis of tooth morphology, cranial and post cranial anatomy and skeletal proportions. Tooth morphology has been intensively investigated by Davis (1980), Eisenmann (1980;

1981) and Payne (1991). The degree of usefulness of these methods very much divides opinion with respect to the high intra-specific variability of the dental characteristics (c.f. Groves 1986, 15 and Zeder 1986, 392-394 for the conflicting arguments). However the dental elements and tooth rows tend to be most frequently found within the archaeological material. An overview of the dental and post cranial elements morphologies of the different equid species can be found in Baxter (1998) especially with regards to the separation of horses and ponies (*Equus caballus*) and donkeys (*Equus asinus*). The author states that the dental morphology is the most reliable but wariness must be shown with very old individuals. The cranial morphology observed to show differences between horses and donkeys include the shape of the supra-orbital crest (Groves and Mazak 1967, fig.3), the placement of the orbits and the length of the vomer (Eisenmann, 1980) plus many more. It is more reliable to have a whole skull with many points of reference so that the reliability of the identification is improved. The postcranial elements are a much more complex matter, size and whithers height can be used to separate horse and donkeys but it is difficult to separate donkeys and small ponies. Mules (*E. asinus* x *E. caballus*) can vary in size, up to 15-16 hands. Hinnies (*E.caballus* x *E. asinus*) are similarly proportioned to horses but donkey sized. Although it unlikely to find such specimens in the Western Europe due to the difficulties in producing such offspring (Gilbert 1991, 101). There are considerable doubts regarding the criteria that could be used to distinguish between mules and horses (Zeder 1986, 392-394). The third metacarpals of horses can be separated easily although the third metatarsal is much more difficult to elucidate, with a range of overlap in the two forms. Dive and Eisenmann (1991) studied the first phalanges of a range of equid species using multivariate and ratio diagrams and can be used to distinguish donkeys and horses. There are many other proposals for the separation of horses and other equids with greater or lesser degrees of success. Baxter (1998, 15) concludes that the metapodial ratio method is by far the most secure method of separating different equids although the more methods that can be used and the greater quantity of the skeleton that is available for analysis will make the identification of equid species more secure. The fragmentation of the material studied here makes it difficult to assign a species to many of the elements found and thus the majority remain identified only as *equus species*, whilst all the bones that could be further identified appear to belong to horse. However, Hüster-Plogmann and Vezseli (n.d.) identified *E. asinus* within the Lausen material. Thus it is possible that misinterpretations have occurred but with the low numbers assigned to species level it is hoped that these have been kept to a minimum.

- *House and Wild Cats*

Cat bones occur relatively infrequently in the archaeological record, it is unusual for them to contribute more than one percent of a bone assemblage. Cats have been domesticated since at least the Neolithic period (Vigne *et al.* 2004), although wild cats, as opposed to feral cats, are still present in many parts of Europe. The method of domestication splits opinion (c.f. Kratochvil 1976 and Todd 1978 for the differing ideas). It should also be discussed whether the two groups, wild and domestic, are actually different groups as most domestic species have acquired Linnean binomials, to show a split from the wild populations in terms of breeding success. The two ecomorphs of *Felis silvestris* (wild and domestic) can and do still interbreed, and is a major conservation problem today (Daniels *et al.* 2001). Thus it is perhaps more reasonable, as O'Connor (2007, 582) suggests that the domestic form should be referred to as house cats and is in some way associated with humans and human settlements, whilst the wild form is free-living. House or domestic and wild cats can usually and reasonably reliably be differentiated by the cranial morphology and measurements. This however requires the specific areas of both the skull and the mandible are represented relatively frequently to allow investigation of the proportions of wild and domestic cats present in the faunal remains. This unfortunately is not the case, these elements tend to be lacking in many bone assemblages, and instead postcranial elements are more frequently identified. There is no reliable method for differentiating wild cats from domestic cats in the postcranial skeleton. Size is often used as an indicator in these elements although as O'Connor (2007) recently observed there is an overlap in sizes between the domestic and wild ecomorphs. However as Kratochvil (1976) discovered there is a difference in sexual dimorphism of the postcranial skeleton, with wild cats exhibiting such differences whilst the domestic cats do not but again this requires a large sample with which to observe the appearance or lack of sexually dimorphic characteristics.

- *Small artiodactyls*

Roe deer (*Capreolus capreolus* L.) remains are also relatively difficult to differentiate from ovicaprids, Schmid (1972) was used to resolve such uncertainties, but the low numbers of small cervids suggests that false attributions are very rare.

- *Large artiodactyls*

Problems also exist in differentiation of small cattle and large red deer (*Cervus elaphus* L.), as with ovicaprids and roe deer, Schmid's (1972) diagnostic features were used to help distinguish between species. Again as with the small cervids, the larger cervids are also rarely numerous so problems with misidentifications were minimal. At the other end of the scale it is very difficult to separate large cattle from the smaller female aurochs (*Bos primigenus*). Whilst it is rare that aurochs appear in the faunal remains, during the period under study here, they are still present in the wild and must be considered as part of the species available to the population during this time.

- *Rabbit and Hare*

All leporid bones are assigned as brown hare (*Lepus europaeus* Pallas), as biogeographically the range of mountain hare (*Lepus timidus* L.) does not coincide with the studied sites and as such further differentiation was not deemed necessary. The differentiation between hare and rabbit is more obvious for two reasons. Firstly the differing sizes of the two species and secondly there is no evidence in Europe of domesticated rabbits until the Twelfth Century where there is evidence of warrens being built to house 'domesticated' rabbits, this however only occurs at the tail end of the timescale studied here and thus unlikely to influence the results here, whilst the elements of leporids present tend to point to them all being from hare.

- *Dogs, foxes and wolves*

Differentiation of small dog (*Canis familiaris*) and fox (*Vulpes vulpes*) can also be challenging, here the diagnostic features of Ratjen and Heinrich (1978) for metapodials were used to better identify those elements that fell in to this category. At the larger end of the scale it is also difficult to differentiate large domestic dogs and wolf (*Lupus lupus* L.). The occurrence of cranial morphological and metrical differences and tooth row differentiation (Morey, 1992) can be used to separate the two species although the postcranial differences are more difficult to elucidate. Here, the assignment to wolf is based on size, individuals that are much larger than the large canids in the IPNA reference collection and of similar sized to the wolf remains in the collection have thus been assigned to the wild species. However, variation in size is subjective and therefore may mean that misidentifications have occurred.

- *Bird identification*

For this study the distinction between bird species was initially carried out using Cohen and Serjeantson (1996) and the bird reference collection at the Institute for Prehistory and Archaeological Science, University Basel. Most post-Roman assemblages contain numerous chicken/pheasant elements. However, the distinction between the two is problematic (See MacDonald, 1992). Although in the sites studied here, no evidence of pheasant (*Phasianus colchicus* L.) remains have been positively identified using reference material, it is however possible that the smaller indeterminate galliform bones could belong to this species.

- *Wild and domestic Goose*

Goose remains are evidenced in small numbers throughout all sites. Mostly the fragments are from larger species and are thus assumed to represent either domesticated goose (*Anser anser domesticus*) or wild grey goose (*Anser anser* L.). There is variety in the size of the goose remains, which means that other species of Anser genus maybe present but the differentiation was not taken further due to the small numbers of remains and the relative value of further identification.

- *Wild and domestic doves*

Similarly, dove (*Columba* spp.) has also been assigned as a domestic species rather than wild, mainly due to the evidence of dove rearing throughout the Roman period and also that all the evidence for the presence of this species, from the faunal material studied here, is found in the area within the *Castrum* at Kaiseraugst and the most likely to be influenced by Roman culture.

- *Ducks*

The remains of duck (*Anas* sp.) were also identified at two of the three sites studied whilst most individuals were designated to mallard-size. Although further identification was not carried out due to the small numbers of bones within all the assemblages, it is possible that some misinterpretations may have occurred, as differentiation based on size difference is a subjective matter.

- *Corvids*

Corvidae were identified to species where diagnostic features (Tomek, 2000) and the reference collection agreed but only when it was felt that genuine differences could be perceived. On this basis the only specific corvid to be found was that of crow (*Corvus corone* L.). Whilst it is possible that mis-interpretations may have occurred, the low numbers assigned to species level make this highly unlikely. The majority of the corvid bones remain undetermined to species level.

4.1.2. Quantification

Two methods of quantification have been used in this study, methods which are most commonly practised throughout archaeozoology. Firstly, the number of identified specimens (NISP), this is a simple fragment count, the calculation of the total number of fragments pertaining to each identified species. The method of NISP calculation used in this study is to attribute all fragments on the desk to a taxon. Unidentified fragments are recorded and quantified separately. Arguments suggest that NISP counts are only limited to describing the laboratory sample and not the death assemblage. Therefore interpretations should be tempered with this in mind. The taphonomic histories of different samples must also be borne in mind when comparisons are made (O'Connor 2000, 55). A second major flaw in this method of quantification is the occurrence of interdependence (Grayson 1984, 20-23), the fact that each fragment is counted as a single entity and that more than one of these may come from an individual animal. So again interpretations must be kept in line with the laboratory sample and not a description of the original population. Other biasing factors include the degree of fragmentation and the number of identifiable bones per individual, e.g. pigs having more teeth and phalanges than ovicaprids. Thus a detailed methodology for producing NISP counts for a given project is needed if the data are to be considered reliable. Gilbert and Singer (1982, 31) describe NISP counts as 'ideal for ideal samples…' and Grayson (1984) and Ringrose (1993) consider NISP counts to be redundant. Despite this NISP counts can provide information on the rank order of taxa, although discretion is needed when comparing the rank order of NISP counts that have widely diverging proportions.

The second method employed for quantification uses the weight of fragment as a measure of taxa abundance. Obviously the larger bodied taxa will clearly be over represented by this method. However, the skeletal component as a proportion of the whole animal remains relatively constant though many species, thus making this method advantageous. It must be recognised that the skeleton of younger animals comprises a lower proportion of the body compared to an adult individual of the same species. Also, density mediated taphonomy can lead to a bias towards the more dense fragments of bone thus distorting the bone to meat weight comparison. There is also the problem of having sediment-free bones to weigh, with cancellous tissue being especially problematic. Interpretation of the result should also bear in mind that potential meat yield and actual meat usage are two different entities. Weight analysis can only describe the potential meat yield.

The data recorded can also be quantified in terms of the minimum number of individuals (MNI). This is a controversial technique, which over many years has been the subject of a wealth of papers without any defining conclusions. The procedure aims to estimate the living population of a given taxa by the most abundant skeletal element after the elements have been sided, where appropriate. The main concern of this method is abuse of the raw numbers produced by this method, those not specialised in bone material often accept the MNI as an absolute number of animals present. It needs to be stressed that numbers produced by a MNI calculation are just an estimate, the calculation of actual population sizes are not possible. It has also been suggested (Grayson 1984) that the MNI is closely correlated to sample size and thus NISP, so any relationships produced by MNI should be available in NISP calculations. Rare taxa are also over estimated using this method when compared to NISP counts. This is not to say that the NISP counts are correct but the MNI is, if Grayson's hypothesis is accepted, just an extra redundant step in the quantification analysis.

There are also many other methods for quantifying animal bones such as semi-quantitative methods, logarithmic transformation to suppress fluctuations and aid interpretation and the estimation of the killed population. All the methods mentioned here have inherent procedural problems that need to be borne in mind when interpreting the results from quantitative analysis. As such the methods of NISP and weight quantification have been used here as mentioned previously these are the most widespread methods for quantifying animal bones. These two methods have also been employed as they represent the data in its rawest form, with no transformation of the data, which can incorporate further errors rather than enhance the interpretation. The statistical approach to this data should also be discussed here, as the sample size of an assemblage will affect how representative the data analysed will be. A small sample of bones is less likely to be representative of the actual bone deposits than a larger sample. Although the collection method discussed above will also affect how representative the data is. Gamble (1978, tab. 20.7) discusses the size of a sample needed for specific archaeozoological questions to be answered with robust data sizes. Here, the sample sizes chosen to discuss species representation has been fixed at two hundred identified specimens, there maybe exceptions to this in certain cases but these will be mentioned in the text where relevant and highlighted in tables and figures with an asterisk(*). Due to the lack of data for individual structures, the figure is reduced for horizontal analysis to just 150 identified bones. This is carried out in an attempt to incorporate as wide a range of structures as possible. It must therefore be borne in mind that some of the assemblages at this lower limit may start to show bias due to sampling error.

4.2. Identified Fragment Counts

4.2.1. Domestic versus wild species

Simply observing wild against domestic species from all sites and time periods shows that with the exception of the fourth to sixth Century 'Bodenniveau' at Kaiseraugst, all the sites have a proportion of domesticates make up over 97% of the faunal material (figs 4.2.1.1-1, 4.2.1.2-1 and 4.2.1.3-1). There will of course be natural deviation within this proportion. However, variations in the proportions of wild species can also be effected by sample size, whereby larger samples will contain a larger number of wild animals through sheer probability, conversely small samples are likely to over-represent some wild species, whilst others will not be represented at all. Here the sample size considered a representative has been lowered to just 150 identified bones to create a greater dataset. For example, Reinach has fourteen time periods ranging from the sixth to twelfth Centuries, however only five of these periods have samples that are large enough with the original level (greater than two hundred identified bones), but extending the dataset without compromising the statistical rigidity at the lower level (150 identified bones) means that in the example of Reinach makes a total of seven time periods that can now be studied. However, where it is pertinent those that are below this lowered level have also been illustrated and marked with an asterisk to set them apart. The results from the 'Jakobli-Haus' 'Bodenniveau' at Kaiseraugst will be discussed in more detail below (§4.2.1.3).

4.2.1.1. Reinach

The data from Reinach can be split into three regions as explained above (§1.1.2.2). The data here is relatively stable with none of the time periods from Reinach falling below 97% domestic animals (table 4.2.1.1-1). The usual cut off point for a sample to contain a distinct proportion of wild animals is 5%. Also the range of the data here can in most cases be covered by a change of not more than six bones. This then suggests that the majority of the assemblages observed with respect to domestic animals against wild animals are very similar. This is true for the first area of the Reinach excavation, 'Stadthof,' which shows a reasonable consistency through time, when considering the domestic and wild species grouping. However, the small amount of variation among time periods must be considered. The 'Gemeindezentrum' area shows after the sixth Century period where there is an absence of wild animals, a clear stability in the ratio of domestic to wild animals, approximately 98% domesticates. Even those periods with small samples show a similar pattern to the rest of the area. The 'Altebrauerei' area is difficult to elucidate, as there are just two time periods and the later Eighth Century period is too small to discuss with confidence. The earlier seventh Century period shows a period with the lowest observed proportion of domestic animals throughout all the areas of the Reinach excavation.

Splitting this Reinach data down further, into structures found within each area and time period, shows that the main factor influencing the proportion of domestic and wild species is sample size (fig 4.2.1.1-2). Those with the largest sample sizes from each period show in most cases the presence of wild species but at a level that is negligible. It suggests that wild species are being exploited but on a low level and in most cases the wild species present is solely red deer. Those structures that fall below the assigned sample size show a greater variation in domestic and wild populations, with some structures showing as high as four percent, with the early eleventh Century 'grube 21' in the 'Gemeindezentrum' area greater than eight percent, although with just 23 bones one bone represents over four percent. It appears that there is little distinction between the different areas of the excavation at this level due to the small samples present.

4.2.1.2. Lausen

The proportions of wild against domestic species at Lausen also show a great deal of stability through time. The Lausen material recorded in this study shows a uniformity of data with respect to the proportions of domestic and wild animals. In most cases the proportions of domesticates is between 98% and 99% (fig 4.2.1.2-1). Even those samples deemed too small to rule out statistical error fall in to this bracket. This would then suggest that wild animals had little importance at the site through all the time periods discussed here, although the material from the early eleventh Century does show a higher proportion of wild animals than the other time periods, falling into the 99th percentile of the data. This could be due to the increasing importance of Lausen as a site at that time. This assertion is examined in a later chapter (§ 4.2.5.2) where the number of different wild species present could represent the importance of wild animals rather than the overall proportions present.

Studying the different structures within the site at Lausen is difficult due to the small number of structures of significantly large sample size from a single time period (fig 4.2.1.2-2). By far the best represented time period is the eleventh Century with six structures. Whilst there is variation between these structures it is not so large that there is a suggestion of differential usage of the structures with respect to the processing of wild and domestic animals. This is probably true for all time periods where the consistency of results between time periods is reflected in the study of the different structures within the time periods. Although it could be argued that 'grube 11'and grube 50' have slightly higher proportions of wild remains than the other structures, both falling outside the ninetieth percentile of the data. 'Grube 50' (* see

§2.1.3) is one of five structures from the late sixth to seventh Century period, the other structures have a lower proportion of wild animals represented. This suggests that the functions maybe different for these two structures, however the small sample sizes is probably the most relevant factor. Hüster-Plogmann and Veszeli (n.d., tab.1) shows a similar result from the same period with 'gruben 2 and 22' having similar proportions to those of the data presented here. Thus it appears that with 'grube 11'and grube 50' showing high proportions of wild animals, it is more likely that these are artefacts of the data rather than real differences also as these structures come from different time periods and different locations within the excavation, making it more difficult to suggest a reason other than statistical error for the relatively high proportions of wild animals. 'Grube 11' is the sole structure related to the early eleventh Century results mentioned above, although other data from the eleventh Century periods suggests again that the difference in proportions of wild animals is likely due to the sample sizes present rather than a change in practice or function between the different structures of this time period.

4.2.1.3. Kaiseraugst

The Kaiseraugst 'Gasthof Adler' excavation shows a high degree of consistency throughout the fourth to sixth Centuries studied (fig 4.2.1.3-1). The small sample from 450-500 AD levels has been included here. The earlier fourth Century period has a lower proportion of wild animals than the following time periods at the 'Gasthof Adler' site. In the mid fifth to sixth Centuries from the same area shows samples that have an increased proportion in wild mammal, although this elevation does not appear to be important. All bar one of the wild mammal fragments from this time period are attributed to either roe deer (*Capreolus capreolus*) or Red Deer (*Cervus elaphus*). This increase in cervids coincides with the antler material finds from the Kaiseraugst 'Jakobli-Haus' excavations (§5.3). The samples of twelfth Century origin from the 'Gasthof Adler' and 'Fabrikstrasse' excavations also show a similarity to those preceding them, although, there is a lack of wild animals observed in this time period. However these samples are small and therefore not too much weight can be placed on these observations but as a tendency it shows consistency with other more sound data. The lack of wild animals in this time could also be due to the tightening restrictions on the hunting of wild animals by the upper classes in the medieval period (§7.1.1).

Observation of the different structures within the 'Gasthof Adler' site shows that a similar pattern to that observed through time can be seen (fig. 4.2.1.3-2). Both the mid fourth Century contexts have a low representation of wild animals (less than 0.5%) and the later fifth to sixth Century contexts sees this proportion slightly elevated (between 1 and 3%). The variation of the latter structures is greater than that observed between the mid fourth Century structures and the fifth to sixth Century structures, which suggests that the difference between the two time periods is merely a statistical anomaly rather than a clear change in practices.

The material from the 'Jakobli-Haus' excavation also shows remarkable similarity throughout all the time periods within the excavation and when compared to the 'Gasthof Adler' excavation, with the exception of the fourth to sixth Century material (fig. 4.2.1.3-1). Also there is a wider wild species presence with both hare and wild boar also present alongside the two species of cervid observed in the 'Gasthof Adler' excavation (Fig 4-1).

Observation of the structures within the 'Jakobli-Haus' excavation, again it can be observed that there is a remarkable consistency of results in those samples with a statistically sound base (fig. 4.2.1.3-2). The structures from the fourth to sixth Century period, namely 'bodenniveau' and 'gruben' have the highest proportion of wild remains. The context 'D03165' (* see §2.1.3) in the 'Ziegelschutthorizont' structure also has a relatively high proportion of wild animals although this context has a small sample and thus may not be representative especially when considering the larger samples from the same 'Ziegelschutthorizont' structure and the structure as a whole.

The real exception to what appears to be a very consistent pattern of domestic and wild groups occurs in the 'Jakobli-Haus' fourth to sixth Century levels. In these contexts there are greater proportions of wild animals. The 'Jakobli-Haus bodenniveau' structure consists of over ten percent wild animals these are mostly made up of corvid and passerine birds although there is a small presence of hare and duck. This assemblage appears to be food waste derived from a higher status level due to the increased proportions of young pig present (§6.4.1.1) alongside the high proportions of chicken (fig.4-1a). Small passerine birds are also known as a delicacy during Roman times, as observed by Schmid (1969; 1972) at Augusta Raurica in the *mansio* kitchen, this 'Jakobli-Haus' deposit could represent such a meal or series of meals, although in the Fortress baths in Caerleon, Wales shows that bathers were served with wild bird (O'Connor, 1986), with the location of the former baths so close to the 'Jakobli-Haus' area, this could be a further explanation. It is also recorded in Rome that these birds were kept for their song too (Parker 1988, 203). Ritual deposits during the roman period show large numbers of young pig and chicken remains (Jacques *et al.* 2008, 245). Corvids are also prevalent in certain ritual contexts in the Roman world (Parker 1988, 209). However, it is difficult to say with any certainty that the 'bodenniveau' contexts here are produced from ritualistic practices, not only by the faunal remains but also due to the lack of other ritual-related archaeological finds. The elevated proportion of wild species from the 'Jakobli-Haus gruben' contexts is derived in a much different process to those from the 'bodenniveau.' The 'Jakobli-Haus gruben' contexts show that the wild portion of the material is made up of mostly red deer with a small amount of wild boar. As mentioned previously, the prevalence of red deer may be related to the antler finds in the 'Jakobli-Haus' area.

Comparison of the two areas at Kaiseraugst suggests that there is little change in the proportions of wild animals in the assemblages in the 'Jakobli-Haus' excavation between the fifth and the beginning of the seventh Centuries at both the 'Gasthof Adler' site and the 'Jakobli-Haus' site, although the 'bodenniveau' and 'gruben' structures suggests that there is a variation on a horizontal level in the 'Jakobli-Haus' area, although the relatively imprecise dating of these structures makes it difficult to relate them to the other structures. The early data from the 'Gasthof Adler' also hints at a change from the mid fourth Century to the fifth Century although the change is small and dwarfed by the variation within the fifth and sixth Century assemblages.

So to conclude it would seem that the proportions of wild animals within the assemblages of the three sites studied here is very similar with most data showing a wild animal proportion of less than three percent. This then indicates that wild animals are not a significant part of the diet or economy of the sites analysed in this work. There is of course horizontal variation within each site although this appears to remain within the boundaries addressed above. The one real exception to this above statement is the 'Jakobli-Haus bodenniveau' context, which has a very high wild species proportion. This wild animal portion is mostly made up of corvids and small passerine birds. The explanation for this is not clear though it differential explanations could be related to special meals or ritual behaviours, although no one solution can be definitively put forward as an answer to this observed change.

4.2.2. Major Domestic species

By separating the domestic and wild groups into more explicit categories, namely main domestic mammals (cattle, ovicaprids and pig), minor domestic mammals (*Equus* spp., dogs and cats), domestic birds (chicken and geese), wild mammals and wild birds interesting interactions through time and space can be observed. Perhaps unsurprisingly the main domestic mammal group is wholly dominant through out all periods and sites, and will be analysed in greater detail below. It is also informative to form a group of the species that contribute most to the diet overall, here this will be called the major domesticated species and contains Cattle, pig, ovicaprids and chicken as these four species tend to represent a very high proportion of the total identified bones in remains thought to be derived from kitchen waste. The figure (fig 4.2.2-1) shows the relationships between the major domesticated species through time using NISP counts. Triangle plots are also used to study the relationships and interactions between the three main domestic mammals (cattle, pig and ovicaprids). The data is considered statistically sound in those assemblages with a sample size of 150 or greater identified specimens, those that are deemed of interest and of smaller sample size are marked with an asterisk (*).

4.2.2.1. Reinach

The material from Reinach studied by date shows that in the early periods, the sixth to the late seventh Centuries, pigs are dominant (table 4.2.2.1-1 and fig. 4.2.2.1-2). In the late seventh Century a change is observed, the pig remains become less prominent whilst the ovicaprids increase in proportions, cattle however remain constant. Domestic fowl also gain importance during this time period reaching a high point in the eighth Century and remains elevated into the following periods. Ovicaprid remains during this Eighth Century period are observed to decrease whilst the Cattle remains become more important. Further investigation is needed to discuss these changes in more detail as many of the time periods are represented by a single structure in a single area of the excavation. This could then suggest that the changes observed are related to variation between the areas of the Reinach site and not necessarily a difference in the practices of the whole settlement through time. The trends observed in the analysis of the individual areas, although mostly small samples bear out the observations noted above for the site as a whole, this is discussed in further detail later in this section.

It becomes more difficult to observe changes in the major domestic species through time with reference to a single area of the site as sample sizes are small and continuity of data from period to period, for various reasons is lacking (table 4.2.2.1-3 and fig. 4.2.2.1-4).

The Stadthof area of the site exhibits a degree of constancy through time with regards to the chicken (~5%) and ovicaprid (~20%) remains, although the fowl show a decrease in proportions during the eleventh to twelfth Century period (fig 4.2.2.1-5). This then suggests that any changes in the material composition are related to the differences between the cattle and pigs. The early data from the seventh Century shows a steady increase in the proportions of cattle whilst the pig proportions are decreasing. The steady rise of cattle continues in to the eleventh Century, with an appropriate decrease in the proportions of pigs. However, there is a complete absence of data for the eighth Century period in the Stadthof area, which alongside the lack of statistically robust data makes it difficult to further elucidate this change. There is a continuation of this trend in to the latter periods, the late eleventh and twelfth Centuries where the cattle proportions settle at around fifty percent and a likewise bottoming out of the pig proportions at approximately 25%.

The 'Gemeindezentrum' sixth Century material has very high proportions of pig remains (fig 4.2.2.1-6). The proportion falls in the seventh and eighth Centuries, in the seventh century the reduction in pig proportion is connected to an increase in cattle, and then in the eighth Century the further reduction in pig proportions, plus a slight decrease in cattle proportions, is connected to ovicaprids increasing. From this eighth Century point on into the tenth Century pig proportions remain relatively stable, whilst the over the same period decreasing ovicaprid proportions correspond to an increasing importance of cattle. Throughout this time period chicken proportions follows the same tendencies as those of ovicaprids albeit at a lower level. After this tenth Century period, ovicaprid remains tend to be consistent. Whilst in the same period, post-tenth Century, pig and cattle proportions have a tendency to 'flip-flop'. The eleventh and twelfth Century data is displayed (* see §2.1.3) suggest that the sampling error bias outweighs any meaningful insights the data might provide. However, the twelfth century 'Gemeindezentrum' (*) proportions of cattle and pig are similar to those of the 'Stadthof' material of the eleventh and twelfth Centuries, which maybe more reliable, though any interpretations can only be tentative. This high proportion of pig in the earliest phases of the settlement is probably due to the 'founder effect' where higher proportions of pig are observed in the early phases of new settlements developed throughout the early medieval period. This effect was observed at West Stow in the United Kingdom with the movement of the Germanic population in to the country. Around this time the migrating Germanic people are also populating the region of Northwest Switzerland, thus the similar results to those at

West Stow and other rural sites in southern East Anglia are observed in the region (Crabtree, 1982; 1990; 1996).

The 'Altebrauerei' region of the Reinach excavation is difficult to interpret, as there are only two periods of settlement, one of which has only a small faunal assemblage. The seventh Century assemblage from 'Altebrauerei' has a similar domestic species composition to that from the sixth Century period from 'Gemeindezentrum', namely high proportions of pig remains. The eighth Century material (* see §2.1.3) it should be mentioned has a composition of the major domesticates that is comparable to that from the eighth Century at the 'Gemeindezentrum' assemblage (table 4.2.2.1-3).

Analysis of individual structures at Reinach proved to be very difficult. This analysis was in the main, hampered by a lack of statistically viable samples. This lack of data then rules out the ability to make any informed analysis of the horizontal variation present in the areas excavated. However it is possible to suggest trends through time for individual areas and possible differences between areas but this must be carried out with the caution needed when dealing with small samples. The three excavated areas at Reinach provided just four structures of suitable sample size for meaningful analysis and this across all time periods. Two of the structures, 'Grubenhaus S4' and 'Grubenhaus K1', had comparable faunal assemblages, both these structure occur in the 'Stadthof' area of the Reinach excavations although chronologically separated, late seventh and twelfth Centuries respectively. The two remaining structures, one 'Gemeindezentrum' ('Grubenhaus G2') and the other from Altebrauerei ('Grubenhaus B1') are also from differing time periods, and have different compositions not only from the two comparable assemblages but also from each other. This then, as mentioned above, means that the analysis of individual structures in terms of horizontal variation within the Reinach site is not achievable. However it is possible to observe trends in the data by using the small sample sets from the structures to produce trend lines for the data. These transformations of the data appear to add weight to the data above, as there are many similarities in the results. There is a loss to the degree of accuracy of the results with the production of these trend lines but this transformation helps to show the general trends of the data through time, where a lack of material might otherwise inhibit the analysis. However in must not be forgotten that these are statistically small samples and as such the inferences made here are tentative at most and should not be considered otherwise.

The trends in the data from the Stadthof area of the excavation, with respect to the structures, show a steady increase in the proportions of cattle from the earliest part of the data, the seventh Century (table 4.2.2.1-7.and fig. 4.2.2.1-8). As mentioned above pig remains show the opposite trend in the site as a whole and again this pattern is repeated when looking at the individual structures. The constancy of the results for chicken and ovicaprids are also noted in the analysis of the structures.

Similar trends are observed in the structures from the 'Gemeindezentrum' area of the excavation for the periods of the late seventh Century to eleventh Century to those seen in the Stadthof structures for the equivalent time frame, although the absence of data at specific times means the data is not chronologically comparable (table 4.2.2.1-9.and fig. 4.2.2.1-10). The decrease in the importance of pig is more marked due to its higher starting point in the late sixth Century (~65%). In this late sixth to early seventh Century period the ovicaprid proportions (~10%) are much lower than those observed in the Stadthof area, although cattle proportions are similar in both areas (~30%). Thus the rapidly declining pig proportions in this area of the excavation leads to an increase in the proportion of ovicaprids to a level that is similar to those observed in the Stadthof area (~20%) and alongside this a steady increase in cattle that is observed, similar to that above. The decline in pig proportions after the initial higher period follows a trend similar to those observed in the Stadthof area.

The data from the structures in the Altebrauerei are of the excavation consists of just two time points and thus a chronology of changes is not achievable and data interpretation difficult. However, in comparison to the 'Gemeindezentrum' area at the same time, the early seventh and late eighth Centuries, it is possible to argue that the composition of the major domestic species is at least analogous. The major difference observed is the low proportions of cattle remains (~15%) in the early seventh Century period. The ovicaprid and fowl remains are very similar, whilst the pig remains are somewhat higher and comparable to the late sixth Century material from the 'Gemeindezentrum' area.

So to summarise the data presented here, it appears that the early part of the site displays a high proportion of pig remains probably due to the resettlement of the site after a hiatus following the end of the Roman occupation of the region. The development of the new settlement involves the intensive use of pig for meat as these are more easily transported when migrating and the high fecundity means that the group size can be increased easily in a short space of time. This period is then followed by a period of increasing importance whilst pig proportions are diminishing. This then perhaps suggests that the settlement is becoming more stable and the agricultural roles of cattle outweigh the food role of the pig. In the later periods, the late eleventh and twelfth Centuries, cattle reach its most important with nearly half of the data represented by this species. The beginning of the manorial system probably has a great deal to do with the changes in practices through time from the eighth century onwards. The results from the differing areas of the site show that there is a continuity of practice throughout the site with little variation. The results from the individual structure then suggest a certain degree of uniformity in the data at certain times. For example the high proportions of pig remains in the earliest part of the settlement are observed throughout all areas of the excavation again suggesting a continuity of practice throughout the site. The period of the late seventh to ninth Centuries have very similar structures when observed through the trend lines again shows a correspondence of practices through the settlement. Furthermore the data from the latest period of the settlement also shows similar patterns of species proportions, whereby cattle are of the highest proportions and pig remains are reduced. It must be borne in mind however that not all areas are represented at all time periods and that the data used here is not considered statistically robust therefore the conclusions drawn are done so with hesitation and the reminder that these results are at most a first step in the understanding of the horizontal variation of the site in terms of the faunal remains.

4.2.2.2. Lausen

The proportions of major domesticates from Lausen shows that pig remains increase in proportions from the sixth Century through until the tenth Century, where this level remains relatively constant until the late eleventh Century (table 4.2.2.2-1 and fig. 4.2.2.2-2). Over this sixth to eleventh Century period the domestic artiodactyls show a similar pattern of development. Ovicaprid remains tend to be present in higher proportions than those of cattle for the seventh to eleventh Century. The sixth century however shows that cattle proportions are higher than both the ovicaprids and pig remains and during the twelfth century cattle again becomes the best represented domesticates. The chicken proportions are consistent (2%) throughout the whole time period studied at Lausen. The concerns over sample size remain, as previously mentioned, all interpretations of the data remain tentative where small samples are concerned.

Lausen has thirteen individual structures from all time periods that are statistically large enough to analyse (table 4.2.2.2-3 and fig. 4.2.2.2-4). These all fall into a fairly similar pattern in that pig is highly dominant and cattle and ovicaprids are of similar proportions, these all fall in to the time period from the ninth to the eleventh Century. The exceptions showing variation in the late sixth to early seventh Century material ('Grube 50' and 'Grube 56') and eleventh century 'Grube 10', which have a similar proportion of cattle and pig. Also 'Grube 38' in the twelfth Century in which cattle have the highest proportions and pig is third best represented, although this last exception has a sample size below the threshold set out previously and therefore must be treated with caution. The early data, the sixth and seventh centuries, may represent the remnants of the Roman influence on the settlement as has been mentioned by Marti (2000, 271-273) being an important site in previous times (§1.1.2.3). The rise in the pig remains during the ninth Century may reflect the growing importance of the site in the region, which reaches a peak in the eleventh Century where it is believed that Lausen was the residence of an important manorial lord (Marti 2000, 276). It has been muted that the owner was Rudolph von Rheinfelden. This high status is shown in the reliance on pig rather than cattle. Whilst the small sample in 'Grube 38' (* see§2.1.3) from the twelfth Century may also show the start of the decline of the site, as cattle become more important similar to that at Reinach, however, this data should be treated tentatively because of the sample size. In the Thirteenth century the site is abandoned altogether. At the site it is very difficult to determine any horizontal variation in the site due to the uniformity of the results presented here and as such suggests that the different structure were probably used, or at least back-filled by similar processes throughout the life of the settlement.

4.2.2.3. Kaiseraugst

Analysing the data from Kaiseraugst shows that there is no little consistency between periods and sites (table 4.2.2.3-1 and fig. 4.2.2.3-2). The highest proportions of cattle are observed in the mid fourth century material at Kaiseraugst 'Gasthof Adler'. This relatively high proportion of cattle decreases from this time period into the fifth and sixth Centuries at both the 'Gasthof Adler' and the 'Jakobli-Haus' excavations and into the following seventh Century data from the 'Jakobli-Haus' site. The observations from the 'Gasthof Adler' excavations shows that pig remains show a subsequent increase in importance with the decrease in cattle remains in the fifth and sixth Centuries, whilst the proportions of ovicaprids remain relatively constant. The late fifth to sixth century 'Jakobli-Haus' levels shows a similar proportion of cattle and pig remains to those in 'Gasthof Adler' at the same period, however the ovicaprids proportions are relatively low in the 'Jakobli-Haus' site. Observations suggest that chicken remains are substituting these low levels of ovicaprids at this time. However, in the sixth Century material there is a large increase in the proportions of ovicaprids (approximately 10%), this seemingly occurs at the cost of the other three main domesticates (Cattle, pig and chicken). This high level of ovicaprid remains continues in to the seventh Century, cattle remains show slight increase whilst pig remains show a small decrease in importance. During this period the number of different species identified decreases, mainly wild and domestic birds other than chicken are absent. The faunal remains from the fourth to sixth century layers at 'Jakobli-Haus' seem to be a special deposit, as there is a very high proportion of chicken remains (~23%) alongside very low ovicaprid remains and lower proportions of cattle remains, thus pig remains (43%) dominate the assemblage. The twelfth century deposits ('Gasthof Adler'* and 'Fabrikstrasse' * §2.1.3) are not reliable indicators of species presence. This is unfortunate as the 'Fabrikstrasse' excavation is the first evidence of settlement outside the Castrum walls and a comparison of the different lifestyles would be interesting.

Analysis of the individual layers within the Kaiseraugst excavations shows that there are similarities both within and across the differing excavation areas (table 4.2.2.3-3 and fig. 4.2.2.3-4). The F2 3 layer from the earliest dates of the 'Gasthof Adler' excavation is an exception with high proportions of cattle remains when compared to the similarly dated 'F3 2' level within the same excavation, which has a marginally higher proportion of pig than cattle. Other structural layers ('F2 4', 'Ziegelschutthorizont' and the unterer Humusbereich') from both excavation areas show a similar appearance to the 'F3 2' layer, although these are of a later date. The 'bodenniveau' and 'Gruben' archaeological structures from the fourth to sixth Century 'Jakobli-Haus' excavation are similar to the 'F3 2' layer from the 'Gasthof Adler' area, although the former show higher proportions of chicken remains. The 'bodenniveau' having an extremely high proportion of chicken and low ovicaprid remains to that which might be expected. All this leaves just two other comparable levels, namely the seventh Century 'oberer Humusbereich' from the 'Jakobli-Haus' excavation and mid fifth to sixth Century dated 'F17 2' from the 'Gasthof Adler'. Within these two layers pig and cattle remains have similar proportions.

Studying specific archaeological contexts within each structure shows interesting variation (c.f. tables 4.2.2.3-3 and 4.2.2.3-5). For example, the seventh Century 'oberer Humusbereich' and the sixth Century ‘unterer Humusbereich’ from the ‘Jakobli-Haus’ excavation shows that some contexts from the latter are very similar to those of the former and the reverse can be seen with the single statistically large context from the ‘oberer Humusbereich’ which is similar to the ‘unterer Humusbereich’ (figure 4.2.2.3-6). The reasons for this is unclear but probably suggests that the site formation processes are similar across both time and space with regards to these structures at Kaiseraugst.

4.2.3. Quantification - Triangular plots

Triangle plots can also be used to show the interactions and relationships of three interdependent variables. This is easier to display and interpret graphically than four variables. Here the variables are the three main domestic species (cattle, pig and ovicaprids), as they constitute more than ninety percent of the faunal assemblages in this study. Thus it is assumed that these species are interdependent. The data from fowl is left out in this case, though widely present the low and in the main constant levels suggest that the integrity of the triangle plots are not compromised. Whilst this is an alternative way to graphically show the data that has already been discussed here it does give a clearer picture in some cases of the differences and groupings between the areas of a single excavation and between the different sites and time periods. However, it is also useful to look at the nature of the structures using this method as it can give some idea as to the utilization of the animals represented. For example, those structures with high proportions of pig elements tend to suggest a higher social status especially in conjunction with an elevated proportion of chicken remains. High proportions of ovicaprids or cattle tend to suggest perhaps use of secondary products and possibly a lower status.

The figures shown here reflect the analysis above with high proportions of pig remains in the early part of the settlement of Reinach (fig. 4.2.2.4-1) and also in the tenth and eleventh century data at Lausen (figure 4.2.2.4-2). There are high proportions of cattle remains observed in the early layers of the Kaiseraugst material, which again reflects the analysis outlined previously (fig. 4.2.2.4-3). The majority of the remaining data, whether looking at structures, an area or the excavation as a whole for a given time period shows a tendency towards data congregating around the centre/bottom-left of the diagram (figures 4.2.2.4-1 to 7).

The analysis of the structures within a time period, or as a whole, becomes more difficult as the sample sizes are reduced. However, given the high proportion of small samples from the structures at Reinach there is a trend that the data points are 'centred' in the centre-left part of the diagram, even though a few points are scattered around the triangle (fig. 4.2.2.4-4). This then suggests that there is a similarity of assemblage accumulation across the excavation as a whole. The wider scatter of the points can only hint at other underlying processes that could account for these changes, including the statistical error that is associated with small samples.

The analysis of the structures at Lausen shows that there is a similar centre point to the data (fig. 4.2.2.4-5 and 5a) although the data tends to be pulled towards the bottom left due to the higher status of the site and thus higher proportions of pig during the ninth to eleventh Century period.

The structures at Kaiseraugst also show similar position in the triangle to those at Reinach although in this case the data is moved more to the left (fig. 4.2.2.4-6). This is perhaps caused by the different nature of the structures as in most cases these are level rather than pits and also the Castrum at Kaiseraugst was an 'urban' centre of such in the region, this also conceivably influences the accumulation of the animal bones within these structures.

The variation in the figures (fig. 4.2.2.4-4 to 6) displaying the individual structures could suggest different uses of different structures but again the small sample sizes for these data probably suggest a wider variation rather than use. The analysis here is not taken any further as it is more appropriate to discuss these results and subsequent trends in comparison with other sites within this and neighbouring regions. This then allows for a better understanding of the results for an excavation in relation to contemporary settlements (§ 8.2.1).

4.2.4. Quantification - Meat weight

Another way to look at the species representation is through the proportion of meat that a species contributes to the diet of the population. It is obvious that body size is an important consideration when assessing the true economic value of the assorted domestic species. It is a simple fact that a large animal will provide more meat and other products than a small one. Thus the comparison of the relative numbers of different species, to ascertain their economic importance, can be misleading.

A tentative approach to calculating the carcass or meat weights of an archaeological sample can be achieved with comparison to the average body weight calculated from modern herds. Though it must be remembered that differing breeds, sex composition, and nutritional status can all affect the calculations and as such this method will not produce absolute values but a guide to the relative importance of each species to the diet.

Other studies (Bourdillon and Coy 1980, 84-85; Dobney *et al*, 1996, 22) have used the Manching data (Boessneck *et al.* 1971, 9) for this purpose and for ease of comparison these figures (table 4.2.2.5-1) will be used for the calculation of meat weights for the three sites studied here.

The tables and figures (4.2.2.5-2 to 10) show the relative proportion of meat that the domestic animals contributed to the diet of the Early Medieval settlements studied in this project. Unsurprisingly cattle due to their body size, in most cases, provide the majority of the meat though all periods at Kaiseraugst (table 4.2.2.5-3 and fig. 4.2.2.5-4). Pig is the second greatest contributor of meat to the diet, whilst ovicaprids provide only a small fraction of the meat consumed. In the later centuries at Kaiseraugst whilst cattle still provide the majority of the meat in the diet there is a decrease in the importance of beef consumption from the early material of the mid fourth Century, which is probably still greatly influenced by Roman cultural proclivities and is comparable to the early city of Augusta Raurica. In the later periods, late eleventh and twelfth Centuries at both Reinach (fig. 4.2.2.5-7) and Lausen (fig. 4.2.2.5-10) there appears to be a greater demand for beef than in the previous centuries, even more than the Roman influenced fourth Century data from Kaiseraugst (fig.4.2.2.5-4). The exceptions to this domination of the diet by cattle can be observed in Lausen where from the eighth century pig is almost as important as cattle to the population and in the tenth Century more so. This is probably due to the increasing status of Lausen in the region and that the population are eating what could be considered a more socially elevated diet than at Kaiseraugst and Reinach. However, in seventh Century Reinach 'Altebrauerei' pig also provides the major contribution of meat, the sixth Century data from the 'Gemeindezentrum' area also shows an increased contribution of pig in the diet (fig. 4.2.2.5-7), this is more likely to be due to the immigration of the Germanic population, as mentioned above rather than an elevated social status as seen at Lausen. The levels of ovicaprid remains are mostly constant in all three sites, through time (fig. 4.2.2.5-11). This simple manipulation of the count data shows similar proportions of meat yield when compared to the analysis by bone weight (c.f.

4.3) and in many cases lends weight to the interpretations drawn on the simple bone counts. However, it must be remember that these are estimations of the meat weight and not absolute figures. The data here gives an idea of the magnitude of the contribution to the diet of each species but cannot give more rigorous interpretations. It must also be remember that the figures for the Manching data are taken from modern breeds and as such there are most certainly difference with respect to live weight in modern breeds and those that precede selective breeding programs of the post sixteenth Century period.

4.2.5. Minor Domestic species

4.2.5.1. Reinach (table 4.2.3-1)

The data from Reinach shows a trend whereby the minor domestic mammals as a whole increase through time from the sixth Century onwards (Figure 4.2.3.1-2). The ninth century is the point at which the minor domesticates are at their peak, though they are more prevalent in the tenth Century contexts however the large number of equids in a small sample probably means that this is misleading.

The data from Reinach 'Stadthof' shows that the domestic birds (chicken and geese) are better represented than the minor domestic animals (*Equus* sp, dogs and cats) (Figure 4.2.3.1-3). The majority of the equid remains are found in the ninth (n=7) and twelfth century (n=6) contexts of the area, although there are remains from the eleventh century contexts (n=2) and a solitary tooth fragment of equid from the seventh century contexts (Fig. 4.2-2 and Fig. 4.2.3-2). The remains from the ninth Century are all found in a single structure and therefore perhaps represent a partial skeleton of a single individual. Conversely the twelfth century remains are spread among three different structures thus suggesting these are unrelated. Canid remains (n=6) are all derived from two structures, 'grubenhäuser H and J,' both dated to the twelfth Century, this then suggests that these remains are probably the partial remains of two dog skeletons from this period (Fig. 4.2-2 and Fig. 4.2.3-1). Similarly the felid remains (n=6) all derive from a single structure, 'grubenhaus C', likewise suggesting a partial skeleton, from the late seventh century (Fig. 4.2-2 and Fig. 4.2.3-3). These probable partial skeletons suggests, in the analysis of the species above, that equids, dogs and cats are most likely over-represented by the analysis, however the low proportions of these species means that the overall conclusions drawn are not affected by this problem.

The patterns seen in the 'Stadthof' area are reflected in the results from the 'Gemeindezentrum' area of the excavation in which the sixth Century material minor domestic mammals are represented at low levels (Figure 4.2.3.1-4). The faunal assemblages from the eighth and ninth centuries are very similar in the composition of the groups and suggest a continuation of practice through this time. After this ninth Century period, sample sizes become too lower to make any conclusive interpretations about the species interactions. However a point of interest is the twelfth Century material where there is an absence of minor domesticates. The proportions of equid remains appear to increase in this area into the ninth and tenth Centuries and few remains are found after this point. Unlike the 'Stadthof' area, the equid remains appear to be much more disparate in their distribution and those that are located in the same structures tend to be from different regions of the body (Fig. 4.2-2 and Fig. 4.2.3-2). This, however, does not rule them out as partial skeletons; the resultant effects of the taphonomic forces over time could produce such a varied skeletal element distribution. The canid remains (n=2) are limited to the ninth century period, these elements are from different structures so probably indicates two individuals (Fig. 4.2-2 and Fig. 4.2.3-1). Felids are also represented in the ninth Century structures by a single find. This alongside the single find from the seventh Century remains the only finds of cats in this area of the excavation (Fig. 4.2-2 and Fig. 4.2.3-3).

The seventh and eighth (*) Century levels at Reinach 'Altebrauerei' show a similar proportion of major domesticates (Figure 4.2.3.1-5). All the equids and canids are found in the earlier structures but this is likely due to the sample size rather than any differentiation in husbandry or economic practices that would affect these species. Further elucidation of the results of the analysis of the minor domesticates is difficult as the samples of these animals are small. Comparison across the three Reinach excavations suggests a consistency is observed in the proportions of minor domestic mammals, as a group, through time.

4.2.5.2. Lausen (Table 4.2.3.2-1)

The minor domestic animals at Lausen, in the early periods, show similar proportions to those at Reinach. This level remains through the eighth and ninth centuries, however in the tenth century there is a large increase in the proportion of the minor domestic animals, this is due to the large proportions of equid remains from this time period especially in 'Grubenhaus 54.' After this point the level is again reduced in the eleventh and twelfth centuries although it remains at a higher level than seen in the earlier periods (Figure 4.2.3.2-2). The smaller samples from these later periods may mean that there is an increase in the variation due to the sample size errors but the samples are not small enough for this to have a profound effect on the results. In all cases the most important of the minor domestic species are equids, this could be due to the more robust bones and so their survival rate is increased in the face of some taphonomic forces.

The equid remains are spread reasonably evenly throughout the different structures through all time periods except for two structures (Fig. 4-3 and Fig. 4.2.3-2). 'Grubenhaus 54' contains over one third of all the equid remains identified, including four complete female pelves. The other structure 'Grubenhaus 28' contains over ten percent of the equid remains. This then suggests that perhaps specific structures were identified with horses at certain times rather than observing an overall increase in the number of equids in the faunal remains within the settlement with the increase in status of the site.

The remains of dog are found in many of the time periods of Lausen, the exceptions being the late seventh century data and the late eleventh Century data and this absence could be due to the sample sizes of the data, although canid remains are also absent from the data in Hüster-Plogmann and Veszeli (n.d., fig. 1) for the same late seventh century data (Fig. 4.2-3 and Fig. 4.2.3.1-6). The small number of remains (n=16) means it is difficult to make an analysis about the spread of the canids throughout the settlement and through time periods. Although the frequency of the gnawing marks at the site attests to the presence of dogs throughout all periods of the settlement. This is one of the mysteries within archaeozoological research; whilst the evidence of dog gnawing is prevalent in most sites the remains of the animals are consistently infrequent (§3.4.1). This is most likely due to the differential deposition of dog remains. Either they are considered they are buried elsewhere in the settlement or outside of the settlement. It is also dependant on the ties of the dogs to the human populace, which it is difficult to ascertain in terms of archaeozoology for these periods. Also there appears to be less evidence of partial skeletons in the Lausen material as opposed to the Reinach remains.

The felid remains are rare at Lausen and those of four elements that have been identified (Fig. 4.2-3 and Fig. 4.2.3.1-8). Each is the sole representative from either the ninth, tenth, eleventh centuries. There are also two juvenile individuals in these four individuals. Thus any conclusions drawn other than mere presence of these animals here will be simple speculation.

4.2.5.3. Kaiseraugst (Figure 4.2.3.3-1)

The equid remains at Kaiseraugst are split relatively evenly in to the two excavation areas within the Castrum at Kaiseraugst (Fig. 4.2-1). The proportional representation of equids through time is also quite consistent (Fig. 4.2.3.1-7). This suggests that the importance of equids change little through the time periods studied at Kaiseraugst.

Canid remains at Kaiseraugst, as with Lausen and Reinach before, are at lower levels throughout the settlement (n=12). This then curtails the amount of information that can be drawn from the remains here in terms of horizontal and chronological analyses (Fig. 4.2-1 and Fig. 4.2.3.1-6). The bones are divided relatively even through the 'Jakobli-Haus' (n=7) and 'Gasthof Adler' (n=5) areas of the excavation and there appears to be no bias with respect to the structures, within these areas, in which the canid remains are found.

The felid remains from Kaiseraugst number just three, with each excavation area containing a single specimen (Fig. 4.2-1 and Fig. 4.2.3.3-8). This means it is difficult to draw conclusions about the presence of felids in the settlement, other than that they appear at very low frequencies. Horizontal and chronological analyses must wait for more data to become available.

4.2.6. Domestic Birds

The remains of chicken dominate the domestic bird group in all cases and at all sites. The incidences of goose remains are infrequent and as such no pattern as to site or time period in which they are present. This then suggests that studying the chicken remains will give similar results to the domestic bird group as a whole.

4.2.6.1. Reinach

The data from Reinach shows a trend, where the domestic birds increase through time from the sixth Century onwards, where they are absent, to the ninth Century, where they are most abundant (Figure 4.2.3.1-2). The increase in domestic birds, leads to the proportion of main domestic mammals over this time being reduced. However in the eleventh Century there is a slight reduction in the proportions of the domestic bird remains, which coincides with an increase in the major domestic animals, but this decrease is recovered in the twelfth Century. This then suggests that there is a direct relationship between these two groups and it could be that there is a relationship between two individual species within these groups that provide this relationship. The most likely species in the bird group would be chicken, however it is altogether more difficult to select the likely partner in the mammal group.

The general patterns from the whole excavation are reflected in the results from the Reinach 'Gemeindezentrum' area of the excavation in which the sixth Century material has a very high proportion of main domestic mammals, but there is a lack of domestic birds (Figure 4.2.3.1-4). The faunal assemblages from the eighth and ninth centuries at the 'Gemeindezentrum' are very similar in the composition to the cumulative remains for the three areas for these time periods and suggest a continuation of practice through this time. After this ninth Century period, sample sizes become too lower to make any conclusive interpretations about the species interactions. However a point of interest is the twelfth Century level in wild and domestic birds make up twelve percent of the total species present, although the vast majority is due to a large number of domestic bird remains but also due to the small size of the sample. A partial skeleton of a chicken from this period could easily account for this high value.

The material from the Reinach 'Stadthof' area of the excavation shows a relatively stable composition with respect to the proportion of domestic birds through time in the samples of which are considered statistically sound (Figure 4.2.3.1-3). The smaller samples however show deviation from this probably due to statistical error, when compared to the results from the 'Gemeindezentrum' area. The seventh Century data has a large proportion of domestic birds compared to other periods, whilst the converse is seen in the ninth Century data where domestic birds are wholly absent.

The seventh and eighth Century levels at Reinach 'Altebrauerei' shows that the level of domestic birds is relatively stable within this area of the excavation despite the eighth Century material (*) (Figure 4.2.3.1-5).

4.2.6.2. Lausen

The excavation at Lausen shows that in the sixth century periods domestic bird remains are relatively rare. However, from this point until the ninth Century a picture of the proportions of domestic birds is unclear as the sample sizes from the material are too small to interpret safely (Figure 4.2.3.2-1). This conflicts with the data presented by Huster-Ploggman and Veszeli (n.d. fig.1), which suggests that domestic birds are relatively frequent in the structures analysed in their work. This then could suggest that different structures are using domestic birds differently; another possibility is that taphonomic forces are having a greater affect on the preservation of the relatively weak bird bones in some structures. In the ninth Century the picture is divided in the material from 'Grubenhaus 9' there is relatively few domestic birds, mirroring the results from the early period, however the large assemblage from 'Grubenhaus 28' shows an increase in the proportion of domestic birds present. This could indicate a difference in the uses or taphonomic forces on domestic birds in the structures or perhaps a change in practices with regard to the domestic birds through this period, if the former pre-dates the latter. The most likely cause of this change is the relatively high status of 'Grubenhaus 28' and thus this probably represents the different use of the structures within the settlement at a given time. In the tenth Century a difference is observed in the different structures, 'Grubenhaus 17' has fewer domestic bird remains than the larger assemblage in 'Grubenhaus 54' which suggests that the difference occurring in the ninth Century is due to the use of domestic birds or taphonomic forces within differing structures rather than changes in husbandry practices through time. Again the results from elsewhere (c.f. equid proportions, tab. 4-3 and section 4.2.3.2) suggest that 'Grubenhaus 54' is related to a higher social standing with in the period. These results then support the hypothesis for different social classes being ascribed to different structures. After this period the remains of domestic birds are relatively stable, although each time period is only presented by a single structure.

4.2.6.3. Kaiseraugst

The proportions of domestic birds through time at Kaiseraugst shows that the levels are relatively consistent in the statistically sound data, the exception to this the material from the fourth to sixth Century levels which as mentioned previously with the high proportions of domestic chicken remains appears to be a special context (Figure 4.2.3.3-1). The material from the 'Gasthof Adler' area mirrors this relative uniformity of the data in the whole excavation with respect to domestic birds (Figure 4.2.3.3-3). The 'Jakobli-Haus' site however differs from the general picture, with higher proportions of domestic bird remains in the early fifth to sixth Century period, whilst the sixth Century material is similar to that observed in the fifth to sixth Century fills in the 'Gasthof Adler' site (Figure 4.2.3.3-4). The early seventh century data shows a reduced proportion of domestic bird remains.

4.2.7. Wild Mammals

The majority of the wild mammal group as with the domestic bird group is dominated by a single species, in this case, red deer. Although there are interesting patterns formed when studying the range of species rather than the proportions that are present.

4.2.7.1. Reinach

The proportion of wild mammals through time at the Reinach excavation remains relatively stable after an initial absence in the sixth Century remains. The seventh to eleventh Century then shows the aforementioned consistency and then disappears again in the twelfth Century (Figure 4.2.3.1-2). The absence of wild mammals in the early periods maybe due to the process of resettlement of the site after an uninhabited period thus there is little or no time for hunting of wild animals.

As with the other species groups, this overall aggregation of data for the excavation is mirrored by the results from the 'Gemeindezentrum' area of the excavation (Figure 4.2.3.1-4). Even down to the absence of data from the sixth and twelfth Century periods. This is probably due to a large proportion of the material being contained within this area.

The 'Stadthof' area of the excavation has much lower levels of wild mammals through all periods of the site but again show a degree of consistency at this lower level (Figure 4.2.3.1-3). Although there are a relatively large proportion of wild animal remains from the ninth Century contexts in this area, the sample size is too small to avoid statistical error.

The 'Altebrauerei' area of the excavation during the seventh Century shows a similar proportion of wild mammal remains compared to the 'Gemeindezentrum' area at a similar time (Figure 4.2.3.1-5). However, the small assemblage from the eighth century (* see §2.1.3) is probably not representative.

4.2.7.2. Lausen

The wild mammal remains from the Lausen material, like those at Reinach, are relatively scarce (Figure 4.2.3.2-2). In the early periods, the sixth Century and the eighth to ninth Centuries (* see §2.1.3), the levels of wild animals are comparable to those observed by Hüster-Plogmann and Veszeli (n.d. Fig. 1). This period, as mentioned above, is dominated by the remains of red deer, with just a single fragment of hare to allude to the hunting of other animals. Wild animals are absent from the seventh century data from Lausen although, again these samples are small and thus are probably not representative of the assemblage. Wild animals are observed in the ninth and tenth centuries but the size of the assemblages uncovered means that the number of individual fragments identified and thus the proportions of wild mammals contained within them are relatively insignificant. Wild mammal remains are again observed in the assemblage of the eleventh Century, the proportion of the wild mammal group is similar to those of earlier periods. However, there is by far a greater range of species present at this time compared to the other periods (table 4-3). Red deer is again dominant followed by hare remains, and there is also evidence of roe deer, wolf, bear, squirrel and mole. This could be due to the size of the assemblage, however the ninth century material of comparable size does not show such a wide range of species, with just red deer, hare and fox present. This is perhaps the high point of the settlement with respect to its status, thus it maybe that a wider variety of animals are being hunted and possibly eaten by the elite of the settlement. The largest proportions of wild mammal remains (2.55%) are observed in the early eleventh Century data. Red deer are present at this time alongside hare and stoat, all constituting a relatively similar proportion. In the late eleventh and twelfth Century data wild mammals are wholly absent. This absence could be in part due to the descent in the status of the settlement at this time, although this decrease in proportions of wild mammals is probably also exacerbated by the size of the samples from this period.

Sample size seems also to play a role in the proportions of wild mammals present in an assemblage with smaller samples. Those below four hundred identified fragments exhibit a higher proportion of wild mammals to those with a greater sample size, which perhaps indicates that the boundary of which samples are considered statistically sound should be raised at least with respect to wild mammal representation. This then suggests that wild mammals, at the lower end, are over represented due to the small sample sizes, as there is no relationship between the size of the samples and the dating and status of the site. This pattern could also be due to a non-linear relationship between wild mammal proportions and sample size. Normally it is assumed where sample size increases, the numbers of wild mammals identified would be expected to increase at a proportional rate. The fact this does not occur then creates a host of statistical problems that cannot hoped to be addressed here. This phenomenon is probably influenced differently at each site by taphonomic and cultural factors that mean that extracting the relationship between solely wild mammals and sample size an almost impossible undertaking. Comparison with the other sites in this study appears to confirm that this is a site dependant phenomenon, with each site processing its own unique pattern. Although, differing in pattern, both Kaiseraugst and Lausen illustrates a pattern that becomes more constant after a sample size of approximately four hundred identified specimens. However more evidence is required at this higher limit to confirm this idea. Analysing the patterning of wild animal proportions with respect to the structures at Lausen shows there is a tendency that the structures with the higher proportions of wild mammals are closer to the track-way that passes through the settlement, although the exception to this is 'Grubenhaus 8' which exhibits a high proportion of wild mammal remains.

4.2.7.3. Kaiseraugst

The composition of the assemblages with respect to wild mammals in the Kaiseraugst excavation shows that there is a reasonable consistency through time, despite the changes observed in other assemblages (Figure 4.2.3.3-2). The levels of wild mammal remains are relatively low and are again, as with the previous sites, dominated by red deer remains although roe deer, hare and wild boar are also present (table 4-1). It also appears that as with Lausen the level at which a sample is considered statistically secure needs to be raised when considering wild mammal proportions. The number of wild boar fragments, throughout all time periods of the site, is higher than at either of the other sites discussed above. However, these tend to be spread through all time periods and areas, so that mostly single elements are identified thus making interpretation difficult. This greater presence of wild suids is perhaps related to the less fragmentary nature of the material at Kaiseraugst (§3.2.3). The greater fragmentation at the other sites means it is much more difficult to distinguish the wild suids from those that are domesticated. Wild mammal remains are absent from the assemblages pertaining to the twelfth Century, this is probably due to the site being reduced to no more than a village at this time. This general pattern throughout the site is also observed in the individual areas.

In the 'Gasthof Adler' area of the excavation the presence of wild mammals is observed in the time periods that is considered statistically large and absent from those that are considered small (Figure 4.2.3.3-3). The 'Jakobli-Haus' site shows the proportions of wild mammals remain very consistent throughout all the time periods of this area, this include the area of the fourth to sixth Century 'bodenniveau' which as mention previously appears to be a special complex with regards to the animal remains (Figure 4.2.3.3-4). Wild mammals are wholly absent from the twelfth Century 'Fabrikstrasse' area, outside of the Castrum, this, like the small 'Gasthof Adler' twelfth Century assemblage, is probably due to the declining nature of the site at the time and is probably exacerbated by the fact that both assemblages are relatively small and thus prone to statistical error.

4.2.8. Wild Birds

Wild birds are sparsely represented throughout all the sites analysed here; in the majority of cases were probably partly commensal in all the sites. The wild birds identified are mostly members of the corvid family and ducks.

4.2.8.1. Reinach

At the Reinach site, just two time periods have examples of wild bird, the seventh and the Twelfth Centuries (fig. 4.2.3.1-2). The former contains two fragments of the common buzzard from the 'Stadthof' area of the excavation (fig. 4.2.3.1-3). These bones are probably related to the same skeleton. The role of this animal and its nature is discussed further in a later chapter (§7.3.5.1). The twelfth Century wild birds are represented by a single specimen of corvid in the 'Stadthof' area of the excavation (fig. 4.2.3.1-3) and a further two corvids from the same period in the 'Gemeindezentrum' area of the excavation (fig. 4.2.3.1-4).

4.2.8.2. Lausen

At Lausen the wild bird group is much better represented through time than is observed at Reinach (c.f. figs. 4.2.3.1-2 and 4.2.3.2-2). Not only in number but a wider range of species are also present. The best represented of which is the stork (n.=7; MNI=4), however these only appear in the ninth Century and in 'grubenhaus 28'. The corvids and duck finds appear individually in a greater number of time periods, whilst tawny owl and jay are also represented by single finds from the sixth to seventh and eleventh Century structures respectively. But again the low numbers prevent any meaningful interpretation being made for this group of species. The roles of these species are discussed at length in chapter 7.

4.2.8.3. Kaiseraugst

At Kaiseraugst except for the assemblage from the fourth to sixth Century 'Bodenniveau' there is also a dearth of wild bird remains from the 'Jakobli-Haus' and 'Gasthof Adler' areas of the excavation (c.f. figs. 4.2.3.3-3 and 4.2.3.3-4). The 'Bodenniveau' level of the 'Jakobli-Haus are appears to be a special deposit with respect to the wild birds and the number (n. =24) from this level far is equal to the wild birds numbers from all other areas and sites in the study. There are twelve fragments of corvid, seven small songbird fragments, two partridge bones, a jay, a thrush and a woodpecker (table 4-1). These birds would likely have all been commensal or at least semi-commensal within the environs of the *Castrum*. This means that interpreting this data is much more difficult. Although with other data mentioned above (§4.2.2.3), it appears that these birds could be part of a special deposit. The remaining periods of the 'Jakobli-Haus' produce a single specimen of duck, corvid and partridge all from various levels dated to the fifth to sixth Centuries (fig. 4.2.3.3-4). The wild birds at the 'Gasthof Adler' site are sparser still with a single specimen of duck appearing in the small twelfth Century fills being the sum total of this group through all time periods (fig. 4.2.3.3-3). These lower levels mean that it is difficult to observe changes in the material from one period to the next.

4.2.9. Summary

4.2.9.1. Reinach

The data from Reinach shows a trend, where the minor domestic mammals, domestic birds and wild mammals and birds as a whole increase through time from the sixth Century onwards. There appears to an increasing proportion of domestic birds from the sixth Century, where they are absent, to the ninth Century, where they are most abundant. The increase in domestic birds, leads to the proportion of main domestic mammals over this time being reduced. The ninth century is also the point at which the minor domesticates are also at their peak, though they are more prevalent in the tenth Century (* see §2.1.3) contexts. Wild birds are absent except for the seventh and twelfth Century levels. The eleventh and twelfth centuries return a similar result to those of the eighth century although in the later period wild mammals are wholly absent.

These patterns are reflected in the results from the Reinach 'Gemeindezentrum' area of the excavation in which the sixth Century material has a very high proportion of main domestic mammals, minor domestic mammals are represented but there is a lack of domestic birds and no wild mammal or birds. The faunal assemblages from the eighth and ninth centuries are very similar in the composition of the groups and suggest a continuation of practice through this time. After this ninth Century period, sample sizes become too lower to make any conclusive interpretations about the species interactions. However a point of interest is the twelfth Century level in wild and domestic birds make up twelve percent of the total species present, although the vast majority is due to a large number of domestic bird remains. There is also an absence of minor domesticates and wild mammals from this period. Wild birds are wholly absent except for the twelfth Century levels.

The data from Reinach 'Stadthof' shows reasonable consistency through time, when considering the domestic and wild species grouping. However, the small amount of variation among time periods must be considered. The variation mainly occurs due to the small sample sizes that are available for comparison. After the main domestic species, the domestic birds (chicken and geese) are better represented than the minor domestic animals (*Equus* sp, dogs and cats). Wild birds and mammals are present in low levels in all periods. The ninth Century (* see §2.1.3) appears to be an exception to the above-mentioned consistency, this is in part due to the small sample but also perhaps due to poor taphonomic conditions for bone survival, the lack of smaller and more fragile mammal and bird bones and a higher proportion of gnawed and weathered bones from this time period supports this concept.

The seventh and eighth (* see §2.1.3) Century levels at Reinach 'Altebrauerei' shows similar proportions of major domesticate, it is at best tentative to make more comparisons on this data. The seventh Century data does show a relatively high proportion of wild mammals, (approximately three percent), when compared to other areas of the Reinach excavation. Wild birds are absent from this area of the excavation in both time periods.

Comparison across the three Reinach excavations suggests that the levels of main domestic mammals are similar throughout time. The exceptions to this being the early period at Reinach 'Gemeindezetrum' with high proportions of main domestic mammals and the eighth and ninth Centuries at the same site, which as stated previously has low proportions of main domestic mammals in coincidence with the increasing domestic bird proportions. The wild mammal proportions remain at a consistent level through out the time period studied. A similar consistency, albeit a high proportion, is observed in the minor domestic mammals. There are only two periods when wild birds are present at the site, the twelfth Century ('Gemeindezentrum' and 'Stadthof' excavations) and at the seventh Century 'Stadthof' excavation.

4.2.9.2. Lausen

The Lausen material recorded in this study shows a great deal of uniformity with respect to the domestic and wild groupings. The main domestic mammal group is approximately 95% of the identified material throughout all time periods with the exception of the tenth Century, which falls below 90%. This is due to the high proportion of domestic birds and minor domestic mammals recorded in this phase. The large majority of the minor domestic animal group at this time is Equus species (probably horse). This tenth Century material is comparable, in terms of main domestic mammals and domestic birds, to the previously recorded material by Hüster-Plogmann and Vezseli (n.d. fig. 1) for the sixth to ninth Century period at the same site. Another point of interest is that in the late eleventh and twelfth Centuries wild mammals and birds are wholly absent. This may be an effect of sample size as both contain 150 identified bones or less. Also a single pit fill represents both of these levels whereas preceding time periods consist of numerous pit contexts. So in a given time period assemblages with a single pit context can be affected depending on the specific use for which the pit is used. However, the particular use of individual pits is an essential point in understanding the settlement dynamics.

4.2.9.3. Kaiseraugst

The Kaiseraugst 'Gasthof Adler' area shows a high degree of consistency throughout the fourth to sixth Centuries studied. The 450-500 AD levels (* see§ 2.1.3) has been included here, as they show a considerable consistency with the large preceding, contemporary and following samples. In the mid fifth to sixth Centuries samples an increase in wild mammal proportions can be observed. All bar one of the wild mammal fragments from this time period are attributed to either roe deer (*Capreolus capreolus*) or red deer (*Cervus elaphus*). This increase in cervids coincides with the antler material finds from the Kaiseraugst 'Jakobli-Haus' excavations (§5.3).

The material from the 'Jakobli-Haus' excavation also shows remarkable similarity of groups both within the area and when compared to the 'Gasthof Adler' excavation. The increase in wild mammals witnessed in the 'Gasthof Adler' is also seen here in the mid fifth to sixth Centuries at 'Jakobli-Haus' and into the seventh Century. Although there is a wider wild species presence with both hare and wild boar also present alongside the two cervid species observed in the 'Gasthof Adler' area. Alongside this increase in wild animal proportions there is also an increase in domestic bird proportions, which depresses the proportion of main domestic mammals for this time period. The samples of twelfth Century origin from the 'Gasthof Adler' and 'Fabrikstrasse' excavations also show a similarity to those preceding them, although, there is a lack of wild animals observed in this time period. However these samples are small and therefore not too much weight can be placed on them but as a tendency it shows consistency with other more sound data. The real exception to what appears to be a very consistent pattern of species groups occurs in the 'Jakobli-Haus' fourth to sixth Century levels. In this period there are a vast number of domestic bird bones observed (approximately 23%). This may partly be due to the fact that the sample is of a small size and the deposition of whole or partial skeletons of chicken (*Gallus domesticus*) exaggerates this bias further. However, this food waste is different from the others at the same time period. This appears to be food waste derived from a higher status level due to the increased proportions of young pig present (§6.4.1.1) alongside the high proportions of chicken. Ritual deposits during the roman period show large numbers of young pig and chicken remains (Jacques *et al*, 2008, 245). Corvids are also prevalent in certain ritual contexts in the Roman world. However, it is difficult to say with any certainty that the contexts here are produced from ritualistic practices, not only by the faunal remains but also due to the lack of other ritual-related archaeological finds.

4.3. Bone fragment weight

The tables and figures (4.3.1, 2 and 3-1and 2) show the relationships between the domesticated species (Cattle, pig, and ovicaprids) through time using the recorded weight of identified fragments. This is much more useful when trying to understand the relative proportions of meat that each species supplied to the population as it takes in to consideration the related to muscle mass and size of the animal.

4.3.1. Reinach (table 4.3.1-1)

Analysis of the identified fragment weight for the three main domestic species at Reinach shows that although cattle is dominant throughout all time periods, the earlier periods, sixth and seventh Centuries, show a lower proportion of cattle than in the latter periods (fig. 4.3.1-2). Pigs are observed to be a substitute for the cattle in these early periods. The latter periods of the three excavation areas at Reinach are extremely consistent with high proportions of cattle, followed by pig and ovicaprids. Ovicaprid proportions show a high degree of stability through all time periods, as also observed in the fragment count analysis (c.f. §4.2). The meat weight calculation above suggested that the seventh Century 'Altebrauerei' layers showed that pig provided a larger contribution to the meat yield than cattle this is not supported by the fragment weight analysis. Although, the fragment weight analysis does show only a small difference between the two proportions when compared to other time periods in the Reinach excavations.

4.3.2. Lausen (table 4.3.2-1 and figure 4.3.2-2)

The ovicaprid proportions at Lausen as at Reinach remain the third best represented species through time but at very stable levels (approx. 10%). The opposite can be observed with respect to the cattle and pigs. Cattle dominate the assemblage through most time periods. Cattle proportions decrease through time to the Tenth Century. After this point, the proportions of cattle begin to grow again. The pig remains at Lausen show the reverse trend to that of cattle, increasing in proportion to the tenth Century before starting to decrease in proportion after this point. In fact in the tenth Century pig is the better-represented species. The fall in the proportion of cattle in the eighth to ninth century period fits well with the increased investment in the site and the elevated social status of the site from this period onwards. The latter periods here show that as the settlement becomes less important probably after the death of Rudolph von Rheinfelden, there is an increase in the proportions of cattle until the relocation of the settlement in the thirteenth century.

4.3.3. Kaiseraugst

Observations at Kaiseraugst show once again that cattle are by far the most dominant species through all time periods with proportions between 65% and 80%. This proportion remains reasonably consistent through time. There appears to be a slight decrease in proportions in the latter periods. This coincides with a relative increase in the remains of ovicaprids during the same time. However these later periods contain only small samples and thus the observed changes are likely down to statistical error rather than any cultural changes that are taking place with in the settlement. Pig proportions make up approximately 20% of the assemblage. The assemblage from the fourth to sixth Century levels show an increase in the level of pig proportions compared to other time periods.

Inter-site comparisons are difficult, Lausen especially, is a specific assemblage through time so is not comparable to the other two sites. However, Kaiseraugst and Reinach show some similarities even though one is an urban centre while the other a rural settlement. Both sites show a relative stability through all periods for the species discussed. Ovicaprids and pigs on average show similar proportions, approximately 10% and 20 % respectively. Cattle proportions are little more fluid, especially with respect to Reinach but on the whole the fluctuations tend to concentrate around the 70% point.

This chapter has looked at the species and there relative abundances within the faunal remains of the settlements; this has been studied through fragment quantification and fragment weight. Fragment quantification showed that throughout all site the three main domestic species represented more than 95% of all the identified bone fragments. Other domestic animals and birds were observed in small proportions throughout all the sites, though the proportion was dependant on the site and time period being observed. Wild animals were also relatively rare at all three sites and all time periods. There were high proportions of corvid remains in the 'Jakobli-Haus' area of the Kaiseraugst excavation. A broad spectrum of different species was observed in the eleventh Century assemblage at Lausen, although this was still a relatively small proportion of the total remains. This coincides with the high point of the settlement and these wild animals may have been the remnants of hunting for sport around the settlement. The data was also analysed by grouping of similar animals to allow an easier understanding of the patterns that could be observed as often, different species have similar uses. Again the three main domestic species were the most important. The quantification of the bone fragments used various methods for looking at the distributions of the three main domestic mammals including triangular plots and meat weight proportions. The latter also allowed a better understanding of the meat contribution the three main domestic species made and how these related to the cultural that have been observed in the archaeological data. This could also be observed by analysing the fragment weight of the three main domestic species at the site. In all cases, except the tenth Century at Lausen, cattle was the dominant species due to it size and thus amount of meat, offal and other products that can be obtained from a single carcass.

Now that the main species proportions have been set out, and the importance of difference species and groups of species observed, the cultural influences that have been brought to bear on these assemblages can be observed in the next chapter. The processes that occur post slaughter that have an influence on the specific elements identified will be analysed and thus inferences about butchery, fur, horn and bone working can be put forward where circumstances allow. Following that there will be analysis of the husbandry practices that meant that certain criteria of animals are observed in the assemblages i.e. age, sex, stature and health.

5. Carcass Representation, Meat, Crafts and Industry

5.1. Introduction

A dependable supply of food is perhaps an important condition for the development of an urban society and as settlements grow, there is a need for increasing volumes of food (MacGregor 1998, 11). Mostly this food, in terms of meat, would have arrived in the settlements on the hoof (c.f. §5.2 and §5.3). It must be remembered that rarely does a faunal assemblage represent the waste from a single process of activity but is a mixture of the different day to day and some of the less routine activities that occur within a settlement. Alongside this value as a foodstuff there is also value in the secondary products from the animal namely antler, bones, hides and horns. More often the waste, as with the assemblages studied here, is a mixture of a diverse range of activities. These will include the secondary activities, such as tanning, horn, bone and antler working, as well as meat consumption. Hides were taken mostly from cattle but it is entirely possible to make leather from almost any animal's skin, although pig's skin was considered a poor material with which to work. Horns again came from mostly cattle but there is evidence of ovicaprid horn working in the early medieval (c.f. MacGregor *et al.* 1999, 1916). Bones from many animals were used to make tools, ornamental and other household items, the bones would have been chosen for size and shape depending on the job in hand (Macgregor 1998, 17-19). Meat consumption can be broken down further into a combination of primary and secondary butchery waste and domestic household waste, as is observed in the majority of assemblages. It must be remembered here that in many cases there exists problems with mixing of deposits and residual material.

The relative frequencies of different skeletal elements within an assemblage, combined with the horizontal distribution can help to provide evidence of the crafts mentioned below. This evidence can influence the interpretations on more general themes such as provisioning of the settlement, as well as distribution and disposal of waste.

High frequencies of the main meat bearing bones, which includes the girdle bones; scapula and pelvis, humerus, femur, and from the trunk; thoracic and lumbar vertebrae and the ribs in the main suggests the presence of domestic food waste. These elements are often sold and cooked with the meat still attached, although, in some cases they may be boned out prior to cooking. It must also be mentioned that the meat surrounding some of these bones also tend to be of better quality than those from other parts of the body. The rump part of the animal for example often contains the choicest meat. The lesser meat bearing bones such as radius and ulna, tibia and, where present, fibula, as well as the cervical vertebra can also compose part of the household refuse. However, these are often associated with lower quality meat cuts. The proportions of these two categories of elements can therefore lead to inferences about the social and economic status of the settlement.

Excessive numbers of skull parts (including teeth and horns), carpals, tarsals, metapodials and phalanges often signifies an area of primary butchery, as these elements are the first to be removed once the animal has been slaughtered and bled. Many of these elements are also of high density and as such can help to understand the taphonomic forces that are affecting the faunal remains (c.f. §3).

In the past, very few parts of the slaughtered animal went to waste. Alongside the meat other products were of commercial value to different craftsmen. The carcass was skinned and the hide removed soon after slaughter and transported to the tanner for curing. The elements from the metapodial to the end of the foot were often left attached to the hide, since to remove these elements was a difficult and time-consuming task. In addition to this there are indications that these elements provided a good attachment point for securing the hide in preparation for the tanning process (Thomson 1998, 4). Thus, ensuring a more efficient use of the hide was possible, with less damage and greater utilisation of the useful proportion of the hide. Subsequently a predominance of these terminal elements in an assemblage is a good indication of the waste from a tannery. The skulls of small animals, probably sheep-sized and smaller, were also often left attached to the hide and only removed at some early point in the tanning process, although there is evidence that the cranial part of the skull of cattle may also have been left attached to the hide (Macgregor 1998, 14). Sheep and cattle skulls would almost certainly find their way to the horn worker and it is often observed that the tanner and horn worker had workshops in close proximity, in past urban settlements (MacGregor 1998, 15). The horn worker would not only receive the cattle and sheep skulls from the tanner but also cattle horns direct from the slaughterhouse. The horns were removed either before of after the cranial part of the skull was broken open to utilise the brain (Macgregor 1998, 14). The horn worker was interested in the keratinous outer sheath of the horn. The horncore would then be discarded, in a similar manner to the terminal bones from the tanner, as it was no longer of economic use. Disposal of these waste materials would probably occur locally, almost certainly utilising any unused or abandoned structure in which to deposit the waste. In the absence of such structures it would probably not be uncommon to produce large mound on the surface.

These craft processes, having stated that they are often found in close proximity, mixed with domestic waste often produce a faunal assemblage that is not as clear as the models outlined above, especially in large urban assemblages such as that from Kaiseraugst. It would be almost impossible to identify all craft and domestic activity from such assemblages. However general patterns of body parts present and tentative implications can aid with the conclusions that may be drawn.

5.2. Skeletal representation

The data presented here are from identified anatomical elements. Data is only considered statistically sound where the NISP counts are greater than 150, although where appropriate those of smaller samples have also been included and marked with an asterisk (*). All identifiable shaft fragments have been included in the analysis. The material is also presented as grouped elements with respect to the position within the body. This is then compared to a standard skeleton and the deviation from this will show the parts that may have been removed or those that are over represented by cultural or post-depositional forces. The total weights of a given period may differ from those of the raw data, as the raw data does not include elements such as the hyoid, patella and other small bones such as sesamoids. The skull group, as well as the skull includes the mandible, hyoid, horncores and loose teeth. The stylopodium group contains humerus, femur and also contains the girdle elements (i.e. scapula and pelvis). The inclusion of the girdle elements within this group is the cause of debate, where some authors choose to include them as part of the upper limbs; others choose to include them as part of the trunk. This decision is a matter of choice but should be stated to avoid comparison of unequal data. The trunk group comprises all vertebrae (atlas, axis, cervical, thoracic, lumbar, sacral and caudal) as well as the rib fragments. The zygopodium data consists of radius, ulna, tibia and fibula. The autopodium group includes all the foot bones inferior to and including the carpals and tarsals (i.e. carpals, tarsals, metapodials, and phalanges 1, 2 and 3). The use of this methodology is much more reliable than comparison of raw data as there can be factors such as fragmentation, excavation techniques and density related destruction of the material which can bias the data and thus more comparable with data from other authors within the research group at IPNA.

It should be expected that through the taphonomic forces certain fragments or parts of elements are likely to be missing from the archaeofaunal remains. The reasons for this are explained more fully in chapter 3 but are mainly due to the relative structural density of different parts of the skeleton. Therefore it is likely that vertebrae and ribs will be lost in relation to the proportion of the whole skeleton as these are thin, relatively less dense than other elements. Small bones such as phalanges of small mammals, as well as smaller tarsals and carpals are likely to be destroyed by taphonomic forces or not recovered from the excavation due to the hand collected nature of the material. Other elements have different densities with in the whole element and thus the survival of more or less of the less dense material can affect the proportions that are different from the skeleton as a whole.

An attempt has also been made to correlate bone groups to utilization (after Maltby 1982, 7). The skull is treated as a group as it is removed soon after slaughter and is composed of the same elements as stated above. The major meat bearing elements (i.e. humerus, femur, scapula, pelvis, ribs, thoracic and lumbar vertebrae) are grouped in a second group. Thirdly, those elements that attach to smaller muscle masses are grouped; radius, ulna, tibia, fibula, and cervical vertebrae. Metapodials are included in a fourth group as these are often used for bone working. Carpals and tarsals are a fifth group formed as these can often be used as game pieces or incorporated in to jewellery. Phalanges, the final grouping, can be used in glue production. Although using this methodology is very similar to the groups created using the region of body. It may be difficult to interpret the results unless clear differences are seen in the proportions of body parts, thus making it redundant, as it is an extra analysis to show a similar outcome. A further disadvantage is that the processes and manufacturing techniques cannot always be linked to certain body parts and in some cases the processes are not entirely understood. While also some of these groups may come together to form a single group such as metapodials, carpals and tarsals and phalanges in the case of tanning as described later in this chapter (§5.5). Thus other than the presentation of the data here further analysis is carried out with body groups. It must also be remember that taphonomic forces can also influence the proportions of elements represented (§3). As stated previously, the material from the three sites here are observed to follow the relative density gradient with weaker elements being preferentially destroyed by the post depositional forces.

5.2.1. Cattle

5.2.1.1. Kaiseraugst (tables 5.2.1.1-1, 2 and 3)

The earliest data from Kaiseraugst shows that humerus, vertebra and femur were the best represented elements in the assemblage. These elements are major meat bearing elements and suggest that the cattle remains from this period are almost certainly derived from food waste. Relatively high proportions of ribs and scapula also attest to this. The large assemblage from the fifth and sixth Century assemblages is much less clear, humerus, radius and vertebra being the most abundant cattle elements. As previously, these elements suggest that the utilisation of meat around these elements is important. However, many other elements are also well represented at this time, such as mandible, femur, skull and metapodials which while the former two elements may also suggest the occurrence of food waste, the presence of relatively high proportions of the latter, which are usually removed early in the slaughtering process implies that other processes may also be represented here. The sixth Century material again shows a similar pattern of representation with humerus, radius and metatarsals being most prominent. Whilst the first two elements again suggest food waste, the later has little meat value. Examining the other better represented elements shows that the meat bearing elements, i.e. scapula, mandible and femur are well represented, although metacarpals are also highly visible. This suggests that the overlying composition of this assemblage pertains to meat bearing elements other underlying processes are also occurring at a similar time. The material from the seventh Century also shows a similar pattern of meat bearing elements and metapodials. However, here the hind limbs are better represented. This wide range of elements that are relatively well represented could also suggest that whole carcasses are brought into the settlement to be slaughtered rather than slaughtering occurring elsewhere and the dressed joints sold at Kaiseraugst.

Studying the horizontal distribution by comparison of the fifth to seventh century data shows that at the ‘Gasthof Adler’ and the ‘Jakobli-Haus’ excavations, patterns of element representation are very similar and thus that the processes behind the accumulation of these assemblages are also probably similar (table 5.2.1.1-4 and fig. 5.2.1.1-5). In the case of this material, remains of food waste is the likely factor as proportions of major meat bearing bones are best represented, although the relatively high proportions of metapodials hint at other underlying processes. However it can be observed that there are deviations in those samples that are not statistically sound. Thus as stated above the cattle material here probably represents mainly food waste and that the parts from which the meat is obtained remains consistent through time.

5.2.1.2. Lausen (figs. 5.2.1.2-1, 2 and 3)

The figures for skeletal representation from Lausen show a complex pattern of survival in the assemblages. The earliest data shows a predominance of hind limb, femur and tibia. Femur is considered a major meat bearing bone, whilst the tibia has a lesser amount of meat and a high survival rate due to its high density. A number of other elements are also relatively well represented. These elements include the major meat bearing elements, scapula, thoracic and lumbar vertebrae, the lesser meat bearing elements of mandible, cervical vertebrae and radius, also crania is also comparatively well represented. This wide range of relatively well-represented bones suggests that as with Kaiseraugst, whole cattle are brought, probably driven to Lausen, where they are slaughtered and butchered at the settlement. The eighth to ninth Century data shows that mandible and humerus are the best represented elements. These elements contain a relatively high proportion of meat as well as being relatively dense and as such high survivorship. Also comparatively well represented are the pelvis and tibia. These elements, again, have high survivorship and with respect to the pelvis carry some of the highest quality meat. The tibia holds meat but of lesser quality. These two elements are also the best-represented bones in the tenth Century material. The forelimb, humerus and radius, and phalanges are next best represented, although these are less than a third of the proportions of those elements that are best represented. The pelvis, femur and skull are most abundant in the eleventh Century assemblages. The former two being areas of high quality meat and the latter could be represented as the brain is being consumed in the diet. Also relatively well represented at this time are mandible, humerus, vertebrae and tibia. Again these are mostly meat bearing elements both of major and lesser quantities of meat. These high proportions of meat bearing elements coincides with the period of highest social status that the site obtains and thus there is perhaps a desire and means to provide better quality of meat cuts. However, as the whole animal is driven to the settlement it is not surprising those other regions of the skeleton, those that provide little, low quality or no meat to also be found in the assemblages. Cervical vertebra exhibits the highest proportions of vertebra from this time period. This element produces cuts of meat that contain lesser volumes of meat when compared to the thoracic or lumbar vertebrae.

Observing the data through body area rather than individual elements shows that there is a greater similarity between time periods of statistically large samples rather than the more confusing picture that is painted by looking at the differing elements that are present (fig. 5.2.1.2-5). Those periods that deviate are those that contain small samples or those that near the limit of this sampling error, this may suggest that the limit of 150 bones is set a little too low. It is almost impossible to study the horizontal variation within a given time period since the samples are too small to a make meaningful contribution to the analysis. However it also possible that the earlier data is a reflection of the status of the site with more meat consumed from the lower quality meat areas included in the zygopodium group. In the eighth to ninth century period it can be seen that there is much higher quality meat in terms of stylopodium available to the inhabitants of the site, this coincides with the massive investment at the site in terms of building structures. The tenth Century data then reverts back to a similar pattern observed to that in the seventh Century period. This maybe due to sample size as mentioned above or perhaps taphonomic factors, as the zygopodium elements on the whole tend to be relatively more robust than those from the stylopodium areas. However this is not reflected in the taphonomic data presented here (§3.2.1 and figs 3.2.1-1). The eleventh Century data is almost identical to that observed in the eighth to ninth Century group thus suggesting that sample size is the major influencing factor in the body part representation seen here.

5.2.1.3. Reinach (figs. 5.2.1.3-1, 2 and 3)

The earliest data from Reinach shows an abundance of skull and mandible elements, with femur, tibia and phalanges also well represented. This suggests that there is probably more than one utilisation of the slaughtered cattle at Reinach. The skull could be split and the brain extracted also the cheek meat is probably removed from the mandible. The femur is a major meat bearing bone and the tibia also carries some meat. The phalanges however carry very little meat. It is known that the phalanges can be boiled in glue production. Along with the abundance of skull parts the phalanges may suggest the removal of the hide for tanning as these parts are often left on the hide when it is removed. This period is also thought to be a time at which the site at Reinach is resettled after a period of abandonment during the end of the Roman occupation of the region. Thus it could also be postulated that this is a time of limited food resources for the new inhabitants of Reinach and as such all parts of the animals are utilised, hence the lower quality meat cuts and high proportions of head elements. The eighth to ninth Century data shows a preponderance of skull and scapula. The proportions of scapula present seem to be increased by the inclusion of a few large fragments thus over-representing the importance of this element in the assemblage. There is a wide range of other elements that are less well represented these include loose teeth, mandible, vertebrae, femur and metatarsals. Whilst this makes interpretation difficult, it shows that the slaughter probably took place at Reinach, as with Kaiseraugst and Lausen cattle. This being a rural site and perhaps a producer site rather than a consumer site may suggest that those animals that are not selected to be sold for market and not deemed necessary for the continuation of the herd would have been the individuals that were butchered and slaughtered at the site. This then leads to the idea that these individuals were probably not of the best quality, as those would have gone to market or to the landlord in rent. Those that were kept for herd maintenance would likely have been the next best individuals leaving the rest for consumption at the site. The assemblage then becomes a mixture of waste from slaughterhouse, butcher and kitchen. The eleventh to twelfth Century material shows that skull and mandible are again best represented alongside the humerus. As with previous periods, it appears that the cheek meat from cattle is important in the diet, the brain of cattle may also be important in the diet due to the proportions of skull observed. The presence of humerus attests to elements with greater muscle mass being present, alongside the less well represented pelvis and vertebrae.

In general the pattern of body part representation is more or less similar through all periods at the site. In comparison to Kaiseraugst and Lausen, Reinach has more skull parts than the former sites and as explained above is perhaps due to the use of the cheek meat, as a replacement for the high quality cuts of beef from the shoulder and rump. Horizontal analysis is not possible here due to the small sample sizes that are available to work with (figs. 5.2.1.3-6-11). Tentatively it appears that there could be differences between the 'Gemeindezentrum' area and the 'Stadthof' area with the early data from the 'Altebrauerei' similar to that of the latter and the later data similar to that of the former, however these are only provisional ideas and should not be taken with any weight.

5.2.1.4. Summary of cattle data

The study of the results for cattle across the three sites shows that there is variation across time and space, although the in the main accumulation of the assemblages are very similar (fig. 5.2.1.4-1). The main differences that can be observed at the sites tends to be the higher proportions of skull at Reinach, whilst there are also lower proportions of autopodium at this site. Both Lausen and Kaiseraugst have similar body part representations for cattle through all time periods. However differences can be observed in the zygopodium, which in the seventh and tenth centuries at Lausen appear to be higher than those periods at the same site, and during all periods at the other sites studied. This is perhaps an artefact of the low sample sizes from these accumulations. It seems that at all sites the cattle are driven to the settlement, where slaughter and butchering occurs on-site, rather than large portions of carcass or dressed joints being brought to the settlement.

5.2.2. Ovicaprid

5.2.2.1. Kaiseraugst (figs. 5.2.2.1-1,2 and 3)

The small nature of these samples makes interpretations through all time periods very difficult. At Kaiseraugst just two samples are considered large enough to warrant further investigation, namely the fifth to sixth Century material and that from the sixth Century. The first shows that mandible and tibia are the best represented elements in this period, followed by radius and the metapodials. In the sixth Century material, again the best represented elements are mandible and tibia, with a relatively high proportion of radius also. The higher proportion of metapodials observed in the previous period are not seen in the sixth Century data. The elements represented here shows that the major meat bearing elements are not present and that possibly ovicaprids are not a major factor in the diet at Kaiseraugst at this time. The relatively low proportions of ovicaprids in the species analysis can evidence this. Although the patterns elucidated in these two time periods likewise seem to be occurring in other time periods, such are the sample sizes that such interpretations are merely speculative. A possible reason for these elements being present in high proportions is due to the density of these elements, distal articulation of the tibia is one of the densest elements in the skeleton and so therefore more likely to survive in the assemblage. Mandibles, proximal radius and metapodials also have high densities and thus good survivorship. Yet this still does not account for some of the major meat bearing bones that also have high densities such as the distal articulation of the humerus.

Kaiseraugst shows a severe lack of data for ovicaprids (fig 5.2.2.1-4 and 5). Only the sixth Century ‘Jakobli-Haus’ data breaks through the 150-fragment border set, all other time periods fall short. However, it can be tentatively asserted that similar practices are occurring, as trends tend to be comparable. The very small samples (i.e. 4-6th C ‘Jakobli-Haus’ and the 12thC ‘Gasthof Adler’) predictably deviate from these trends. Tentative analysis, due to sample size, of the horizontal distribution of elements across the two excavations ‘Gasthof

Adler' and 'Jakobli-Haus' shows that similar processes are also occurring with respect to ovicaprid elements.

5.2.2.2. Lausen (figs. 5.2.2.2-1, 2 and 3)

The eighth to ninth century data shows that mandible, humerus, radius and tibia are the best represented element in this assemblage. These are elements that all carry a portion of meat whilst the distal end of humerus and tibia, the proximal end of the radius and the mandible are all dense areas of the skeleton and thus preferentially preserved. The data from the tenth century also shows a preponderance of loose teeth alongside mandible and tibia, this again could suggest destructive forces at work as loose tooth tend to have a high survivability in the ground. The proportions of humerus also suggest that meat is an important factor of the elements represented here alongside the differential preservation noted. In the eleventh Century, skull, radius and tibia are all well represented followed by loose teeth, humerus and ribs. This composition of skeletal elements suggests that while meat is an important factor in this deposit, taphonomic forces also influence the assemblage. This could be due to the area of the excavation the deposit is found as each time period is represented by one or few pit fills and thus the area in which those fills fall may affect the interpretation of the data. These taphonomic forces maybe more pronounced in the smaller species such as ovicaprids rather than the larger species such as cattle and horse. The high proportions of pig, which is a similar size to ovicaprids may negate some of these taphonomic factors. The preponderance of loose teeth from ovicaprids could also represent the occurrence of tanning at Lausen. If the skulls were left attached to the hide after its removal, as an evidence of sex and age of the animal as has been alluded to (MacGregor, 1998, 14), then hanging the hides to dry would cause the decomposition of the flesh around the teeth and with time they would fall out. Unfortunately this hypothesis is merely tentative as there is no other evidence for tanning at Lausen.

There is more information obtainable from the ovicaprid remains at Lausen with three of the five time periods showing a statistically sound sample (fig 5.2.2.2-4 and 5). The patterns of body part accumulation is similar in these three periods, whilst it is possible to suggest that the smaller samples also follow the same trend with an allowance for a wider deviation.

5.2.2.3. Reinach (figs. 5.2.2.3-1, 2 and 3)

The earliest data at Reinach shows an abundance of loose teeth, mandible and tibia. This suggests that taphonomic forces as well as the anthropogenic influences are the cause of the assemblage at this time as with the analysis of the previous sites this is probably due to the small nature of the ovicaprid bones. High proportions of canid gnawing in the 'Stadthof' excavation, from where most of the early material is found is the likely reason for this density mediated preservation. The eighth to ninth century data also shows an abundance of loose teeth and distal tibia again suggesting a destructive force ravaging the assemblage probably again related to the high proportion of gnawing observed, this time from the 'Altebrauerei' site in the eighth Century. The sample sizes from other time periods are too small with which to make sound interpretations but the body area and use data from the eleventh to twelfth Century suggests that the assemblage is similar to that of the earlier more statistically sound data, though tentative, this suggests that similar processes are at work in formation of the assemblage.

Similarly to Kaiseraugst there is only a single statistically sound sample. However, as with the previous sites the small samples tend to follow the trends displayed by the larger samples albeit with a wider margin of variation (figs. 5.2.2.3-4 and 5). Horizontal analysis across the different areas is not possible because of the small samples (figs. 5.2.2.3-6 to11). It appears though that there maybe a higher proportion of stylopodium at the 'Gemeindezentrum' site compared to the other sites though this is tentative.

5.2.2.4. Summary of ovicaprid data

Comparison of the three sites in terms of ovicaprid remains shows that there are very similar practices being employed at all three sites in terms of use of the meat from these animals (fig. 5.2.2.4-1). There is a slightly high proportion of stylopodium at Lausen compared to Reinach and Kaiseraugst, in all likelihood this is due to the status of the site. However it is possible that there is a temporal difference as the data from Reinach and Kaiseraugst are earlier than those from Lausen. This could be related to the lower proportions of skull at Lausen and higher proportions at Reinach and Lausen. So it can be shown that despite minor fluctuations described above that the ovicaprids from all three sites were undergoing similar treatment throughout the five hundred years covered by the time periods represented here.

5.2.3. Pig

5.2.3.1. Kaiseraugst (figs. 5.2.3.1-1,2 and 3)

The earliest period of Kaiseraugst data shows high proportions of crania, mandible, humerus and tibia, next best represented was scapula. As discussed previously, humerus and scapula represent major meat bearing bones; the mandible also carries a large amount of meat. The crania may be utilised for the brain, which is a rich source of nutrients. The tibia is probably partly represented because of its meat worth but also because of its high density thus high survivorship. This hypothesis can also be argued for the distal humerus and mandible. A similar pattern is seen in the fifth to sixth Century period, with mandible, humerus and tibia the best represented elements, although the proportions of crania are much reduced in this period. The sixth century and seventh Century time periods show a similar pattern of skeletal representation. In these periods high proportions of humerus, scapula and mandible, correspond to the major meat bearing elements thus pointing to domestic food waste. Tibia and crania also again have high proportions suggesting that similar processes as in proceeding time periods are occurring. In the seventh Century data femur becomes better represented than previously observed, this would fit well with the high proportions of other major meat bearing elements.

There is a similar pattern of body part representation at Kaiseraugst through all time periods and areas in the statistically sound data (figs. 5.2.3.1-4 and 5). However the material from the beginning of the seventh Century in the ‘Jakobli-Haus’ area, this appears very similar to those samples that are considered to small to be error free and thus suggests that the deviation may occur because of this and that a higher boundary should have been set for the material. These small samples seem to be over-representing stylopodium whilst zygopodium are under represented, other body areas remain very similar.

The discussion of horizontal variation in the fifth to sixth Century time period appears complex, whilst the ‘Gasthof Adler’ excavation shows a preponderance of mandible, humerus and pelvis, the same period for the ‘Jakobli-Haus’ site shows that mandible, ribs, femur and tibia are all well represented. To further complicate the analysis the sixth century and seventh Century time periods relating to the ‘Jakobli-Haus’ site show a different pattern of skeletal representation again. Considering the grouped data, it can be seen that similar patterns are formed with a high proportions of fore limb elements and major meat bearing elements being present. These similar patterns despite the differences in elements present suggests that similar processes are being carried out in both excavations, maybe it is a matter of household preference as to which cuts of pork, and thus elements present, are utilised.

5.2.3.2. Lausen (figs. 5.2.3.2-1,2 and 3)

The sixth to seventh Century data at Lausen show that mandible, humerus and tibia dominate the assemblage. As discussed previously the humerus is a major meat bearing bone, the distal end of which is relatively dense, whilst mandible and tibia carry less meat, they are relatively dense bones and thus all three have a high survivability. This sample is relatively small and may influence the results when compared to other time periods. The eighth to ninth century period still shows high proportions of mandible and humerus no doubt for the same reason mentioned above, although survivorship maybe less of a factor in this period as skull parts are also well represented at this time. The preponderance of cranial elements, along with the number of young animals could reflect the amount of whole suckling pig that was consumed at Lausen at this time. Other elements that have prominent proportions include scapula, pelvis, femur and tibia, these excluding tibia are all major meat bearing bones. The relatively small proportions of metapodials and phalanges could suggest that data from this period is biased by the large amount of data from the higher status 'grube 28' and the waste represented here is from the table rather than kitchen waste which may be located elsewhere in smaller samples. Conversely, this could be due the fact that dressed joints of the well represented elements were more often brought to Lausen. In the tenth Century again, skull, mandible and humerus are highly abundant and is probably due to a continuation of the practices of the previous period, however there is not the preponderance of other meat bearing bones seen previously. The next best represented element is tibia, partly due to its survivorship in the assemblage and partially due to it also carrying a quantity of meat. This pattern changes slightly in the eleventh Century, where not only skull and mandible are still well represented but vertebrae shows high abundances too. Thoracic and lumbar vertebrae, those vertebrae that carry the most meat make up over 85% of the vertebra present. So in all likelihood this suggests that these elements represent food waste and fits the other data well in terms of higher meat cuts being well represented as femur and humerus also show the next best represented elements.

The body part analysis for pigs at Lausen at first glance appears more complex than those seen in other species at the same site (figs. 5.2.3.2-4 and 5). However if the eleventh Century data is set aside different patterns can start to be seen that are comparable to other species described earlier. Firstly the data from the eleventh Century at Lausen shows a body part pattern that is almost similar to the standard skeleton and thus suggests that whole pigs were being served at the table. This would fit well with the high status of the site at this time and the typical medieval scene of a roasted pig being served to the lord and his retinue. This then allows the rest of the data to be studied independently of this data. Here it seems that there is a pattern of increasing proportions of skull through time whilst a corresponding decrease in stylopodium is also observed. Other elements tend to vary little during this period. Smaller proportions of humerus from the eighth to tenth Century can explain this change compared to the earliest data. During this time there are also elevated proportions of mandible fragments. However this could be due to variation in practices seen on a horizontal level, that different parts of the settlement are producing different waste for a given time period and by chance different strategies have been picked up for different periods because elucidation of horizontal variation across the site could not be attempted. This was due to each time period being made up of a single pit fill or where more than a single context was available the small sample sizes of one or more of these made further investigation impossible.

5.2.3.3. Reinach (figs. 5.2.3.3-1,2 and 3)

The sixth to seventh Century data from Reinach shows a high proportion of skull and mandible with scapula, humerus, vertebra and tibia also well represented. This suggests that the meat portions of pig are present. Perhaps these are whole suckling pigs or joints of older individuals. The skull parts again suggest that the brain is part of the diet at this time. The eighth to ninth Century period shows a preponderance of skull, mandible and humerus, alongside which scapula and pelvis is also well represented. This again suggests that the main meat bearing bones are present with scapula and pelvis representing the higher quality cuts of meat. The latest period under study, the eleventh to twelfth Century, shows that mandible and humerus are best represented; pelvis and tibia are also well represented. Again this suggests that meat procuring is the main process in the formation of this assemblage.

The horizontal analysis for each period across the different areas of the Reinach excavation was unfortunately not possible as the number of statistically large samples was inadequate to attempt such a study.

5.2.3.4. Summary of pig data

The body part representation the pigs studied across all sites suggests that as with cattle and ovicaprids that they are treated in a similar way through time and geographical space. The one exception to this is the eleventh Century material from Lausen in which there is a high proportion of trunk remains. This coincides with the highest social status of the site and thus the picture of medieval hog roasts are brought to mind, whereby whole animals would have been spit roasted and served to the landlord and his retinue. The dataset with a similar line to the standard at least suggests that whole animals were discarded in a similar fashion. Again the skull fragmentation plays a large role in the body part proportions observed. Those sites and time periods with higher proportions of skull tend to have lower proportions of the higher quality meat bearing bones and vice versa. This of course could suggest that the cheek meat, brain and muzzle are cheaper forms of protein per unit weight than those of the rump and shoulder and is being consumed by those of a lower social grounding, however the data from Lausen shows that the highest proportion of the best meat cuts (stylopodium) is the earliest period and thus one of relatively low status compared to the later periods. The relative stability of zygopodium post deposition may reflect the similarity observed in the data from all time periods and sites. However as horizontal differences cannot be observed due to the lack of comparable samples in the same period and site it may be unfortunate that social differences within a site are contributing to these differences but are not readily observable here because different social practices are not observed together and thus separable.

5.2.4. Domestic Fowl

The next best represented species, chicken, in terms of body part represented is reasonably easy to elucidate. There are high proportions of leg and wing bones because these are relatively denser than the other elements in the body. The small bones of the foot and wing tips are likely to be absent due to the excavation only using hand collection methods as a matter of course. The skull of chicken is rarely seen found in the faunal remains throughout Europe this probably due to its fragile nature. So with the patterns established, the remains from the three sites here can be compared. The Kaiseraugst site has a similar body part pattern across both areas of the excavation and thus similar to the material as a whole (Table 5.2.4-1). Wing and Leg bones of high density are surviving better than the relatively less dense bones as stated above. It is perhaps not surprising that the 'Jakobli-Haus' is similar to the whole as this data makes up the bulk of the sample (147 of 181). However the small sample from the 'Gasthof Adler area is also equivalent to the other area, which means that in all likelihood similar processes are occurring in the preparation of fowl in both areas. The Lausen material shows a very similar pattern of body part compared to that at Kaiseraugst with the higher density bones surviving better in the ground (Table 5.2.4-2). Vertical variation can be observed for at least part of the periods covered by the settlement here. These are small samples and must thus be treated tentatively. However there is little variation to be observed between the ninth and tenth Centuries at Lausen, thus suggesting as with Kaiseraugst that similar preparation processes are being used through time and across different sites. The variation that can be observed both between the different sites and the different time periods within Lausen is most probably due to the small sample sizes that are being considered here. It is more than likely that chickens were running around both settlements at the time of the study here means that nearly all the body parts would be represented in a pre-deposition assemblage and those elements that are missing post deposition are likely missing due to the ravages of taphonomy rather than cultural proclivities that would have seen joints or prepared whole birds, head and feet removed, being moved from site to site. Reinach has much smaller sample sizes thus comparison becomes ever more tentative but the whole assemblage of chicken elements shows that a similar pattern of body parts are represented at this site as compared to the previous sites (Table 5.2.4-3). The main difference that can be observed is perhaps a higher proportion of girdle bones, scapula and pelvis, the reason for this is perhaps sample size as other explanations do not clarify the purpose of why these bones would be overly abundant as section of the bird would not have occurred in a way to produce joints or quarters that would mean these elements were represented over others.

5.2.5. Equids

The number of fragments of equid bones at each site is smaller than those for chicken and thus the statements made here are at most speculative. The idea is to present the data and draw similarities where possible and assume that most deviation is due to the small sample sizes and the errors that these provide. Lausen is by far the best represented with respect to equid bones (Table 5.2.5-1). This is due to the fact that there is a high percentage from ‘grube 54’ in the tenth Century and a further proportion from the eleventh Century although these tend to be more scattered through different pit fills. Reinach has a much smaller representation of equid bones but comparison to the Lausen material shows that both are relatively similar taking in to account the sample error variation (Table 5.2.5-2). Kaiseraugst on the other hand tends to diverge in key areas compared to the two rural sites (Table 5.2.5-3). At Kaiseraugst there are fewer tooth fragments recorded and a higher proportion of trunk elements. This could be due to the lesser degree of fragmentation that occurs at the Kaiseraugst site compared to the other sites thus the teeth are more likely found in the mandible and the larger fragments of vertebrae and ribs will perhaps be more readily identifiable as equid than those at Reinach and Lausen which will be smaller and less likely to containing key morphological features.

5.2.6. General overview of the body part distribution

In general there are very few deviations in cultural or taphonomic influences that are affecting the body part proportions across time and space for all the species presented here. Cattle remains are similar at Kaiseraugst, Lausen and Reinach from the early fourth Century at Kaiseraugst to the twelfth Century at Reinach (figs. 5.2.2.3-4 5). The greatest change is due to the larger proportions of head fragments at Reinach. The other gross change that can be observed in the data is the eleventh Century material at Lausen, where the pig data shows almost like for like proportions to that of the standard and thus it is hypothesised that whole pigs are being eaten by the wealthy inhabitants at the site, later data may reveal that these are young pigs and this would suggest that these roast were of suckling pigs (c.f. §6.4.1.1). There are also suggestions that there are differences between Reinach and both Kaiseraugst and Lausen for this species with respect to the proportion of stylopodium present there tends to be a lower proportion of these elements at Reinach compared to the other sites. However the largest differences appear due to statistical error rather than observed cultural differences. Such differences due to statistical error occurs more than once in this data which suggest that in future the boundary level must be set higher than the 150 bone level taken here. Ovicaprids at all sites tend to be prepared in a similar way through all time periods and at the different sites, likewise with pig barring the exception mentioned above. Horizontal analysis across individual sites could help elucidate on this unfortunately due to sample size restrictions this was not possible to take forward. It appears from the data that at all sites live animals are brought to the site either from the surround fields or further away on the hoof, slaughtered and the processed further as needs require.

This data then sets out the body parts and elements that are most prevalent in the assemblages for the three main domestic species. These results can now be used to formulate hypotheses on the formation processes of the assemblages due to the anthropogenic practices that are likely to occur and have been discussed above (§5.1). As discussed in Chapter three, there is also a case to make for the destruction of the material through taphonomic forces as the data shows high proportions of shaft fragments and the part of elements that have a relatively higher density in the body compared to other elements. This appears to be the case through the three main domestic species that have been analysed here. These forces then mean that inferences made about the assemblages here with respect to the body part, are biased in favour of the larger animals and the relatively more dense elements within a species. However, Seetah (2008, 6) suggests that a highly fragmented assemblage is unlikely to have been caused by taphonomic forces alone and that a proportion of the bones will have been broken through butchering to facilitate marrow removal. Whilst this is likely also the case with the sites studied here, the marks created by this breaking, spiral fractures and chop marks, are difficult to elucidate as they are also created by post-deposition breakage and other butchery practices respectively in the two cases mentioned previously.

Evidence of finished goods produced from bone, antler and ivory comes from a variety of sources in the sites under consideration. The evidence for manufacture at these sites is much harder to find. The earliest proof of bone and antler working in the locale of Kaiseraugst dates from the middle of the first to the early second Century in Augusta Raurica (Deschler-Erb, 1998 fig. 148). These industries are evident throughout the lifespan of the Roman city and into the period of the Late Roman *Castrum.* Although in the Late Roman *Castrum*, it is not possible to definitively pinpoint any centre for bone or antler production, even though there is a local demand for the production of antler artefacts (Deschler-Erb, 1998). Large concentrations of working debris and waste allow discussion over the possible location of workshops within a time frame and to what extent production may have taken place.

5.3. Antler working

Manufacturing debris from the working of antler was found at both 'Jakobli-Haus' and the 'Gasthof Adler' excavations (Table 5.3-1 and 2). The greater part of this material comes from sawn tines and crown sections which are un-worked suggesting that these are waste products as opposed to sectioned raw material.

Firstly consideration must be given here to the problems of residuality that occurs at Kaiseraugst (§3.1). The single finds analysed in this section can be affected by this residuality. Thus the dating of the objects here are relatively insecure. Although the fact that all the material falls into a relatively constricted time period may suggest that the effect of residuality is less than might be imagined. To this end, any conclusions that are drawn here must be tempered with the fact that due to these residual processes the temporal distribution of the artefacts may not be as that at deposition.

The observed off-cuts imply that the whole antler was brought to the site and sawn up into sections for production. The antler may have arrived either still attached to the carcass of a slaughtered animal or as an individual item, since the assemblages contained both shed and unshed antler. Shed antler was no doubt collected from a wide area around the Castrum during the late winter/spring period that the antler is shed; although it is possible that antler was imported from other places for the production of antler goods at Kaiseraugst. Red deer postcranial elements within the faunal assemblages (c.f. table 7.1.1-1) indicate that the meat from these animals were utilised whilst unshed antler probably came into the Castrum still attached to these carcasses.

Concentrating solely on the period from the middle of the fourth to the early seventh Centuries, the post cranial elements from red deer appears in both sites within the Castrum but the antler remains are located within the 'Jakobli-Haus' site, this may indicate that the antler is used within or close to this area and the off-cuts discarded here (c.f. tables 5.3-1 and 7.1.1-1). By far the greater quantities from the 'Jakobli-Haus' site derive from the fifth to the beginning of the seventh Centuries. There is also a portion of the waste that derives from contexts that were not possible to date. This difference in distribution could be due to the different uses of the sites analysed here. As mentioned above (§1.1.2.1) the 'Jakobli-Haus' site is falling into disrepair, whilst the 'Gasthof Adler' site appears to be an area in which different trades are based. The neglect of the 'Jakobli-Haus' site perhaps means that waste from these trades was being dumped here including the waste of an antler workshop, thus forming a small concentration of off-cuts. However there is no indication of any kind of workshop in the 'Gasthof Adler' region of the site which suggests that production of antler goods took place elsewhere or perhaps in an itinerant state that left no structural or archaeological finds to observe.

Furthermore the Lausen and Reinach excavations contain little evidence of antler remains before the eleventh Century even though, as with Kaiseraugst, postcranial elements are found. Fragments of blackened and polished antler are found within a sixth century 'grubenhaus' in Reinach (Marti 2000b, 230). These fragments were recorded as artefacts and as such have not been included in tables 5.3-1 and 2. This suggests that the raw material would be available if desired. A wide scale use of antler, i.e. domestic production of everyday tools and objects by unskilled people would be illustrated in the faunal remains by a low but even distribution of antler waste and debris throughout these settlements. As there is no clear evidence of this from either Lausen or Reinach and only localised remains in Kaiseraugst, this would suggest that artefacts were produced by, at least semi-skilled or part-time craftsmen, made when the raw material is most abundant i.e. late winter/spring. This could also be true of other professionals making tools as and when they were needed. Then during the rest of the year, it would be possible for the craftsman to be employed in alternative labours (MacGregor 1998, 19). This is not to suggest that there is no small scale domestic production of antler goods, probably items such as knife handles were produced in the home for specific requirements. Alongside the possibility of this production representing a part-time or seasonal manufacture, itinerant craftsmen may have worked in this area alongside the other manufacturing processes that are observed from the archaeological record of the Kaiseraugst site. The transient nature of the craft would mean the fashion and artistic styles of the surrounding areas would find their way to the region. There are indications of outside influences and close contact with Burgundy and Rhone valley, such as the three 'Bein' buckles from early sixth century in the burial ground, Kaiseraugst, and a comparable piece from Basel-Aeschenvorstadt (Martin 1991, 114-15).

Deschler-Erb (1998, 279-281) and Marti (2000b, Tbl 43, 51, 55, 62,66-67) identified, in the 'Gasthof Adler' excavation, different types of artefacts produced from antler, found within the settlement layers of the early medieval and medieval layers inside the Castrum: two spindle whorls (one undated, one early medieval/medieval), five composite double row combs (three mid-fourth Century and two mid-fifth to late sixth Century period), one game piece, one needle, and a spindle (all mid-fourth Century), and an unidentified tool (mid fifth-late sixth Century period).

The 'Jakobli-Haus' excavation contains eight fragments of double row composite combs, all of which are dated to the mid fifth to late sixth Century (e.g. fig. 5.3-4) and a seventh Century knife handle/comb fragment with an iron pin still attached (fig. 5.3-5). Finally, a knife handle, made from antler was also discovered in an undated pit (fig. 5.3-6). Comparing these artefacts above to those found in the burial ground associated with the fourth -seventh Century Castrum, it is possible to observe similarities.

The early phase of the burial ground, 4th-5th Century (Martin 1991, 49-50): Two double row composite combs, typical of the Roman province from late fourth Century, three, three-cornered combs, which are typical of the Gallic provinces and neighbouring *Germania libra*.

The second phase of burials from the 6th-7th Century contained (Martin 1991, 148): ten 'bein' (possibly Antler?) combs. Two very ornate examples are present, the rest are of a more simple design similar to the pieces found within the Castrum and two comb cases.

There are exceptions. Antler spindle whorls for example are found within the burial contexts but are not found within the settlement layers, although bone spindle whorls are observed in both contexts. Conversely some artefacts are only found within burial layers such as elaborate comb cases and the three-cornered combs, the latter being typical of the Gallic provinces and neighbouring *Germania libra* (Martin, 1991 pp49-50 and 148). Bone spindle whorls are also found from sixth Century graves (Martin, 1991 pp138), although there is very little evidence of other worked bone from either excavation within the Castrum during this period. It could be that these Gallic/Germanic style three-cornered combs are being used in the graves as a ritual item, a cultural identifier of some description and possibly the reason it is not found within the settlement layers. The custom of furnishing burials with combs ends in the seventh Century.

Naturally, artefacts do not signify a place of manufacture, this is borne out at both Reinach and Lausen where antler combs are present (Marti 2000b, 126-157) but as mentioned previously very little raw material is found (table 5.3-1). Ideally, you would detect unfinished artefacts, blanks and shavings to positively identify a workshop site. Although other indirect evidence could be used to point to an antler work place, these include the distribution of the remains found within the excavations, tools (saws e.g. Dijkman and Ervynck 1998, 16-17, knives e.g. Ulbricht 1978), structures (pits, fireplaces e.g. Deschler-Erb 2005, 209) and other artefacts used in the working of antler and also the presence or evidence of other trades could be used to add weight to other forms of evidence. The distribution of the waste material from the "Jakobli-Haus" excavation shows that the majority (~76%, see table 5.3-1) falls within an area of less than 70m^2, although there is no evidence of other artefacts or structures that could be related to antler working at the site (c.f. Müller, 1990, 1991, 1996 and 1997).

From the data available at Kaiseraugst it is hard to say for certain, although as mentioned earlier, domestic production would accompany a sparse distribution of the antler remains with no focal point. A full-time production workshop would see a greater amount of discarded material in a tighter concentration. This may then suggest a part-time or itinerant craftsman. There are differing opinions on whether craftsmen at this time would have been itinerant or produced these artefacts on a part-time basis possibly during times when agricultural labour was not needed. For example at Rheinau in canton Zurich (Hedinger 2000), The watchtower is of Late Roman date, three-sided combs and amulets are found at the site and waste which is similar to that observed at Kaiseraugst, with the majority of waste being sawn tines and beam sections, here there are half finished combs and rough outs which indicate a place of manufacture and in Hedinger's opinion this probably indicates a solider with a lot of unoccupied time producing artefacts from antler. Although, the author does not go so far to say that this is a workshop.

Closer to the sites studied here, Deschler-Erb (1998) studied the Roman bone, antler and ivory artefacts from Augusta Raurica and the Castrum although her data stops in the fourth Century. The evidence from the Castrum itself shows that 7.7% of the artefacts come from this area (Deschler-Erb 1998, fig. 285), which equates to almost four hundred artefacts of bone or antler. Sixteen of those (approximately 9%) are defined as antler. The finished products are mentioned above, the waste constituted parts of tines, beam and a rose. There is also a gap in the evidence of antler as a raw material between the beginning of the third and the middle fourth century (Deschler-Erb 1998, fig. 275).The later material from the fourth Century derives mostly from the Castrum and is relevant to the study here. The thesis shows that in the whole material, tines are clearly the majority of the antler waste (Deschler-Erb 1998, fig. 274). The analysis here, consists of whole tines as waste material (fig. 5.3-7a), however perhaps significantly different from this are the tips of tines (fig 5.3-7b) which are predominantly present from the fourth Century fills of the Castrum in the work by Deschler-Erb (1998, fig 274).

A late Roman site at Pfyn (Canton Thurgau, Deschler-Erb, 2005) shows antler artefacts and waste from production processes that made antler bracelets to imitate a fashion for Roman ivory bracelets. The waste found at the site is mostly from shavings and rods of beam, which are obviously half finished products and thus indicating a workshop site.

Further afield, the late roman and early medieval layers of Maastrict, Netherlands (Dijkman and Ervynck 1998) produces various artefacts, including combs in various styles, hairpins, pins, needles, pottery stamps, amulets and a casket decoration, although only the double row composite combs are found in the early medieval layers. The waste products from most of the settlement are similar to that of Kaiseraugst with tines being most frequent followed by crown and rose segments with very little beam parts represented (Dijkman and Ervynck 1998, tbl. 1).

The presence or evidence of other trades could also be used to add weight to the possibility of antler manufacture in Kaiseraugst. Pottery production and glass working are present in some form between the late fourth to early seventh Centuries (Fünfschilling, 1996 and Marti 1996). Even with the breakdown of Roman administration and the departure of at least part of the Roman population there was a tendency to follow the preceding Roman styles at least with the glass production (Fünfschilling, 1996). This keeping with the Roman style is totally different to that seen with the domestic food waste, which shows a change from high proportions of cattle to pig remains predominating (c.f. fig 4.2.2.3-2). The higher proportion of pig remains suggests a much more self-sufficient style of living. This could indicate a collapse of the infrastructure and provisioning of the Castrum by the following administration. This goes against the definition of early towns as described by Christlein (1978) where urban centres are still basically a rural economy but the food demand is higher than production from the associated buildings. So food has to be brought to the settlement. Production concerns are orientated in a different direction i.e. ceramics, glass, metal, bone or antler more likely a mixture of all.

So in summary, it is not possible to locate a workshop within these Kaiseraugst excavations, either by the existing archaeological finds or from the presented archaeozoological data here. Although a spatial and temporal concentration of antler waste can be observed. There is also very little evidence of antler from either Reinach or Lausen within the time period under study. This with other indirect evidence hints at the localisation of antler working at Kaiseraugst. However, the evidence is far too sparse to make a bolder statement than this. Other evidence also includes the movement of the Germanic people into the area at a similar time to the presence of waste. Also the styles of the artefacts found within the excavations are different to those that would suggest a continuation of a Roman style. There is localisation of production of other manufactured items such as ceramic and glass and possibly metalworking. This localisation could be caused by the large manufacturing nature of the city drawing those types of trades to the area. It is possible that the centralisation of production of antler and the other goods mentioned previously could be enforced by those central figures within the *Castrum* (diocese of Kaiseraugst), as is the case with other trades, although there is little evidence for this. Comparisons between the antler artefacts from the settlement and those from the associated burial grounds highlight differences. These differences suggest that perhaps Germanic combs and spindle whorls from antler may contain a somewhat cultural meaning and therefore found only within the grave layers.

5.4. Bone working

Artefacts of bone appear as consistent elements in material culture throughout the societies of post-Roman Central and Northern Europe (c.f. Schleswig, Ulbricht 1984; Wolin, Cnotliwy 1958; York, Macgregor *et al.* 1999). Bone seems to have been the material of choice in many implements utilized in different crafts (MacGregor 1985, 185-193). These were mainly simple implements that could be made from food waste and was probably produced to requirement by the end user. Also no specialised equipment would have been needed, in most cases nothing more than a knife. This is similar to the working of antler as mentioned above (§5.3). This evidence does not allow a postulation of an economic industry developing at the time. However, if we consider the bone composite combs that have been produced and compare this to similar antler combs, then it must suggest at least a part-time trading in these products. Off-cuts and waste from bone working has been found in many sites (e.g. Dorestad, Clason 1980; Hederby, Ulbricht 1978 117-119; Lund, Christophersen 1980; Munster, Winkelmann 1997; Southampton, Riddler 1992 150-151) and in some cases in very large quantities, showing that there is some extensive working of bone, but again the scale of these activities is not clear. In Northern Europe in the early medieval, bone working becomes much more prominent and eventually exceeds that of antler. This is perhaps partly to do with the changing fashions but also related to the management of forests and the growth of urban centres, where bone and horn are in much greater abundance. Later, restrictions on the use of the forested areas by the upper echelons of society may also have contributed to the decline in the use of antler (MacGregor 1998, 19-20). There are just a few items of worked bone that have been identified here and are separate from those catalogued by Marti (2000b) that have been mentioned above (c.f. 5.3). The worked bones identified here consist of two indeterminate long bones from a medium sized mammal, where the edges of the bone have been polished. The first artefact comes from the twelfth century 'grube 23' in the 'Gemeindezentrum' area in the Reinach excavation. There is a similar unidentified bone from the tenth century 'Grube 10' at Lausen. There was also a seventh century pig fibula that has been drilled; the reason for this is unknown as the artefact is broken (fig. 5.4-1), it is found in a 'grubenhaus' structure from the 'Altebrauerei' area of the Reinach excavation. There are three examples of worked bone from the Kaiseraugst 'Jakobli-Haus' area; two metatarsals, one example from the beginning of the seventh Century in cattle and the second from goat dated to the fifth to late sixth Century, have been chopped at the proximal end and shows signs of polishing. The third artefact is a pig rib that also shows signs of polishing, like the goat, it is dated to the fifth to late sixth Century. The 'Gasthof Adler' area also shows three items that appear to be worked; two from the mid fourth Century shows an ovicaprid femur that has polishing on the outer surface of the bone. The second is less clear, with a large mammal rib appearing to have been notched along the ventral surface. The last artefact is dated to the fifth to sixth century, as is a polished indeterminate large mammal long bone. These worked bone fragments don't offer much information as to the nature of the processes or the scale to which the working of bone was being carried out at any of the three sites studied here. It shows that bone working was being carried out at all three sites maybe on an as and when the needs arose in either other handicrafts or domestic situations.

5.5. Horn working

Horn sheath has a very low survival rate in archaeological deposits. It takes a specialised set of environmental conditions that allows its preservation. This is due to the fact that unlike antler, which is a deciduous outgrowth of bone, horn is keratin, an organic material that is not shed. This organic layer is deposited around a hollow bony core. The tip of the horn core is solid and has also been utilised by the people of the early medieval (MacGregor 1998, 12). The low preservation of horn sheath means that only glimpses can be observed of a trade that was probably more extensive during this time than the evidence allows (MacGregor 1998, 21). The simpler preparation of horn, such as trimming and polishing of entire horns could have been carried out by almost anyone. Tips of horns could be cut and used as handles again with little preparation. Although, there is evidence of small plates of horn used decoratively that suggests a more skilled, labour intensive preparation of the material than the previously mentioned techniques (MacGregor 1985, 95). The bone would have been soaked to allow softening and bending, these techniques are seen to a large degree in later periods of the medieval, which suggests that there is a diversification away from the simple products.

There is very little evidence of a commercial trade in horn from the archaeological remains from any of the sites here (table 5.5-1 and 2) although many of the surviving horn cores show chopping marks at the base, either to aid the removal of the hide or to remove the horn itself (table 5.5-3). The fragmentary nature of the assemblages means that there are very few surviving complete horn cores and as such it is difficult to show whether the tips of the horn sheath that surrounded these horn cores were used. However there are patterns that can be suggested from the results observed in the tables here. There is a greater number of horncores (101 of 153) observed in the material from Kaiseraugst than the rural sites, this may not be surprising given the results from the antler material and the manufacturing background of the Castrum itself. Again as with antler, the evidence is too scant to be able to suggest that there is a full-scale horn working site in the settlement. However there appears to be a greater demand for horn products, at least from the higher proportions of waste products, namely the horncore, in the Castrum when compared to the rural sites studied here. There is evidence of horn worker being present in Basel during the eleventh Century as high proportions of horn cores and associated pits attest (Schibler and Stopp 1987, 323 and fig 6).

5.6. Tanning

There is no evidence from the three sites studied here to suggest that tanning was carried out on a large scale. Although there is evidence of tanners in the region due to pits lined with bark remains are found in Basel (Schmid 1969; 1973), which is thought to be indicative of tanning as the bark produces chemical agents used in the softening of leather. The tanning trade probably worked in conjunction with any flourishing horn working trade as it is often cited that the horns and feet of an animal were left intact with the skin after flaying (MacGregor 1998, 14). There appears to be a distinctive trace of these trades in the faunal remains. This indirect evidence of tanning is needed, for as with horn, leather only survives in specific environmental conditions due to its organic nature. Other indirect evidence such as pits (Schmid 1969; 1973) and tools known to be used by a tanner, as well as waste products for the production of the chemical agents (e.g. chicken and dog manure) needed by the tanner (Buckland *et al.* 1974, 29; Keene 1985, 285-292). All this means that it is very difficult to positively identify a tanning or horn workers workshop; much is based on inference and supposition based on the scant evidence available. The process of tanning hide was a long and painstaking one that has been well documented elsewhere (MacGregor 1998, 14-15).

5.7. Fur trade

The fur from many animals were used in the early medieval period, from the relatively abundant martens, foxes, hare and squirrels, to perhaps the more sought after bear, wolf and ermine. Fairnell (2007) has discussed the techniques used to skin these animals extensively. The trade in furs was quite extensive with furs from northern Europe sold as far as the Caliphate on the Bosporus in the early Middle Ages (Howard-Johnston 1998, 67-68). This was quite a turn around from earlier periods where the Mediterranean population considered the wearing of fur as a barbarian activity as Ovid's tone asserts in *Tristia*, iii.10, v.7, v.10, (Wheeler 1988). However, in the sites studied here there is no evidence for the large scale production of furs from the wild animals present in the faunal remains. Whilst the remains of fur bearing animals are found, these tend to be single or at most very few finds. This may hint at production for a single household or for a small community. Although, the majority of the bones of fur bearing animals are found with in the eleventh Century fills of the pits at Lausen (table 4-3a). At this time the site is thought to be of high social status (Marti, 2000, 276), and perhaps linked with Rudolph von Rheinfelden as an estate. It is not possible to tell whether the wide range of species is found due to sporting pursuits or the high status of the site meaning rarer species being more affordable.

5.8. Butchery

In its very simplest form butchery involves killing, blood removal, skinning, evisceration and portioning and the process remains analogous throughout many countries (c.f. FAO animal welfare guidelines at http://www.fao.org/ag/againfo/themes/animal-welfare/aw-guitous/en/). However in modern Europe the subsequent meat processing varies greatly between countries (c.f. Lignereux and Peters, 1996 figs 23-30), indeed it can vary from region to region within a country (Swatland 2000, 60-63). This variation is developed through time perhaps due to regional culinary proclivities, species, age of animal, the implements available, and the skill of the butcher. It can be argued, at least in North Western Europe that these variations probably occurred sometime from the Early Medieval period onwards. Butchery, like many other trades and crafts in the Roman Empire, was highly regulated and thus formed standardised practises throughout the breadth of the Roman world. This can be observed not only through literary sources (c.f. Lignereaux and Peters, 1996) but also through archaeological analysis of the faunal remains throughout Europe (Deschler-Erb, 1992; Lignereaux and Peters, 1996; Maltby 1989 and Seetah, 2008) and thus leading to the assumption of variation occurring at some later point.

It has been stated that the Roman practices allowed thorough yet rapid processing of the whole carcass (Maltby 1989, 91). The haste with which this process occurred was probably due to the requirement of large military conglomerations and later an increasing and concentrated population. The heavy chopping cleaver appeared to be the tool of choice of the Roman butcher, as there are numerous references to this tool (c.f. Lignereux and Peters 1996 figs.8-15) yet there is no evidence of the use of a butchery-specific knife (Seetah 2008, 16), however the use of an all purpose knife in household and trade surroundings would have common place and thus likely also to have occurred on the butcher's block.

Rixson (1988) classified the marks that could be observed on archaeological bone material in to five categories, primary butchery, secondary butchery, tertiary butchery, marrow extraction and bone working. This alongside the recent work of Seetah (2008) that addresses the process of butchery through experimentation and replication allows a greater understanding of the marks observed on the faunal material from archaeological sites. The type of mark that is left on a specific bone is dependant on the tool used, the activity being carried out and the weight with which the tool is used. The species and body part will also be a contributing factor. Breaking of the bones and disarticulation of joints often take heavy blows with a heavy bladed instrument to accomplish the job at hand, and thus the marks left on the bone will tend to be deep or possibly completely severe the bone. Conversely filleting and the fine knife work needed to remove all the meat will only leave minor surface marks, if marks are left all. Seetah (2008, 7-16) discusses the full gamut of marks that are left on the skeleton by butchery, their implications to the butchery process and how to recognise them in archaeological bone assemblages. The skill of the butcher can perhaps also be recognised in the type of marks that are left on the skeleton of an animal. A more skilled practitioner will leave very few traces on the bones for the archaeozoologist to record. The fine filleting marks will perhaps be wholly absent or at least few in number, whilst the heavy chopping and disarticulation marks will remain, they are perhaps more precise and successful than a less skilled butcher or even domestic butchery. Domestic butchery and novice butcher may be alluded to by repeated marks in a small area indicating several attempts at dismembering or breaking of the bone. The finer marks will also be more numerous and perhaps deeper than those made by a seasoned professional.

The starting point for the analysis of the work here is the highly standardised Roman style butchery. This has been attested to at length in a local setting by the work of Deschler-Erb (1992) at *Augusta raurica* and other authors studying the bones within the wider region (Deschler-Erb, 1999, 2006 and 2007; Deschler-Erb *et al.* 2002, fig.169; Schibler and Furger, 1988).

The data presented here will firstly take the form of quantitatively analysing the butchery marks, type and placement that are present on the main domestic species at the sites and through different periods. The cranial elements include the skull and mandible, horncores are set aside in a category of their own to allow for the reduction of the bias in the data towards this element as removal by or for the horner occurs relatively frequently. The forelimb group consists of the humerus, radius and ulna. All vertebrae and ribs correspond to the trunk area. The girdle bones are represented by the scapula and pelvis. Femur, tibia and fibula make up the hindlimb group whilst the carpals, tarsals, metapodials and phalanges make up the foot group. Secondly a discussion about the marks observed on individual elements will take place although a lack of data means that this discussion cannot involve differences between periods and sites except where there are butchery traces that are unique to a specific site or period. Samples are considered statistically sound when the whole assemblage, butchered and non-butchered, of a specific species is greater than 150 bones. When studying butchery marks alone then a sample of more than thirty is considered robust enough to allow comparisons to be made.

The placement of butchery marks on individual elements can be discussed in terms of those that are present or absent. Here diagrams of the skeleton as a whole is shown with the butchery marks indicated and the time period in which they are present are indicated. The data has been divided into chopping and knife marks and the resulting patterns may indicate differing processes with regards to the type of mark.

5.8.1. Cattle Butchery

Table 5.8.1-1 shows that at the three sites studied here only ten to twenty percent of the cattle bones showed signs of butchery. This suggests that the intensity of butchery is similar at all three sites. Considering the types of mark left on the bones, a consistent pattern with an allowance for a degree of variation, is observed. Light marks, those marks that are made by a small knife and left whilst removing meat and other fine blade work are highest at Lausen although this is probably not significantly higher than the other two sites. Intermediate marks, chopping and scraping marks are also very similar across all sites, heavy bladed instruments used in primary butchery and jointing of the carcass would leave these marks. The marks that cleave the bone completely, including saw marks is also similarly low at each site. The number of marks during a certain process has also been recorded in the hope that professional butchers and domestic butchery can be observed. However as with the other results mentioned here, the differences across the sites are minimal. Removing the chopped horncores so to reduce the bias by this manufacturing process does little to change the results across the three sites. Antler material has also been removed here.

Studying the individual sites chronologically also elucidates patterns in terms of processing of the carcass. Here not only will the types of mark will be analysed by chronological period but also the body region in which the mark occurs can be analysed. At Reinach it can be seen that in the early periods, sixth and seventh to eighth Century periods have a higher proportion of butchered cattle bones to those of the later periods (table 5.8.1-2). This could be due to the changing nature of the settlement in the early periods of resettlement in the sixth Century maybe cattle are being more intensively utilised due to the transient nature of the settlement and in later periods as the settlement is more established perhaps the reliance on greater exploitation of the carcass is reduced. The number of marks in a single process is very similar through out time with approximately two-thirds of the butchered bones displaying just a single mark.

Investigating the body region in which the marks occur (table 5.8.1-3) is more difficult as the sample sizes are small and thus an understanding of the marks present is difficult although it is probably safe to say that the majority of the marks observed here are recorded on the trunk region (vertebrae and ribs). This probably represents two processes, firstly the sectioning of the carcass in to flanks of meat, thus chopping of the vertebrae occurs. The second probably comes from the production of racks of ribs. There will also occur some marks relating to the removal of the head with marks left on the axis and atlas vertebrae. Girdle bones, scapula and pelvis are also relatively intensively butchered. This again is not surprising as these will be the points at which the limbs are removed during the primary butchery stage. It should also be considered that these are areas of large muscle masses and are thus likely to receive attention from the butcher. Surprisingly perhaps there is a greater proportion of forelimb butchery marks compared to hind limb marks. This could be due to the greater propensity for the humerus distal end to survive taphonomic forces compared to the same region in the femur. Although the tibia also survives relatively well in the faunal material there is less meat in this region of the hind limb.

Lausen also shows a similar split in the data to that seen at Reinach again the early data has proportionally a greater amount of butchered bones compared to those of the later periods (table 5.8.1-4). Each mark type is proportionally higher in these early periods compared to the later periods. Although the variation here is not as marked as at Reinach and the variation could be due to sampling error as much as cultural changes. The number of marks for a single process at Lausen is similar throughout time although the proportion of single marks (approx. 50%) is a little lower than that at Reinach. Analysing the butchery body area at Lausen (table 5.8.1-5) shows that the statistically large samples have similar compositions the main difference being the high proportions of trunk marks in the eighth to ninth century period followed by girdle bone marks, this is reversed in the eleventh to twelfth century period. This could be due to better cuts of meat from the rump and shoulder being represented in the latter time period during which the status of the site is at its highest. However, the former period is also a time of change and escalating social status at the site.

The Kaiseraugst material is more variable between periods than the consistency observed in the rural sites (table 5.8.1-6). The mid fourth Century and seventh Century have comparable results with approximately ninety percent of bones without traces of butchery. Intermediate marks are the most prevalent. There are greater proportions of butchery seen in the sixth Century. This increase is due to a larger proportion of intermediate marks whereas light and heavy marks remain relatively constant between these time periods. The fifth to sixth Century period shows a further increase in the proportion of butchery marks observed in the material. More than one quarter of the material exhibiting butchery marks. Heavy marks remain at similar levels to those of the periods mentioned previously. The light marks are probably also very similar but again the majority of the increase is due to the intermediate marks. The twelfth Century material is statistically small, and error because of this is too high to make insightful comments about the butchery in this period. Comparison of the number of marks per process appears to show a split in the data with the fourth and sixth Centuries having almost two thirds of the evidence showing a single mark whereas the fifth to sixth and the seventh Century data have a little over fifty percent single marks. These results make interpretation of the changes in processes of different time periods very difficult to elucidate. The agglomeration of material of the different areas of the excavation may be the cause of this complexity. There may be different patterns according to the different areas either through social differences that can be observed (c.f. Lehman and Breuer 1997 and 2002). Analysing the results by body region (table 5.8.1-7) shows that from the fourth, fifth to sixth and seventh Centuries are at least analogous. There is an even spread of cut marks through all body areas, when the horncores are removed from the analysis. However, trunk butchery is still the most prevalent whilst the cranial parts are the least prevalent.

The placement of the marks shows little change through time (figs. 5.8.1-8 to 13) with primary, secondary and jointing butchery marks being observed on the bones through all periods. The main difference that can be observed in cattle is the longitudinal scoring of ribs that occur only at the Kaiseraugst site during the early period. This is discussed further below (c.f. 5.8.1.3).

5.8.1.1. The skull and mandible

The presence of skull and jaw fragments amongst food waste in all deposits from all periods suggests that the majority of the carcass was utilised for food. The fragmentary condition of the skull parts, and chop marks observed on the cranial parts of the skull probably indicates that the skulls were smashed open to remove the brain, although, destructive taphonomic forces most likely exacerbated this fragmentation. Butchery marks found on the mandible, particularly around the dorsal condoyle and on the junction between the transverse and ascending ramii probably detaches the mandible from the skull that enables the tongue to be removed easily and also removal of the cheek meat. There is also some evidence from some periods that the mandibles were split open, perhaps for the extraction of marrow, marks observed on the diastema of the mandible perhaps added further weight to this argument. Chopping marks also appear on the premaxilla of some cattle. It has been suggested that this could be related to the consumption of muzzle. According to these sources this part was frequently found in the roman diet and in later periods of the medieval until today this part of the animal is still regularly consumed.

Horncores or the basal parts of horncores are attested too at all sites and commonly show marks around the base of the horncore to aid the removal of the sheath, this maximised the amount of horn sheath that could be utilised. At Kaiseraugst the removal of the tip of the horncore is also observed, this would no doubt have damaged the horn sheath and suggests that some crafts only required the tip. The fact that no large agglomerations of horncores were observed at any of the sites suggests that there were no large-scale horner’s workshops at the sites, although it could be that individual households or butchers are removing the horn sheath and sold on to the horner.

5.8.1.2. The long bones

The low frequency of whole bones throughout all sites, even allowing for breakage due to taphonomic factors, highlights the frequency of butchery for meat and marrow. Cut marks occur most frequently on these bones. The forelimb appears to be removed from the trunk towards the distal end of the scapula, with marks at the base of the scapula spine and proximal to the glenoid illustrating this. Evidence of the removal of the scapula spine and fine knife marks on either side of the spine suggests the filleting of the scapula is also seen in some cases. Marks on the dorsal edge of the scapula may also occur with either the removal of the meat from the bone or the sectioning of the carcass.

The best-represented part of the humerus was the distal articulation and lower shaft. The proximal portion of this element has a poor survival rate in archaeological sites. The butchery marks found on the distal articulation of the humerus suggests the removal of the meat from the bone rather than severance of the joints. The evidence of chopping on the distal end of the shaft infers that this may have been the point of severance. Although at Reinach and Lausen chopping of the proximal part of the diaphysis also occurs suggesting that in later periods, severance may have taken place more proximally. Knife marks around the proximal articulation are also demonstrated at all sites, which allude to the removal of the meat from the joint. There is also evidence from the Lausen and Reinach excavations that the humerus was split longitudinally probably for marrow extraction.

The proximal part of the radius and ulna exhibits butchery marks that correspond to similar marks that are seen on the distal end of the humerus and removal of the meat from the elbow joint. Chop marks are recorded at the distal shaft of the radius and ulna as well as longitudinal chop marks in all sites and are likely to be caused by the extraction of marrow. However, at Kaiseraugst chop marks are also observed around the midshaft point of this element (fig 5.8.1-8). This maybe a different method of marrow extraction or marks created for some other unknown reason.

Similarly intensive butchery is observed in the hind limb. The limb is removed from the trunk at the illial shaft. The crest of illium also sports marks of butchery possibly due to the removal of the large amounts of meat from this area. Marks on the ventral part of the pelvis, the ischium and pubis, are observed in Kaiseraugst although not at either Reinach or Lausen (figs 5.8.1-8, 10 and 12). Knife marks around the acetabulum of the pelvis also illustrate the disarticulation of the hip joint. This may have occurred after the sectioning of the carcass in to large joints of meat.

The proximal articulation of the femur displays knife marks that correspond with similar marks around the acetabulum of the pelvis. At Reinach and Lausen, the femur is most often severed at either the proximal or mid part of the diaphysis (figs 5.8.1-10 and 12). The Kaiseraugst data shows no evidence of this process. At Reinach and Kaiseraugst, the distal end of the diaphysis is also chopped probably with the sectioning of the knee joint. This may not occur at Lausen as the femur is severed higher up on the midshaft. If this is the case then Reinach may show these two varying methods as both midshaft and distal chop marks are observed. There is no evidence of longitudinal splitting of the femur at any site. The tibia typically exhibits severance of the bone at both the proximal and distal parts of the diaphysis. The proximal mark is associated with the jointing of the knee. The more distal mark is perhaps due to the extraction of marrow as observed in the radius. Longitudinal marks are also seen at all sites attest to the extraction of marrow.

The carpals and tarsals display a number of marks that are probably related to the either the severance of the main meat bearing bones from the lower limb bones or the removal of the hide. It could also be possible that these small bones are chopped and boiled to produce glue.

The metapodials display marks at either end of the diaphysis, firstly this could be due to the removal of the foot, although a high percentage of whole specimens suggests this may occur high up the limb possibly at the carpals and tarsals. Secondly, marrow extraction could result in the observation of these marks, although there is no evidence of the longitudinal splitting of the bones that is observed in the humerii, radii and tibiae. A cause of the lighter knife marks, which are observed at all sites, could be due to the possible removing of the hide. Metapodial shafts are also used a great deal in other manufacturing processes such as tool making or the production of handles, although the high proportions of complete bones appear to counter this argument.

The phalanges bear few marks although some are seen at each site. These elements have little in the way of meat value. Though as with the carpals and tarsals, these maybe evidence of glue manufacture. The boiling of these elements for many hours produces a substance that can be used as glue. A large-scale production of this process is seen close by in the 1st Century

AD at Augusta Raurica in the region of the theatre (Deschler-Erb, 2006a). The chopping occurs to reduce the size and make the boiling process much quicker and easier. This would also be contrary to the belief that the phalanges were dumped at primary butchery.

5.8.1.3. The trunk

Cut marks are also present on the ribs and vertebrae at all sites. The ribs exhibit marks that occur on the neck and repeatedly along the shaft. These marks on the blade of the rib occur at approximately 10cm intervals in cattle. These ribs appear to be sectioned into racks. Whilst this process occurs at all sites, the phenomenon of longitudinally scoring the shaft of the rib is only observed in earlier periods of the Kaiseraugst material (fig 5.8.1-8). This type of mark is widely associated with smoking of meat in the Roman period and is seen throughout the North Western parts of the Roman Empire and local production of such meat is also attested during the Roman settlement of Augusta Raurica (Deschler-Erb, 2007). Whilst this could be considered residual material from earlier periods, it could also suggest that this specific manufacturing procedure has survived the departure of the Roman administration and carried on into the early medieval period. This suggests that this process was economically very profitable.

Cervical, thoracic and lumbar vertebrae show lateral cut marks through all sites and time periods. This suggests that the cattle were sectioned along the flanks. As is perhaps to be expected there is no evidence for cleaving the vertebrae dorso-ventrally. This style of sectioning the cattle into sides of beef occurs much later in the medieval period. At Reinach and possibly Kaiseraugst the upper most cervical vertebrae, the atlas and axis, also display heavy butchery marks, cleaving the region around the atlas and axis would facilitate the removal of the skull.

5.8.1.4. Summary

The cattle present at the three sites studied here were obviously intensively butchered. All three sites showing similar patterns of butchery marks and thus similar methods by which dismemberment and jointing of the carcass takes place. Comparison of the placement of these marks to a general picture of the joints of meat available today from cattle shows that many of these marks observed in the data here aligns with these joints (c.f. fig 5.8.1.4-1). This is probably in part due to the process of primary and secondary butchery, there are but a few efficient ways in which to get a cattle carcass into large joints. The shoulder and pelvis are ideal points at which to remove the limbs. It is easier to produce flanks of beef by cutting through the lateral processes of the vertebra with a heavy knife rather than attempting to hack through the vertebral bodies with a similar implement. Only later with the use of a saw does it become easier to divide the carcass this way (Seetah 2008, 23). The single difference that is observed is the presence of smoked meat in the early part of the Kaiseraugst data, which evidently follows a Roman tradition that is seen in many parts of the empire, which is also locally produced. Little of the carcass seemingly went to waste. Those parts that were not procured for meat were often put to other uses. Marrow extraction appears to play a major role in fragmentation of long bones, whilst other processes such as glue production involves the use of phalanges, carpals and tarsals. Metapodials are exploited in tool making. Although there is little other archaeological evidence to suggest that these latter two processes are occurring at the sites studied here. It must also be remembered that internal organs and tissues would have been of value. Offal is becoming less widely eaten in Europe today, however, in the past as with the intensive use of the carcass, so the internal organ were probably also just as comprehensively used. Unfortunately other than evidence from written sources, no physical proof of these tissues as a foodstuff survives in the archaeological record.

5.8.2. Ovicaprid butchery

The sample sizes are far too small for ovicaprid butchery practices to be analysed as fully as would be hoped. Quantitative analysis can be carried out here although without the extensive range of marks needed to indicate butchery processes it is difficult to put the results in to a wider butchery context. Although, it can be implied that similar patterns of butchery are seen in all sites. There are examples of primary butchery and the dressing of joints in the instances that have been recorded.

The types of marks that are observed on the ovicaprid bones occur in similar quantities throughout all sites studied here (table 5.8.2-1) even when the horncore marks are removed to leave those marks relating to butchery for meat alone.

Lausen shows a similar pattern of butchery mark types in the eighth and ninth Century and the tenth Century (table 5.8.2-2). This incorporates about ten percent of the ovicaprid assemblage exhibiting some form of butchery. The material also has similar number of light and intermediate marks. However in the eleventh to twelfth Century this pattern changes with more intermediate marks observed, this leads to a reciprocal rise in the proportion of the butchered bones. The number of mark per incidence of butchery is relatively stable through time, although the tenth Century (* see §2.1.3) material has a higher incidence of single marks, the earlier period and that which follows the tenth Century has very similar results with high sample sizes, with around two thirds of the marks observed being of a solitary mark. It is difficult to find reasons for these changes in butchery that are observed here. It is unlikely that the changes follow the rise in status of the site as you would perhaps expect wealthier inhabitants to be able to command the best butchers and thus fewer marks would be observed, at least fewer repeated marks. This does not fit with the results here. The observed results could be due to the sample sizes available and that there is simply not enough raw information with which to make a considered hypothesis. The horizontal variation across the site must also be taken into account. Structures related to functions that occur within different social backgrounds can reflect a change in butchery results however the samples are too small with which to consider this aspect further.

It is difficult to discuss the chronological changes observed through time at Reinach with regards to the butchery practices as there is little evidence of change and also sample sizes prohibit an extensive analysis of these data (table 5.8.2-4). The main observable difference is the higher proportion of single marks in the tenth to twelfth century data when compared to the earlier seventh to eighth Century period, although the data here is again sparse. Analysis of the data through body area is impossible at Reinach as there are too few data points to make further analysis worthwhile, although the data is presented here (table 5.8.2-5). Analysis of body part suggests that there is a much wider range of butchery marks observed throughout the eighth to ninth Century period compared to the eleventh to twelfth Century period. In this later phase marks on the trunk and forelimb are mainly observed. This could suggest perhaps that the earlier periods have more primary and secondary butchery occurring within the structures whilst the latter periods this maybe mainly occurring elsewhere and just the main portioning of the joints are occurring in the recorded structures. This scenario however feasible is probably also probably unlikely as the body part analysis (c.f. 5.2.2.3) shows that similar elements are found across the time periods discussed here thus likely different uses of the animals is difficult to anticipate.

The data from Kaiseraugst shows that the results are similar, at least for the periods in which the samples are considered large enough to rule out statistical error (table 5.8.2-6). Throughout the phases studied here there are many similarities in the results, the phase that deviates most is the twelfth century sample as this change can be squarely laid down as errors associated with sample size. The majority of the periods have approximately ten percent of the fragments showing butchery traces whilst the two large samples the fifth to sixth and sixth century periods show similar results in the mark that are present however these results deviate when the repetitiveness is observed. The sixth century material has a much higher proportion of repeated blows the fifth to sixth Century. This could be an indication of the skill of the butchers present in each period or perhaps some function in the use of the ovicaprids. The relationship between body area and mark can perhaps shed light on this as there is a much higher proportion of marks from horncores in the sixth Century material and in the main the removal of the horn sheath requires more than a single blow (table 5.8.2-7). However it is difficult to discuss this with certainty as all periods have too few butchery traces with which to make secure inferences. However it can be observed that all periods at Kaiseraugst have higher proportions of horncore marks, in part due to the higher presence of horncores in the assemblages, which perhaps again leads to the inference of at least a part time horn worker.

The skull shows marks that remove the horncores at the base so that the maximum amount of sheath can be utilised. There are also marks on the frontal bone, which suggests that the brain was utilised. There are very few incidences of cut marks on the mandibles, perhaps due to the smaller muscle mass on the cheek compared to cattle and pigs, it may also suggest that the tongue of ovicaprids were not consumed.

The long bones show similar marks to that of cattle with marks on the distal humerus and proximal radius and ulna. The femur shows knife marks on the head and proximal midshaft related to the removal from the pelvis. The pelvis is also cleaved and removed from the trunk around the illial neck. The femur was often fragmented with chop marks on the distal end that suggest the marrow may have been extracted after the knee articulation was jointed. The tibia is often chopped towards the distal end, perhaps as a means to extract the marrow. There are also only very few examples of butchery of metapodials. There is no evidence of butchery to phalanges, although these maybe used in glue production but are small enough so that breaking them down further is not required.

The ribs are regularly sectioned in a similar way to that seen in cattle, the fragment size being around 5 cm and the vertebra show a lateral sectioning as with cattle and there are no signs of dorso-ventral cleaving. There is also evidence of the removal of the head with the transverse cleaving of some atlases and axes.

The ovicaprids, at the three sites under study here, were no doubt as intensively butchered as the cattle. However, there remains sparse evidence from the assemblages to piece together a comprehensive pattern of butchery. The similar patterns seen in ovicaprids compared to cattle suggest that similar processes are occurring. There are examples of primary butchery and also examples of smaller joints and cuts being produced. The marks that are observe are similar to those recorded for written sources of cuts of lamb (fig 5.8.2-8).

5.8.3. Pig butchery

In general the quantatative analysis of the butchery marks of pigs from the three sites show on the whole that a similar proportion of marks are observed at each site and at Lausen and Kaiseraugst the same types of makes are also observed (table 5.8.3-1). However at Reinach a slightly different picture emerges, there are fewer intermediate marks at Reinach, which reciprocally means that there are a higher proportion of bones that lack butchery traces as the light and heavy marks are similar to those at the two other sites. Studying the repetitiveness of marks suggests again that the results are similar across all sites, as with ovicaprids, approximately two thirds of the butchered fragments analysed have a single mark.

The results from a study of the chronological changes show that the statistically sound datasets are similar across time periods (table 5.8.3-2). This then suggests that there are few changes through time in terms of pig butchery marks left behind at Reinach. The repetitiveness of traces however differs between time periods, although this appears to be due to the small numbers of butchered bones being unrepresentative compared to the large body of material in the seventh to eighth century. Again, if this period is considered representative, then around two thirds of the butchery marks are of single marks. The sixth Century (* see §2.1.3) shows a greater deviation from the results recorded in the later phases. There is a much higher proportion of butchery traces within the assemblage. These mostly consist of intermediate marks however there are also a large proportion of light marks when compared to the other phases of the site. This could be due to the cultural influences that are noted with the resettlement of the site during this period but such inferences must be tempered. Studying the body parts that exhibit butchery it can be seen that there is similarity in the sixth and seventh to eighth century phases that contain statistically sound datasets (table 5.8.3-3). The marks occur relatively evenly through all body areas with the trunk region most heavily represented.

The chronological changes that can be observed at Lausen show that there is an increasing proportion of butchered bones through time (table 5.8.3-4). This change is not related to an increase in the number of intermediate marks that have been observed elsewhere in this study but shows increasing proportions of all mark types. This then hints at a more intense butchery of pigs through time. Although this would appear in contradiction to the body part data which shows that in the later phase, in particular the eleventh century, all body parts are represented equally (c.f. 5.2.3.2) and thus the hypothesis was suggested that the pigs were being roasted whole and that in terms of butchery would perhaps mean that there would be few marks left as cooked meat would require much less in terms of force to remove meat and joints from the carcass than if it was raw. The analysis of the body area butchered also seemingly contradicts this hypothesis, as there appears to be mostly trunk and girdle bones representing the majority of the data (table 5.8.3-5). However it could be argued that if the whole animal is roasted only the meat from the trunk and girdle bones need be butchered as the other joints could be removed with a knife between the bones, severing the soft cartilage and tendons rather than the tougher osseous material, thus leaving few traces on the fragments themselves. This though is mere speculation as there is, in all likelihood, more than one process occurring throughout the site within any given time period.

Studying the results from the Kaiseraugst material it can be observed that around ten percent of the bones show traces of butchery and that the proportions of the types of marks are similar for all periods except the fifth to sixth century period (table 5.8.3-6). This exception has a higher proportion of butchery traces that are represented by a greater proportion of intermediate marks. It is not immediately clear the reason for this difference. Observing the number of marks for a specific process shows that there is a correlation between the small sample sizes and divergence from the oft-noted proportion of approximately two thirds exhibiting a single mark. With regards to body area in terms of butchery it can be seen in the two statistically sound samples that there is little difference in the areas that the marks are represented (table 5.8.3-7). Although it does appear that the proportions are different for these periods, trunk is the main part followed by girdle in the fifth to sixth century, in the sixth century phase the forelimb is better represented than the girdle. Again it is difficult to elucidate a reason why this occurs.

The placement of the marks shows little change through time (figs. 5.8.3-8 to 13) with primary, secondary and jointing butchery marks being observed on the bones through all periods.

5.8.3.1. The skull and mandible

The high fragmentation of the skull parts is such that it precludes the destructive post depositional forces alone from causing such damage and thus butchery must be a factor in this fragmentation. The butchery marks are observed on the skull of pig in Reinach and Lausen, although not in Kaiseraugst (figs. 5.8.3-8, -10 and -12). The brain, as with cattle and ovicaprids, was probably recognised food and the marks at Reinach and Lausen are attempts to retrieve this food source by chopping the cranium open in a cranial-caudal direction on the dorsal aspect of the skull. There is also evidence from Reinach of chop marks on the zygomatic and maxilla, however, these are of unknown purpose (figs. 5.8.3-10).

The mandible again shows marks on the distal condyle and the junction between the ascending and transverse ramii, probably caused in an attempt to remove the cheek meat or to remove the mandible from the skull to gain access to the tongue. Cleaving of the two mandible halves is also observed at all sites, evidence usually occurs on the inferior portion of the lingual surface again this maybe to gain access to the tongue.

5.8.3.2. The long bones

The forelimb is separated from the trunk by chopping through the distal end of the scapula, with marks at the base of the scapula spine demonstrating this. Evidence of fine marks to the side of the spine suggests the filleting of the scapula. Marks on the dorsal and ventral edge of the scapula may also occur with either the removal of the meat from the bone or the sectioning of the carcass.

The best represented part of the humerus, as with cattle and ovicaprids is the distal articulation and lower shaft. The butchery marks found on the distal articulation of the humerus implies the removal of the meat from the bone rather than severance of the joints. The evidence of chopping on the distal end of the diaphysis suggests that this may have been the point of severance. Although at Kaiseraugst and Lausen chopping in the mid region of the diaphysis also occurs suggesting that severance may also have occurred in a more proximal region (figs. 5.8.3-8 and -12).

Corresponding butchery marks to those on the distal end of the humerus are displayed on the proximal part of the radius and ulna with the removal of the meat from the elbow joint. The extraction of marrow from the radius is attested to by the observation of butchery marks on the mid portion and distal end of the diaphysis.

The hind limb of pig shows thorough butchery too. Again the hind limb is sectioned at the neck of the illium. There is little evidence of marks of the illial crest. Marks on the ventral part of the pelvis, the ischium and pubis, are observed in Kaiseraugst and Reinach although not Lausen (figs. 5.8.3-8 and 10). Disarticulation of the hip joint is evidenced by knife marks around the acetabulum. This could have also taken place after the sectioning of the carcass in to larger joints.

The proximal articulation of the femur displays knife marks that correspond with similar marks around the acetabulum of the pelvis. The femur is often severed at both the proximal and distal end of the diaphysis. The proximal marks evidence the jointing of the rump and the more distal marks are left after the sectioning of the knee joint. There is also evidence of chopping the femur at the midshaft, this could be to remove the marrow from this element. There is no evidence of longitudinal splitting of the femur at any site. The tibia most displays marks on the mid or distal part of the diaphysis. These marks are perhaps due to the extraction of marrow. Longitudinal marks on the tibia again are not observed at any of the sites.

There is very little evidence of butchery on the metapodials this suggests that the feet are removed at the carpals or distal part of the radius in the forelimb and at the tarsals or distal tibia in the hind limb. This would then imply that the foot or trotter is then either boiled and eaten or discarded as waste as a single unit. The lack of wastage from other areas of the skeleton would seem to suggest that the trotters would be part of the diet especially as they have remained part of the diet until today. The fragile nature of the metapodials and phalanges of pig means that they rarely survive in large number in the osteological material and therefore it is difficult to draw any hard and fast interpretations.

5.8.3.3. The trunk

Butchery of the trunk is observed at all three sites with marks on the ribs and vertebrae. The ribs are sectioned at the neck and then repeatedly along the shaft. These marks on the blade of the rib occur at approximately 5cm intervals in pig. These ribs appear to be sectioned into racks. The marks that attest to the smoking of the ribs are not seen in pigs.

Cervical, thoracic and lumbar vertebrae show lateral cut marks through all sites and time periods. This suggests that the cattle were sectioned along the flanks rather than sides. The cleaving of the vertebrae dorso-ventrally occurs at a much later period as mentioned previously. At Reinach (fig. 5.8.3-10) and possibly Kaiseraugst the upper most cervical vertebrae, the atlas and axis, also display heavy butchery marks, cleaving the region around the atlas and axis would facilitate the removal of the skull.

The three sites in the study again show very similar practices in the primary butchery and dressing the joints of pig. This is also likely as pig has very little other uses than as a meat animal. Written sources and known butchery practices also produce similar placement of the marks compared to those found here. Although it must be considered that there are only a few ways in which primary and to a certain extent secondary butchery can be carried out (fig 5.8.3-14).

5.8.4. Butchery: other domestic species

5.8.4.1. Horse (table 5.8.4.1-1)

There is evidence of cut marks on horse bones at Kaiseraugst. The marks all come from the mid fourth Century data in the ‘Gasthof Adler’ excavation. Marks that are represented are not just those of rough dismemberment but also knife marks around the glenoid articulation of the scapula and chop marks on the blade of the same element. These marks could suggest the removal of the meat for human consumption. Although it is also known in medieval times that horsemeat was removed and fed to hunting dogs in wealthier households. Lausen also demonstrates butchery of equid bones with chopping marks on a rib and on the shaft of a tibia from the eleventh Century. The second mark probably represents the dismemberment of an individual for disposal. The lack of evidence at this site despite the higher proportions of equid remains in some periods; tend to suggest that on the whole equids were not part of the diet although this cannot be fully ruled out with evidence of the chopped rib. At Reinach a single butchery mark is observed on a femur of tenth Century date at the 'Gemeindezentrum' area of the excavation. This is a knife mark on the greater trochanter, it is likely that this is a mark left by dismemberment of the carcass for disposal it is possible that this is a mark made during the removal of the femur from the acetabulum.

5.8.4.2. Domestic fowl (table 5.8.4.2-1)

There is more evidence of chicken butchery than that for equids, which is surprising, as a well-cooked chicken can be pulled apart by hand, and leg and wing limbs can be eaten without the requirement of butchery. The majority of the marks observed on the chicken bones appear to be disarticulating the joints, with knife marks comprising the majority of observed marks at all sites. The evidence of knife marks along the midshaft of long bones and on the furcula, suggests that the meat may have been stripped from the bone, it is impossible to tell if this occurred before cooking or at the dining table. There is evidence of chopping of certain elements, such as the distal end of the tibio-tarsus. This characteristic could indicate the removal of the feet, as distally to this point there is very little in the way of meat. This could have occurred when dressing the carcass in a similar way in which modern chickens are dressed. Chopping of the coracoid, proximal humerus or proximal femur could indicate signs of sectioning of the carcass into its component limbs and torso. Again it is impossible to tell whether sectioning of the animal occurred before cooking or whether the fowl was cooked first, sectioned and then served.

5.8.5. Butchery: Wild Mammals and birds (table 5.8.5-1)

There is evidence of butchery on wild animals from all sites. The majority of the cervid, all of which are from red deer, butchery marks occur at the Kaiseraugst site. There is butchery evidence from all parts of the body except the feet, so in all likelihood the whole carcass would have been brought to the site to be butchered rather than selected cuts of meat being brought back to the settlement. The processes of butchery will probably take the same course as that observed in other large bodied mammals i.e. other artiodactyls and horses.

The single butchery trace on wild boar does not give much information about the practices of dismembering and jointing of this animal but most probably it was treated in a similar way to that of domestic pig. The exception being that the meat would only likely be available to those of higher social status.

The few traces of butchery observed in rabbit and goose as with wild boar do not impart a great deal of knowledge about the processes of preparation and jointing of these animals but because of the size of the animals and only knife marks being represented it is likely that these animals were treated in the same way as chicken, most likely cooked whole, quarters or large joints. The knife marks appear as the joints are separated at the table or perhaps before serving.

There is a single incidence of butchery on a fox mandible. This animal is unlikely to have been hunted for the dining table thus it is likely that this mark is made in the skinning of an animal that may have been trapped or hunted with dogs for its fur. However with just a single incidence it also excludes any ideas about this being a flourishing trade in Lausen.

5.8.6. Summary

The butchery remains are also quite consistent through time, where sample sizes allow analysis, for the species presented here. Although it must be stated that in a lot of cases it is difficult to piece together a chronological analysis of the butchery due to the small samples of cut marks that can be observed in these highly fragmented assemblages. The most interesting difference is the evidence of what could be the process of smoking meat in the early part of the material from Kaiseraugst. This late fourth Century material shows ribs of cattle and pigs with scoring marks longitudinally down the bone to allow the penetration of the smoke. This is known to have occurred from an early period in the region, but for reasons unknown perhaps the withdrawal of the Roman administration and military, it disappears after this late fourth century evidence.

This chapter has studied the body part represented by each animal in the final assemblages, and it has been shown that at all the sites presented here that the animal is brought to the site before slaughter. All body parts being represented at all sites albeit in varying proportions evidence this. This variation is caused by the taphonomic destruction of the less robust bones in the main when not being removed from the assemblage by cultural practices.

Evidence of the activities of craftsmen or other industrial activities other than butchery was not obvious from the excavations studied here. The remains of antler waste may be a tentative pointer in to the practices of craftsmen in Kaiseraugst. Chopped horn cores again suggest a craftsman at work but with no large accumulations and little in the way of other evidence it is hard to make comprehensive conclusions about the nature of crafts and industries in the early medieval of the region. In this section an overview of the crafts and industries relating to animal bones is given, and evidence from the faunal remains from the sites studied is laid out.

The following chapter will analyses the results from the data in which inferences can be made with regards to the husbandry techniques used to produce the animals for slaughter and the secondary uses to which these animals were put before slaughter. In this section, age at death, pathology, sex ratios and biometry will be used to infer differing techniques for their use both between species and within the sites through time according to the need of the population at a specific time.

6. Husbandry and Economy

6.1. Introduction

6.1.1. Age at death

Age at death yields important information about the husbandry and hunting strategies of past populations. An age distribution that is different from the 'natural' mortality pattern of a species shows the selective nature of hunters and farmers and thus links to the human decision making processes. There is a vast array of research dedicated to studying the age at death from the faunal remains (c.f. O'Connor 2006, table 1 for examples). There are four main techniques for assessing the age at death of a mammal; Cementum increment analysis, dental eruption and wear, epiphyseal fusion and histological analysis. Of these dental eruption and wear, alongside epiphyseal fusion data are used most often in archaeozoological research, mainly due to the limited time and money in most projects.

Cementum analysis studies the laying down of cementum around the roots and crown of the tooth. The cementum is laid down at regular intervals throughout an animal's life, including humans, ungulates, carnivores and many other mammals. Primarily, this periodicity was thought to be an annual cycle, however there is a growing body of literature to suggest that the laying down of cementum may follow a different rhythm (Spinage 1973, 178). However the full details of the physiological processes are not understood. In humans there is a clear correlation between the age of an individual and the thickness of the root apices (Gustafson, 1966). Cementum increments are usually studied in thin section, using decalcified sections in modern samples and non-decalcified in archaeological material as decalcification causes rapid destruction of the sample. This is due to the likelihood of poor preservation of the archaeological material. Clearly there are problems with this technique when applied to archaeological material. The procedure is destructive, which is not always desirable. Also the process is complex with much preparation is need before analysis, expensive and relatively slow compared to other techniques. The procedure has an acceptable level of reliability, however as mentioned above, there needs to be a level of confidence that what is being counted is what is believed is being to be counted. Cementum increment analysis probably remains a technique that is suited to certain circumstances but unsuitable for routine analysis of the faunal remains.

Dental development and eruption, in mammals, as with humans occur at reasonably predictable ages. All that needs to be known to be able to use the state of eruption of the deciduous or permanent tooth is a typical age at which the tooth erupts in the studied species. Ideally the whole tooth row would be examined in an individual and an approximate age at death of the animal can be assessed. This age is based on the assumption that dental developments of the individual were not abnormal. Research has produced data for dental development and eruption in many of the domestic animals around the world and many more wild species that are of economic importance to modern and past populations (c.f. O'Connor 2006, table 1 for a list of species). However, the eruption of the deciduous and permanent dentition is only useful up to a certain point, the age at which the permanent dentition is fully erupted. In many mammals the dentition is fully erupted well before the maximum age of that species is obtained. Age at death after full eruption can be assessed due to the fact that these teeth are in constant wear. The degree of attrition can be measured in two ways, either by measuring the crown heights of teeth or by the examination of the patterns left by dentine exposure on the occlusal surface.

Measurement of the crown height is perhaps most useful in herbivores, where an abrasive, high volume diet cause a large degree of change in the crown heights over time. Although, Lowe (1967) showed that there is a high degree of variability, with respect to crown height between individuals of a red deer population. So this limits the use of the technique for individuals but does allow individuals to be placed in age categories, which can then give an idea of the age profile of the population as a whole. It must also be remembered that age and crown heights do not have a linear relationship but an exponential one (Klein *et al.* 1981). Modern data gives the best fit when the natural logarithm of crown height is used to predict age. Levine's (1982) work on horse crown heights is a good example of this, producing tables from modern data and then allowing either age at death of archaeological samples to be calculated through regression equations or mortality patterns for a population.

Recording the attrition of the dentition by wear of the occlusal surface requires some form of classification of the differing stages of wear. This has been carried out in different ways but usually by means of noting the sequence and wear upon the cusps of each tooth as the enamel covering is worn down and the underlying dentine is exposed (c.f. Payne 1973, Grant 1982). The structure of cattle and ovicaprid teeth is such that it lends itself well to such systems, however pig teeth are more intricate, with highly folded cusps are much more difficult to accurately record. The method of analysing tooth wear designed by Grant (1982) is perhaps one of the most widely used systems in Europe, yet whilst the recording of the teeth is useful, the subsequent analytical phase is open to criticism, mainly in the fact that there is some form of approximation when molars are missing and also it has been shown that some stages of tooth wear are longer than others (Moran and O'Connor, 1994) yet in Grant's (1982) analysis all wear stages are given the same value. This then imposes a certain pattern on the age profiles, as certain wear stages are more likely due to them being a larger proportion of the animals' life. So when assigning an age profile to an animal population it must be borne in mind that different attrition rates can occur to those outlined above. This could be due to the fodder the animals are eating or the substrate from which the food is taken. Healy and Ludwig (1965) showed that the soil ingested by ovicaprids was the overwhelming factor in excessive wear rates. The authors also showed that the majority of the attrition occurred in late winter and spring and could be reduced by supplementary feeding. Despite these disadvantages a recent paper by Greenfield and Arnold (2008) showed that even widely dispersed geographical populations had similar tooth wear patterns to those expressed by Grant (1982). This then suggests that Grant's method is more widely applicable than first imagined. Microwear on teeth can also be studied to determine the content of the diet, however this process is very labour intensive and expensive and rarely carried out aside from answering very specific research questions. The techniques of tooth development and attrition in assigning an age profile to a population are still a widely used method for observing husbandry and hunting strategies.

As with dental development the skeletal elements of the body also develop in a reasonably predictable manner. This is to say that the unfused epiphyses of a young animal fuse to the diaphysis at a predictable age. All that is needed is the data as to the timing of the closure of the epiphyseal plate. Work by Silver (1969) and Amorosi (1989) have tabulated forms of the epiphyseal fusion times of many species. However being able to observe more than one bone of a single individual is a rare luxury in archaeozoological analysis, often only a small part of any single element is available. These procedures also need confidence in the timing of fusion of modern data. It has been shown that under fed animals often have delayed fusion. Castration can also delay fusion (Hatting 1993) although Clutton-Brock *et al.* (1990) noted no such variation. This maybe due to the timing of castration, as castration can be carried out at varying times. Moran and O'Connor (1994) showed that castration has greater effects on the fusion of bones in sheep between the ages of 18 and 24 months, rather than preceding or following ages.

The interpretation of the epiphyseal fusion data presents a number of difficulties. These difficulties are due to the lack of precision regarding the time of fusion of any one epiphysis. Another problem is that the data mostly consists of disarticulated material from an unknown number of individuals. The fact that data is often analysed longitudinally, which is the number of deaths though a given period of time, is better suited to the study of a live population (O'Connor 2000, 96).

So the best approach to ageing archaeological bones is to examine the data from tooth eruption and attrition alongside that of the epiphyseal fusion data, thus any discrepancies in either technique will be highlighted by the other such as the effects of castration or excessive wear patterns.

Histological analysis of the bones can also be used to ascertain the age in an animal population. However until today this method has mostly been used on human bones and concentrates on the remodelling and the deposition of secondary osteons. Ruddle (1996) applied this technique to known age roe deer alongside dental development and attrition. The results showed that this technique could predict the age in the population but was however a little less accurate than use of the dentition. So whilst it is possible to use this technique more studies are needed, plus the time consuming and labour intensive procedure perhaps makes this technique less attractive than other more simple methods.

Birds are more difficult to age as they are only immature for a short period and also the skeleton does not produce epiphyses as with mammals. So many age determinations are of an immature to mature ratio. The size of a fish is related to the age, so size can be used to investigate the age distribution of a population although knowledge of modern data is required and the distribution of size within a given shoal of fish.

The analysis of age at death with respect to mandibular tooth eruption and occlusal wear was carried out where appropriate to determine an age demographic for the animal populations at the three sites under study here. It is often an interesting and necessary exercise to compare this analysis to the epiphyseal fusion results to observe differences in the age structures produced. However, due to the small numbers of relevant mandibular elements statistically sound interpretations cannot be made on this data alone. The data here is represented in a form where the epiphyseal fusion and toothwear data are combined (as previously stated in §2.1.3).Sample sizes are considered statistically sound if they number greater than thirty.

6.1.2. Biometry

Biometrical data can be put to a wide range of uses in archaeozoology. Various measurements can be used to separate skeletally similar species for example the distal metacarpal can distinguish between sheep and goats (Payne 1969). It can also be used to distinguish between wild and domestic forms of a species. Domestication often leads to a reduction in size and other morphological changes that can be analysed through measurement. The separation of pigs and wild boar is an example of this. Sex differences and also breed differences can be tested and observed through metrical analysis. The changing morphology of an animal population through time is also an important question and many papers have been written on this topic alone (e.g. France, Audouin-Rouzeau, 1991; Belguim, Peters, 1998; Netherlands, Peters, 1988; Switzerland, Breuer *et al.* 1999 and 2001 and the United Kingdom, Albarella *et al.* 2008; Dobney, 2001; Maltby 1981). However, all the uses that metrical data can be put to, it must be ensured that the measurements taken by different authors at different sites and time periods are comparable. There has to some agreement on the measurements used and to this end a published series of measurements is widely used (von den Driesch 1976). This defines and illustrates hundreds of measurements that can be taken over a wide range of species. However this does not mean that all measurements must be taken when available, as some are clearly interrelated. Transforming the primary data by log standard index also allows a greater sample size to be studied and thus more conclusions to be made on smaller amounts of data.

It must also be understood that there will be some inherent variation in the values between different authors, even the same researcher repeatedly taking the same measurement will involve some degree of variation, a good example of this can be seen in Frosdick (n.d., 65). The taking of measurements should be undertaken to answer a research question and not as an end to itself.

6.1.3. Sex determination

The determination of sex ratios is an important topic in archaeozoology as it leads to information on hunting strategies, husbandry practices and cultural significance of sex. There are many techniques for identifying sex many of which are dependant on the species being studied and skeletal elements. Both continuous and discontinuous data can determine sex. In some taxa, there are reliable differences in the pelvis morphology of the two sexes and also castrates, which means that the studied assemblages can be differentiated according to sex (e.g. Grigson, 1982; Davis, 2000). However the pelvis and especially the pubis, the part that is used to differentiate between species have a poor rate of survival after deposition. Metapodials have also been used to distinguish between sexes, mainly through metrical analyses, these elements are also more robust and commonly found within faunal assemblages. Studies (Higham, 1969; Davis, 2000) have shown that bovid metapodia are indeed dimorphic, however, Albarella (1997) observes that variation can also occur due to breed differences. This is a particular problem in urban studies as animals tend to be drawn from different areas of the hinterland into the towns (c.f. Nussbaumer and Rehazek, 2010). Large accumulations of metapodials usually occur due to the presence of crafts within urban centres, these also attract large numbers of horncores, which are also separable in to different groups according to sex. Armitage and Clutton-Brock (1976) devised a system whereby horncorn could be divided into different archaeological types and these types then further split into sex groups according to the size and shape of the horn cores. Bulls tended to have oval-shaped and short horns, whereas cows tended to have circular and long horns. Castrated were shown to be a mixture of these morphological traits. Armitage (1982) furthered this study by reclassifying the groups and adding an age determination factor by horncore texture. However this methodology is highly subjective and many researchers have found them problematic (e.g. Weinstock, 2002). It is no matter a useful step in the direction being able to assign sex to certain elements in the faunal remains with an idea of recognising population profiles within them.

Tooth presence and morphology can also be used in certain species as an indicator of sex. The presence of canine teeth in equids tends to point towards a male individual as these teeth are rarely found in females of the taxa. The shape of canine teeth in suids can also help identify the sex and age of an individual. Male canines on the whole tend to be more robust and squarer in profile than the more gracile and oval shape of the female canine.

In chicken the presence of a tarsometatarsal spur, like the canine tooth of equids, signifies a male yet the absence of the spur does not necessarily equate to a female as these can be also be missing in males too. Medullary bone identifies female fowl at certain points in their life cycle as this spongy bone is laid down during the laying season.

Some species possess baculum as a distinctive male trait, much like antler is cervid species. However these like the metatarsal spur and equid canines do not reveal much about the ratio of the sexes, only presence or absence of either sex.

Multivariate analysis can also be used to distinguish between the sexes of some mammal species as Ruscillo (2000) eludes to in here thesis. However this type of analysis is rarely used and standard uni- and bivariate plotting is used to observe distinctive changes in certain morphological features of vertebrates. If changes are observed then a decision needs to be made as to whether the features observed diverge through sexual dimorphism or through the presence of two morphologically distinct populations (O'Connor 2006, 5).

Ancient DNA can also be used as an identifier of sex. Although the application has been shown to be useful in some cases, the number of bones that are likely to yield the right amount of the correct sequence from archaeological bone is very low. This alongside the restrictive costs and destructive sampling of the technique means that it will never be used as a standard procedure.

6.1.4. Pathology

The lack of a large body of data for this topic means that the long term well-being of the animals studied here cannot be fully addressed although indications of the factors that are affecting the individuals within the herds of the region can be noted and compared to existing literature and research. There is evidence for pathologies caused by developmental abnormalities such as extra foramen in the skull of cattle. Work related skeletal change is also observed, e.g. the distal widening of metapodials and phalanges with extra osseous growth. Dietary pathologies can also be observed such as a ridged canine tooth of a pig from Kaiseraugst ('Jakobli-Haus'- late fifth to sixth Century). However, many of the identified pathologies recorded from the material have an unidentified cause. Agents of pathological change without definite cause, other than those mentioned above include trauma and disease, these cover a wide range of factors such as other environmental conditions such as overcrowding of enclosures, accidents and perhaps intentional injury caused by husbandry practices e.g. hobbling. Trauma can lead to infection and thus different sets of observable pathologies. However not all evidence of infection are caused by trauma as infectious diseases can also leave similar traces on the bones.

There are two types of developmental abnormalities of the skeleton those that are inherited through genetic material and of no-known genetic component. Both groups vary widely in the degree of expression from minor abnormalities to changes that are incompatible with life itself. It is of course not possible to distinguish between the two groups by examination of the lesion alone. This requires a dedicated breeding research programme, these defects have little or no economic importance so such studies are unlikely to take place, and thus it must be assumed that all developmental abnormalities are not inherited unless the evidence proves otherwise.

It is probable that developmental abnormalities are under represented in the archaeological faunal record. This is most likely due to the fact that many animals with such defects die shortly after birth, and that the rarity of these abnormalities are further obscured by the poor preservation of juvenile bones in the archaeological record. Also the observation of minor defects requires an intimate knowledge of the ‘normal’ anatomy of the bones if they are to be detected. It could be argued that the individuals that are severely affected by abnormalities would not have made it to the table for human consumption and would have been, as today, thrown to the dogs or disposed of in manure heaps. It is also possible that these conditions often affect the soft tissues and as these are only found in rare preservation conditions will be missing from the faunal material that makes it to the researcher’s table.

Roberts (1971) shows that there are 156 possible non-inherited malformations that occur in domestic species. However, just 56 of these involve skeletal change to a greater of lesser degree. There are a large number of agents that can cause the abnormalities observed by Roberts (*ibid*.). These agents can be grouped in to nutrition, physical, radiation, though this is less likely to have been a problem in past populations as it is to modern herds, therapeutic, either deliberately or inadvertently by human use and misuse of certain materials, botanic agents, infectious agents and lastly ageing gametes can all produce malformed animals. Although the majority of the agents within these groups form a wide range of malformations and only very few are associated with specific abnormalities. Perhaps the most widely occurring and one of the least debilitating to the individual is the formation of extra foramina. These are regularly seen in the diastema of herbivores, where multiple foramina can be observed. Vertebral bodies are also highly susceptible to extra foramina. The skull is also subject to abnormal perforations, there is a growing body of data showing that cattle skulls exhibit large perforations, usually in the parietal bone, this is presumably a congenital malformation (c.f. §6.2.4 as evidence at Kaiseraugst).

Teeth can also show variation and abnormality. Supernumerary and absence of teeth is observed, with the absence of the second premolar in ruminants a well-researched example (Andrews and Noodle, 1975). The major problem with research into the extent of variation in the teeth of animals is that many teeth are found separately from the mandible or the mandible is fragmented.

Inflammatory conditions of bone are frequently observed in the archaeological record as well as modern material. Despite this prevalence of data, both modern and ancient, until recently very little research was carried out on these conditions. Inflammatory conditions are categorised into three groups on pathological grounds, osteoperiostitis, where the disease starts in the periosteum of the bone. Osteomyelitis, is where the marrow cavity is the point of infection and osteitis, in which the infection is centred in the soft tissues surrounding the bone. These are aetiologically important distinctions. However in the analysis of archaeological material it is often very difficult to decide which type is present. Infectious inflammation can also be categorized into agents that opportunistically attack bone, those which non-specifically attack bone and are as likely to attack other soft tissues as bone. The second category include agents which affect certain sites, including bone, specifically if not exclusively and the third group contains agents in which attack is directed at bone tissues almost exclusively. Non-specific agents such as those in the first two categories above usually gain access to the bone either through the surrounding soft tissue or through the blood stream. Necrosis of bone can also observed in archaeological material; this is where the blood and nutrient supply to the bone is cut off perhaps by trauma or in some cases thrombosis of a major blood vessel. This lack of nutrient supply causes the bone to die and by various mechanisms, dependant on the size and site of the necrotic bone, cause remodelling of the remaining live bones that attach to it.

Traumatic injury is perhaps the easiest form of pathology to recognize in the archaeological faunal material and the literature is full of examples of such injuries. Trauma can be categorized into damage from human agents, intra- or inter-group conflict, accidents and disease related. It is not possible or the aim to detail all the various aspects of traumatic injuries here. However it possible to suggest ways in which it is best to record these types of injuries. These types of injuries should be carefully described in as much detail as possible and ideally photographs and radiographs taken. Problems occur when injuries to the bones are sustained near to or at the point of death or injury does not effect the bone itself but secondary infection from the surrounding tissues does. Classifying ante-mortem trauma is difficult with healed traumas as misalignment and the type of fracture is not always easy to elucidate. Traumatic injuries from a particular site often reveal little new information, unless there is some new interpretation or a novel form of pathology, these types of injuries need to be viewed in the context of other sites or as a larger group of trauma injuries. Two large studies of animal bones of Holocene date showed that a common frequency of fracture presence in the archaeological record is 0.04% (Siegal, 1976). This sample of over 75,000 bones could be considered a baseline for fracture presence in an assemblage. Frequencies of injury to specific areas of the skeleton varies from family to family, *Carnivora* tend to suffer fractures of radius, tibia and ribs whilst *Artiodactlya* suffer most from fractures to the skull, tibia and ribs (Roberts 1980, 92 and table 1.). The results from this study also suggest that there are anthropogenic factors affecting this 'natural' patterning of fractures.

Disease of the joints is, like trauma, one of the more common abnormalities of animal bones observed in the archaeological record (Siegal, 1976). Whilst the aetiology of a particular change may be unknown, the lesions observed can be grouped into a different number of disease progressions. Depressions in the articular surface, osteoarthritis, spavin, joint infections, dislocation and other joint effecting diseases such as osteochondritis dessicans in large canids can all be shown to produce varying decrees of joint change in domestic and wild animals.

Depressions of varying sizes and forms can occur on certain articulations of the skeleton of animals. Most are thought to be non-pathological although they have been widely noted in the archaeological record, Barker and Brothwell (1980) suggest that a prevalence of around 3% is likely, although these need to be more regularly studied, to gain an idea of the variation of these depressions. They are most likely to occur in the phalanges of cattle and have also been observed in the articular surface of the mandible. Though, these have also been noted in other species including humans. Minor changes are also seen in the pelvis, such as the deep cleft in the acetabulum of a sheep pelvis from Wroxeter Park (Baker and Brothwell 1980), again this is considered non-pathological variation to 'the norm'.

Osteoarthritis is a degenerative disease that affects the articular cartilage. The cause of osteoarthritis is not clear but it appears commonly to result from repetitive trauma to the joint, thus accelerating the normal wear and ageing process of the joint. Osteoarthritis is more likely to occur naturally in older animals due to wear and tear on the joints through time. There is also a high prevalence in draught animals, so it is postulated that heavy working animals have a higher risk than other animals though there is no reason why it cannot occur in other species. Diagnosis of osteoarthritis has in the past been variable but there are four changes in the joint that when seen in conjunction, signifies a case of osteoarthritis. These are grooving or pitting of the articular surface, eburnation, extension of the articular surface by new bone growth, and extoses on the periphery of the joint. There are other diseases that produce one or two of these changes and may be similar in appearance but only osteoarthritis exhibits all factors in a single articulation.

One such disease is spavin, which is a disease of the tarsal region found in horses, cattle and camels. There is also a similar disease that affects the carpal region of cattle. Typically the disease exhibits itself in the medial/distal region of the tarsal joint, causing ossification of the ligaments, which will lead to limited movement in the affected joint. The aetiology of the disease is undetermined but a large number of possibly inter-related factors are involved. Hereditary factors are thought to underlie the process, repeated trauma is also thought to be involved, and onset is also observed after a rarefying osteitis of the small tarsals. Spavin causes mild lameness and in many cases after ossification has taken place the animal is pain free despite the limited movement of the joint. The main difference between this and osteoarthritis is that in Spavin the articular surface is unaffected and patent, extoses on the outer periphery of the bones cause the joint to fuse. Spavin is well attested in the archaeological record in both cattle and equids (c.f. fig 6.5.4-5; Spavin could be a differential diagnosis of the pathology observed.). Ring bone is another form of disease that appears similar to osteoarthritis yet does not affect the articular surfaces, again this is mainly seen in equids but is also possible in cattle and is thought, like spavin is caused by repeated trauma.

The area affected by ring bone is the inter-phalangeal joints. This disease was more common in the last century and is rarely seen in modern animals.

Infectious joint diseases are relatively common in many modern animal populations and the infection causing organisms can be categorised into two groups, pyogenic and non-pyogenic. Pyogenic organisms come into the body from outside and the latter being enteric organisms. The enteric organisms very rarely leave traces of disease on the skeleton that will be seen in archaeological record. The external disease causing agents can gain access either through a wound, and spread by osteomyelitis or through haematogenous spread from another area of the body. These types of disease are easiest to identify when cloacae are formed to allow drainage of the pus produced from infection. If the infection is persistent then bone modelling will take place and may even produce signs of osteoarthritis such as grooving of the articular surface and eventually fusion of the bones of the joint. These types of diseases are also relatively common in the archaeological remains, there seems to be a predominance of infections infecting the foot of animals perhaps because the distal part of the extremities are more susceptible to wounds that are then exposed to infectious organisms. Despite this infectious diseases are possible throughout the body.

Dislocation of the joints can also be seen in the archaeological remains if the dislocation is not reduced, either naturally or through human action shortly after it occurs. Evidence of dislocation can be in the form of extoses around the joint where ligaments have been torn or in severe cases the formation of a pseudo-joint, where the dislocated bones comes to rest against another. This is perhaps most likely in large animals as the muscle masses are much larger and thus more difficult to manipulate the joint back into it original position. Sever damage to the ligaments without dislocation can also lead to ossification of these tissues. The likelihood of differentiation of sprains and other causes of ossification of the ligaments around a joint will be almost impossible in most cases of pathology found within the animal remains of an archaeological excavation. However, this does not mean that pathology should not be recorded in detail and as precisely as possible.

Hereditary causes of dental abnormalities have been discussed above, however other diseases can affect the dentistry of animals during it life diseases such as caries, calculus, periodontal disease and the formation of abscesses are all seen in the archaeological remains. Those that are due to infections will follow the same pathways as for infections of a joint. The mouth is also more likely to have larger proportion of infectious agents due to the passing of food through it and the presence of wounds.

The list of cases of pathology mentioned here is by no means exhaustive but more a list of the most likely categories that can be seen in the archaeological record. In any case most instances of pathology seen in the faunal remains will not be diagnosed to a single cause; most likely several differential diagnoses will be put forward. The pathologies mentioned above mostly occur in mammals but there is no reason why some may not occur in birds, amphibians or reptiles, these cases and other more obscure pathologies will be discussed where appropriate in the following sections. Here the pathologies have been grouped in to general categories to try to observe the prevalence of certain types of pathologies in certain animals. Thus in each group the range of pathologies can range from very debilitating conditions and possibly the agent of death to those that were probably not even noticed by the live animal.

Following this introduction the presentation of results from each species will now take place. This will allow the data gathered from the different site within this project to be put into a context with regards to the above information.

6.2. Cattle

6.2.1. Age at Death

6.2.1.1. Kaiseraugst

The age structure of the slaughtered cattle at the Kaiseraugst excavation indicates that the majority of animals (approximately 70%) reached adulthood (table 6.2.1-1). Adulthood in cattle is considered to have occurred at around three years of age, where the adult size is reached, the majority of the epiphyses have closed and further feeding does not result in a further proportional increase in size. At this age the meat of the animals is considered to be at its best. However, there are only a few individuals that show signs of reaching senility. The number of subadult and younger animals remains fairly constant throughout the time of the settlement at Kaiseraugst, where samples are considered statistically sound. Those samples that are considered statistically small however do show similar tendencies to those of larger sample size.

This kill-off pattern, largely adults, points to the many uses of cattle. They are probably being utilised for meat, traction and dairying. Intensive beef production would usually result in an age pattern dominated by animals in their prime, at which full development of the carcass is seen. As mentioned above, this occurs around 3 years, perhaps a little later for the earlier unimproved breeds of the time period. If dairying and/or veal production were a major concern then the age structure would consist of the elderly females that had ceased to produce milk and the male calves that were surplus to breeding requirements. Individuals used for traction would have probably been slaughtered at an age where they were no longer useful as a work animal. This maybe younger than those elderly 'milkers' yet older than those prime individuals slaughtered for meat alone. A single production type is very rarely observed in the archaeological material; usually a mixture of these types is seen.

Classical literature suggests that cow's milk was not important to the Romans, Pliny (*Nat. Hist.* XXV.53; XXVIII.33) stating that it was mainly of medicinal use. This of course refers to the Italian based Roman culture and in all probability a different scenario is played out at the outer limits of the Empire.

The Kaiseraugst results are similar to those observed in many urban centres of Roman construct. The data here suggests that the preponderance of adult individuals carries on into the early medieval periods of the settlement. This possibly suggests that this is a pattern for urban centres rather than a typically Roman pattern. This reinforces the point that cattle were bred probably for traction rather than meat. Classical literature (*Nat. Hist.* see above) and archaeozoological data from the region (Schibler and Furger, 1998; Lehmann and Breuer 2000) support this hypothesis. Apicius' recipes (Flower and Rosenbaum, 1958) rarely mentions the use of beef, again this is considered classical Italian Roman literature so must be treated with caution when being applied to other parts of the Empire. Further still it is not until later in the medieval that the horse takes the place of cattle as the main animal of traction (c.f. 6.2.3).

Considering the intra-site variation at Kaiseraugst using the fifth to sixth Century data from the 'Jakobli-Haus' and 'Gasthof Adler' excavations, although broadly similar in composition with large numbers of adult individuals, it can be seen that there are more individuals of younger age at the 'Gasthof Adler' site than compared to that at the 'Jakobli-Haus' site (fig. 6.2.1-2). Whilst this probably does not represent a change in the wider use of cattle for traction, it could suggest that an underlying use for prime meat is more perceptible at the 'Gasthof Adler' site. It must also be considered that this difference could be due to post depositional changes due to the lower density of young animal bones as previously stated (§3-introduction). There may also be differentiation in the social status of the different area of the excavation; these are discussed more fully in chapter 8 (§8.1.1.3)

6.2.1.2. Lausen

The slaughter age of cattle at Lausen does not show the same degree of consistency as that at Kaiseraugst, here at Lausen it appears that there are changing practices through time (table 6.2.1.2-1).

The ninth Century group shows a large proportion of subadult animals with similar numbers of adult animals. The adults tend to be from the younger end of the adult spectrum (Fig. 6.2.1.2-2). This pattern suggests that the animals were probably primarily being killed for meat. The large numbers of individuals that are labelled as 'not adult' (a group created to consider those individuals slaughtered before the time of maturity) spanning the subadult and juvenile groups further suggests that these are animals in their prime, when meat quality is at its best (Fig. 6.2.1.2-3). This would fit well with the higher status of the site during this period. This could perhaps be a consumer site, with reduced thoughts of production concerns. However, this time period is dominated by the large sample of material from 'grube 28', a large pit filling in which many higher status finds were uncovered. Other areas of the excavation may show very different patterns of slaughter. However, within these other structures the sample sizes are too small to create concrete interpretations to elucidate horizontal variation within the settlement. It must also be borne in mind that the status of the site would mean that the payment of rents or taxes would possibly be due from the population that are living on and using the land of the landlord. The payment of the rents could take various forms including livestock, thus it must be considered that a part of the material here may have arrived through these means.

The eleventh Century data again shows high proportions of subadult and adult animals being slaughtered. This suggests that while prime meat is still an important strategy, traction and dairying are probably also an important consideration. At this point the site is probably at its most prominent and therefore the luxury of the best meat, whilst also maintaining a level of older cattle to work and milk. It could also suggest a horizontal social or husbandry difference within the site. However, the ‘sub-groups’ (* see §2.1.3) shift the material in favour of the adult age category probably due to density related issues. Similarly the sixth to seventh Centuries (*), tenth Century (*) and twelfth Century (*) are dominated by adult material, probably representing the post depositional density related changes that can occur to an assemblage but the lower status of the site during the sixth to seventh Century period may also suggest a different function for the animals at this time. The continuation of the settlement from the Roman period into the early medieval may suggest that the early material here, from the sixth and seventh Centuries is influenced by the preceding years of Roman rule and provisioning thus things carry on as ‘normal’ despite the removal of the Roman administration. However the samples here are too small to corroborate this idea. The data does show similarities to that at Kaiseraugst at least for this early period.

6.2.1.3. Reinach (table 6.2.1.3-1)

The earliest period at the Reinach excavation, that has a statistically large sample the seventh Century period, shows a slaughter pattern in which adult animals are slightly more predominant than those of subadults. This like the eleventh Century group at Lausen probably suggests a multi-strategy regime that is being employed within the site. Whilst the younger animals are probably being killed for meat, a proportion of the population is kept well into adulthood as draught animals. Again as with Lausen this could also be due to horizontal differences within the settlement, however, the sample sizes are too small to investigate this question further.

The twelfth Century group at Reinach shows a different pattern to that seen in the earlier material of the site. In this time period subadults are proportionally best represented, followed by the ‘younger than subadult’ group with the adult group taking up third position. This indicates that the main strategy of slaughter is for meat procuring. Most animals are being killed, when their meat quality is at its best at or around 3 years of age and younger. Whilst there is little archaeological evidence to show a higher status during this period, the results show that there are a higher proportion of subadults being consumed than in Lausen during the eleventh Century. This with the higher proportions of chicken elements observed during this same period may suggest a better lifestyle in terms of meat consumption at twelfth Century Reinach. Data from other periods here are too small to be noteworthy and thus make observing the differences noted above difficult to fit into a larger picture of change throughout time and space. Likewise horizontal analysis, even to the extent of noting gross changes between the different areas cannot be carried out due to the minimal data from all the time periods at the site. This lack of evidence is probably due to the high degree of fragmentation that is observed at the site (§3.2), thus reducing the identifiable elements and also those fragments that contain ageing data.

6.2.1.4. Summary

So to the inter-site comparison, while this is made especially difficult due to the sample sizes available, some patterns can be elucidated from the data. It is possible to perceive that the urban centre of Kaiseraugst has a strategy that has a greater dependency on adult cattle than that of the more rural settlements of Lausen and Reinach (Table 6.2.1.4-1). This could be due to the continuation of the older Roman traditions or just as likely could be due to the transport needs of a large settlement. The comparison of the rural settlements is more complicated. So comparing the eleventh Lausen to the twelfth Century group from Reinach, it can be observed that Reinach has the stronger need and/or desire for meat procuring than that of Lausen, where there are greater proportions of subadult animals. This then suggest that during this period at Reinach the cattle are on the whole not needed as draught animals. This maybe explained in terms of herd management at Reinach where the excess livestock are being slaughtered for the population rather than continue feeding them and to keep them for work that is not available. It may also be that the adult animals are being moved elsewhere to market or maybe as payments of rents and taxes to the landlord. Written sources from the abbey at Irminon shows the types of tithes and rents that would have been payable to the church and landlords (website 10).

> C.1. The Abbey has in Villeneuve 1 demesne with a house and other edifices in sufficient number; of arable land…. In forest there is land 4 leagues in circumference, where 500 hogs can be fed.
>
> C.3. Arctardus, a colonus, and his wife, by name Eligildis, tenants of St. Germain, They pay 4 solidi silver for protection; and in another year they pay 2 solidi as tax on their animals; and in the third year they pay as herbage tax 1 ewe lamb with its dam; as a grazing tax, He also pays 3 chickens and 15 eggs..
>
> C.84. Aclebertus and his wife, the serf Frotlindis, tenants of St. Germain…[payments include] 3 chickens, 15 eggs.
>
> C.95. The Abbey has in Villeneuve 60 free manses (or holdings), which pay each year either 15 cattle and 16 solidi are also paid as tax on animals; and 60 ewes with lambs every third year. The Abbey has there 13 and a half servile holdings.; they pay 324 chickens and 1670 eggs.

Guerard, Polyptyque de l'Abbe Irminon, c800

Conversely, the opposite is true with the earlier data, whilst the seventh Century data at Reinach is not strictly comparable to the ninth Century data of Lausen. The differences in social standing of the rural sites of Reinach and Lausen can also be observed on a broad scale. Observations show that the higher status of Lausen has a greater proportion of young animals when compared to the Reinach site which is dominated by adults, at this time the site is undergoing resettlement by a population that appears to be from outside the region and maybe choices on herd management are dictating the results seen here. The herds of cattle are being built up slowly over time, as it would have been difficult to take whole herds of cattle across large parts of continental Europe. The low fecundity of cattle, compared to pigs, means it takes much longer to build up a structured herd. It appears that the strategy employed by a settlement is one of need, desire and necessity rather than of a cultural influence i.e. the people that are entering the region are adapting slaughter strategies that are individual to each settlements make-up, this depends on status, size, need, and other production concerns. Horizontal analysis of kill strategy within the sites studied here is very limited as sample sizes are too small for individual areas to be analysed as separate entities.

Comparison of these results to other contemporary sites in the region shows some variation. Adults predominate alongside smaller proportions of subadults and younger animals, in both *Augusta Raurica* and the *Castrum Raurecensce* from the third and fourth Centuries (Lehmann and Breuer Schibler and Furger 1988, 202-203); this is perhaps not surprisingly similar to the age profile of the material from the later periods in the *Castrum*. Eleventh Century Altenberg (Marti-Grädel 2008, fig 123) also shows a similar pattern of age at death suggesting that the cattle had similar uses at these sites. However, a different scenario emerges when comparing the data from Reinach and Lausen to that at Develier-Courtételle (Olive 2008, figs 102 and 115), in the Canton Jura, a similarly dated rural settlement. It can be observed that animals aged three years of age and younger are much more prevalent in the sixth to eighth century, and likely to have been used as meat animals rather than the older animals at the rural sites in this study, which were probably used as draught animals. Slightly further a field are Schleitheim and Berslingen (both in canton Schaffhausen). Schleitheim (Rehazek 2002, fig 121) shows an age structure in which adult cattle predominate through all time periods likewise in Berslingen (Rehazek 2000) adult animals are the greater part of the aged animals and thus are more comparable to the settlement of the Castrum at Kaiseraugst and perhaps the early data from Lausen rather than Reinach. These results maybe observed because the settlements are established unlike Reinach, which is trying to establish itself.

6.2.2. Sexing

The analysis of horncore and pelvis morphology provides evidence of both males and female animals being present at all three sites (Table 6.2.2-1). However, the sample sizes are too small with which to make further interpretations about the composition of herds with respect to sex of individuals. The required sample size should have at least thirty individual assignations to make the inferences solid. Lausen has the largest sample size, with data pooled from all time periods; there are eight males and five females present when considering both pelvis and horncores. Kaiseraugst presents seven females and five males. Reinach the smallest sample exhibits 2 females and 2 males. The expected herd ratios of female and males is very much dependant on the production/consumption strategy of the sites. It is always assumed that herd construction would have been similar to modern herds with large numbers of females and only few males and castrates. This means that the male offspring that were unwanted would have either been slaughtered and consumed or sent to market for sale. These decisions would then affect the food waste of the production site. It could be either old females or young males that are found depending on whether the excess herd is sent to market or kept on-site for consumption by the population.

6.2.3. Biometry

Cattle size is partially predetermined by the genetic make-up of a breed, but also affected by environmental factors such as climate and nutrition alongside anthropogenic factors such as husbandry techniques. There were only small samples for each individual element when the material was divided in to the chronological periods due to the highly fragmented nature of the assemblage. The data presented here, tables 6.2.3-1, 2 and 3, and is that which is used for the analysis below. Where the same element is represented by a sample that is greater than ten the raw data is also included. Using a log ratio technique can combat the problem of small samples. Considering the raw data from the three sites, it is impossible to gather any meaningful data as the sample sizes were too limiting. For example, just thirteen withers heights (after Maltosci 1970) could be obtained from the data recorded here (table 6.2.3-4). Such a small sample cannot be representative of the whole population across the sites and through time. The means of the three sites vary between 1.17m and 1.22m. The largest animal came from the Kaiseraugst 'Gasthof Adler' levels standing at 1.26m, whilst the smallest is 1.11m and is found in the Lausen material. These results tend to suggest that the withers heights at different sites and time periods remain consistent, which goes against the theory of decreasing cattle size that is put forward below. Comparing these results to those from Altenberg (Marti-Grädel 2008, 79-80), it can be observed that the range of shoulder height at Altenberg is much broader than the samples studied here and tends to be extended towards the lower end, so that the minimum shoulder height is 1.00m compared to 1.11m seen here. This of course is probably due to the small sample size of the material record at the three sites. It is also possible that due to the decrease in the size of cattle from the Roman period in to the Medieval (Breuer *et al.* 1999) that the likely later date of the Altenberg material reflects the smaller cattle sizes of the medieval compared to those from an earlier time. The shoulder height of cattle from Develier-Courtételle (Olive 2008, 176) is similar to those portrayed at both the rural sites studied here and those at Altenberg, perhaps suggesting the noted differences are more likely an artefact of sample size.

The two elements that are most numerously presented with respect to measurements are the astragalus and the first phalanx. The astragalus is a good indicator of size as its growth is independent of sex (fig. 6.2.3-5). These are still very small samples especially at Reinach and Lausen but the trend follows that which is shown below using the log ratio technique. Those measurements taken from Kaiseraugst tend to be larger from the earlier periods whilst the smaller examples tend to be from later periods (fig 6.2.3-6a and b). Comparing this data with other contemporary sites also shows the same trend (fig 6.2.3-7). Those at Kaiseraugst tend to be larger than those from later time periods and the material from Barfüsserkirche (Schibler and Stopp 1987) is on the whole smaller than the other sites, which again mirrors the log ratio results below.

The first anterior phalanx data is much more difficult to discuss as the first phalanx is an early fusing bone and thus there will be some age related variation in the size of the phalanges. The results here tend to suggest that at Kaiseraugst the 'Jakobli-Haus' material tends to be smaller than the 'Gasthof Adler' material (fig 6.2.3-8 and 9 left hand graphs), although this is by no means a statistically significant separation. This is probably a size related change as the age profiles, as discussed above (c.f. §6.2.1.1 and fig 6.2.1.1-2), are similar at both sites. The difference may occur due to the earlier fourth Century material being found at the 'Gasthof Adler' site, this early data tends to be larger and more like the previous Roman cattle as discussed by Breuer *et al.* (1999). The 'Jakobli-Haus' site having later material shows a reduced size of first anterior phalanges. This size change probably occurs due to the absence of the roman administration, which is discussed at length below. However, it is possible that the lower end of the 'Jakobli-Haus' range is due to the appearance of younger individuals. The Lausen and Reinach data tend to occur at the lower end of the 'Jakobli-Haus' site material and is perhaps due to the material coming from a similar time period and later. These later periods see the size of cattle decrease still further. Despite the small sample sizes at both Reinach and Lausen, one interesting point does come to light from the Reinach data. In that some of the data appears to be a different shape to those at Lausen. Some of the data that have similar breadth measurements appear to be longer at Reinach compared to the Lausen material. This certainly does not apply to all the Reinach material, but this may indicate the presence of the different sexes or perhaps a different breed, it may even suggest these animals being put to a different use, as broadening of the lower parts of the limbs is seen in animals used for pulling heavy ploughs and wagons. Similar individuals are observed at the 'Jakobli-Haus' site in Kaiseraugst again possibly suggesting the different groups outlined above. The material from Altenberg (Marti-Grädel, 2008) is much lower than that of the Reinach and Lausen material and may reflect the later date and therefore size of the individuals. The larger sample size could also mean that the age variation that could appear in the data may be present here. Thus the lower end of the Altenberg material represents those individuals of younger slaughter age. The patterns observed for the first anterior phalanx are mirrored in the results from the first posterior phalanx data (table 6.2.3-8 right graph). However, the individuals at Reinach and 'Jakobli-Haus' that showed at different conformation are not present in the posterior data. This could lend weight to the 'draughting' argument as in most cases broadening of articulations, and bones in general is more likely to occur in the fore limbs, as these are the load bearing limbs. However with the small numbers of data from the study here exhibiting this, it is at best a tentative suggestion that should be looked at further as more data comes to light.

In work by Breuer *et al.* (1999) logarithmic size scaling techniques were used to graphically compare the size of cattle from the Iron Age into the Late Roman period. Results from this method suggest that in the period of their study an initial significant increase in cattle massiveness in the late First Century AD and occurs at a time where the Roman presence in the region is taking a strong hold. This was followed by a series of significant increases into the third Century AD, in relation to the prosperity of the Roman city of *Augusta Raurica*.

Until recently there has been a lack of comparative data to study the effects of the collapse of the Roman Empire on the region. This work can now specifically highlight changes in stature of livestock, through biometrical analysis, with respect to changes in society of the time. Comparisons to similarly dated sites within the region will also elucidate the complexity and extent of the changes observed.

Analysis of the data from Kaiseraugst in a single orientation, in this case breadth (fig. 6.2.3-10), as suggested by Davis (1996) shows a step-wise decrease in the stature of cattle through time from the fourth Century onwards. Residuality affects should be accepted as being present and perhaps influencing the results. The influence mainly appears to be on the outer boundaries of the data creating a wider range of outliers, when considering observations from the log ratio histogram, and thus the effect is probably negligible (fig. 6.2.3-11). In fact considering the skew of data with respect to the median reveals very little difference between the data, with data from the fifth and sixth Centuries at both sites, the sixth Century at the 'Jakobli-Haus' site and the data from the beginning of the seventh Century also from the 'Jakobli-Haus' site all showing a deviation of less than 0.005 log units. Whereas the data from the fourth Century at the 'Gasthof Adler' site has a negative skew suggesting that there is a bias towards the smaller end of the cattle scale, which whilst providing no information on the effects of residuality does give further evidence to the declining nature of the cattle during this period.

Although later in the analysis the log ratio data is based on the combined width and breadth measurements (fig 6.2.3-12). Whilst this is not the most ideal way to perform this type of analysis, it does allow greater sample sizes and better comparisons with previously published literature (e.g Breuer *et al.* 1999 and 2001) from the region. Results show that there are similarities to those based on breadth measurements alone. This, on the whole, is a predictable result considering 70.0% (716 of 1015) of the measurements are in the medio-lateral plane. As mentioned earlier the phalanges fuse early in the animal's life and as such it is unclear if adult animals (greater than three years of age) are being measured, phalanges are not the only early fusing elements may others fuse before adulthood e.g. the proximal articulation of the radius, proximal metapodials and the glenoid of the scapula. Thus an attempt to observe the changes with respect to age has been made here. The data compares the whole material from a time period at Kaiseraugst to that of just the later fusing elements, those that are most likely adults. The results show that the later fusing elements are very similar to those of the assemblages as a whole (fig 6.2.3-13). There are some small samples thus the data is not statistically watertight but the trend suggests that there is little difference in size compared to the standard. The main deviation from this the results from the sixth Century, the adult animals appear smaller than the assemblage as a whole. This is probably due to the removal of a large number of high values in this material. However it could also be suggested that the change is the beginning of the size decrease observed in the material dated to the beginning of the seventh Century. Observation of the results of all limb elements at Kaiseraugst divided into the different limb areas shows that these are also in a similar relationship to those of the standard (fig. 6.2.3-14). The single difference that can be observed is the slightly smaller log ratios seen in the hind limb measurements. This is perhaps due to the difference in conformation of the individuals at Kaiseraugst compared to the standard individual. There could be a difference between the dates from which the hind material comes compared to the other limb areas, although this is not borne out by the measurements observed in table 6.2.3-1.

The data for the mid fourth, fifth and sixth Centuries at Kaiseraugst show that the cattle samples are of similar size. The Mann-Whitney U-test confirms that these cattle populations are not significantly different from each other (tab. 6.2.3-15). However the seventh Century data shows a highly significant decrease in the size of cattle at Kaiseraugst (fig. 6.2.3-16). The cattle at the rural settlements of Reinach and Lausen in the late sixth to late seventh Century are of similar size to those at seventh Century Kaiseraugst. These results suggest that the change in the size of cattle observed is probably due to a regional or wider influence rather than a site-orientated pressure. The fact that Kaiseraugst is an urban centre and that both Reinach and Lausen are rural sites suggests that this change is also not a site-type orientated change. The material from Reinach in the seventh to tenth Century period shows a similar size to the preceding time period. However, the cattle from the same time period at Lausen show a further significant decrease in size. The eleventh and post eleventh Century data material from both Reinach and Lausen demonstrate similar proportioned animals to those from seventh to tenth Century Lausen. This then suggests that perhaps Lausen is the forerunner to the second change, sometime in the eleventh Century. An alternative scenario could be that the change occurs sometime in the seventh to tenth Century period, but the Reinach data is biased toward the early part of this material and Lausen the later part. The raw data suggests that this second scenario is possible as there is a heavy bias for the early part of the period in the material at the Reinach site, whilst at Lausen the material is heavily biased in favour of the ninth century data due to a large assemblage from ‘grubenhaus 28’. ‘Grubenhaus 28’ is a relatively large building within the settlement (Marti 2000, 276). The fact that this same change is seen in later periods at Lausen and also at Reinach again suggests a change with regional influence. The difference in the settlement types of Reinach and Lausen, with the rising status of Lausen at the time, also suggests that the status of settlement is independent of the change of cattle size.

The comparison of the cattle results presented here with previously published literature (Breuer *et al.* 1999; Ginella n.d.; Marti-Grädel 2008; Reich 1985; Schibler and Stopp 1987 and Stopp 2007) produces a chronology of cattle size change from the late La Tene period through to the 13th Century (fig.6.2.3-17). It also allows the data studied to be put into a regional context. There are significant increases in cattle size from the late La Tene period at Basel Gasfabrik to the early Roman occupation of the Munsterhügel site also in Basel (Breuer *et al.* 1999). This is followed by further significant increases in the stature of the cattle population as the *civitas* of *Augusta Raurica* gains greater and greater prominence within the region. This increase in size peaks at the height of the city's prosperity. For nearly two centuries, until the late third Century, the data suggests the large cattle breeds are present in Kaiseraugst. It is known that the Roman used large cattle breeds as well a castrated animals for ploughing soils on large tracts of land. However, after this point the Roman Empire as a whole is being destabilised from within and military forces are being withdrawn from the borders to protect Italy. Life becomes more violent on the borders of the Roman world including that at Kaiseraugst the protective *Castrum* is built, as attacks from the Germanic tribes become more frequent. Alongside the decreasing military presence, the Roman administration of Kaiseraugst is also withdrawn. The *Castrum* at Kaiseraugst during the fourth Century was involved in much conflict with raiding Germanic tribes coming across the border (civil war!) and it is thought by some that one such raid was the cause behind the fire which devastated the *Castrum* in 350AD (Demandt, 1998). At this time much of the population from the surrounding hinterland moved to the relative safety of the *Castrum* (Schwarz, 2010). However, this came at a cost of abandoning some of the large villa farmsteads (Ebnöther and Monnier, 2002). This made provisioning the busy city very difficult. The areas of safely farmed land would probably have been reduced, as would the amount of grazing land thus the keeping of large cattle would be largely an extra strain on already tight resources and probably accounts for the first decrease in cattle size during the fourth Century. Interestingly, the material from the relatively stable Gallo-Roman city of Strasbourg and the Roman military depot at Biesheim show that cattle size remains high during the fourth century (Ginella, n.d.). This again suggests that the change in the size of cattle at Kaiseraugst is due to the departure of the Roman administration and the subsequent breakdown in the large villa farmstead provisioning of Kaiseraugst. The figure from Biesheim could also be relatively high due to a higher proportion of oxen utilised for transportation by the military. Unfortunately there are too few data with sex-assignations to prove this hypothesis. It is difficult to tell the underlying cause or causes of change in this period at Kaiseraugst, whether this due to change in size or sex ratio of a single breed or a change in the represented proportions of two or more differently sized breeds or even a mixture of these. The data (fig. 6.2.3-11) shows no deviation from a normal curve in all time periods thus appearing to rule out changes in sex ratio or the appearance of more than one breed.

What the Roman military and administration bought about in centuries of centralisation and standardisation, from the fifth Century onwards, once again became more regionalised (Furger, 1996). Although it appears that life in the *Castrum* was now much calmer. From approximately 600AD changes become apparent, with new influences particularly from the Frankish areas of eastern France and the northern upper Rhine area (Marti 2005, 250; Martin 1991, 308-344). This maybe partly due to the fact that Kaiseraugst orientated itself more strongly toward Burgundy, where the Gallo-Roman culture remained unaffected by the political upheaval and the threat from the eastern side of the Rhine and the Germanic people. There is also a great influx of Germanic peoples in to the area. It is possible that with the migration of these new peoples into the region so they brought their own cultural identity, this is seen with the changing of place names (Marti 2000, 308-360) and the grave goods (Martin 1991). It is entirely possibly that the cattle were also being bought with the new settlers, new breeds of cattle or breeds similar to those seen at Basel Gasfabrik. Whilst the size proportions are visible in the archaeozoological record, unfortunately herd size cannot be alluded to as the recovered material is only ever a sample of a sample of the original living herd and written sources of the time are very sparse especially in the region of Switzerland. However sources exist for Charlamanges royal domains, an example of a smaller holding is quoted in Ogg (website 11) as containing the following herds:

> ‘Of cattle: 51 head of larger cattle[sic]; 5 three-year olds; 7 two-year olds;
> 7 yearlings; 10 two-year old colts; 8 yearlings; 3 stallions; 16 cows; 2
> asses; 50 cows with calves; 20 young bulls; 38 yearling calves; 3 bulls;
> 260 hogs; 100 pigs; 5 boars; 150 sheep with lambs; 200 yearling lambs;

> 120 rams; 30 goats with kids; 30 yearling kids; 3 male goats; 30 geese; 80 chickens; 22 peacocks'
>
> *Source-Text in Monumenta Germanie Historica, Vol. I., pp. 178-179.*

This is clearly a wealthy site and perhaps hard to equate with the sites here but it does give an idea of the composition of the herds. It is possible that the original Latin text states 51 female horses rather than the mistranslation of large cattle presented on the website. This does not however have any implications on the conclusion that this is a wealthy site and that the proportions of the animals are only a pointer as to the composition on other sites.

Although there are still remnants of the preceding Roman styles in ceramics (Marti, 1996) and glassware (Fünfschilling, 1996) at Kaiseraugst, however a different ceramic production was observed in Reinach (Marti 2004). These changes in society coincide with the second change in cattle from Kaiseraugst, Reinach and Lausen.

The reasons for the third decrease in cattle size around the eighth or ninth Century is more difficult to elucidate. There is not enough data from other settlements in the region to say how localised this change is, perhaps it occurs at only few sites in a small area. The more likely explanation is the adoption of the manorial system and a move to a three-field system of agriculture. The system would better suit smaller cattle as they would be more docile and easier to manoeuvre in the smaller fields than their larger counterparts (alluded to in the above quote). Around this time the padded harness for horses is also developed, which in theory would allow horses to be used as replacements for cattle in ploughing teams. Although at the rural sites considered here, the populations are likely to be too poor to be able to afford horse to replace cattle until much later. The status that horses held at this time also meant that they were unlikely to be used in the field. This decrease in size could also be due to sex, breed composition of the sample, husbandry techniques or nutrition. Age is not considered a factor here, as chronologically the age profiles of cattle remains are similar throughout Kaiseraugst, Lausen and Reinach. There is also evidence from Alpine regions that smaller cattle produce more milk, which could be more preferable to a people that are living a self-sufficient lifestyle.

In the period after this change, the stature of cattle appears to remain constant through time, at least until the thirteenth Century, perhaps even as late as the 15th Century, as work from Bern

(Rehazek 2006; Nussbaumer and Rehazek 2010) attests, although a comparison has not been included here. At this time society is becoming more complex, especially in urban contexts, with increasing differentiation within the cities due to factors such as crafts, religion and social status. Schneidergasse cattle from Basel (Reich 1985), the higher status castle at Altenberg (Marti-Grädel 2009) and the rural sites of Lausen and Reinach all show statistically similar sized cattle. This suggests that the type of site studied is not a significant influence on the size of cattle slaughtered, however the exception Basel Barfüsserkirche (Schibler and Stopp 1987) which consistently shows significantly smaller cattle to those at Basel Reischacherhof (Morel n.d.) in the eleventh to thirteenth Century period. Hüster-Plogmann & Rehazek (1999) suggested this could be due to differentiation in society; the richer areas could be receiving cattle from their own property in the hinterland around Basel, whilst the craftsmen in the Barfüsserkirche area may have kept their own animals in backyards within the confines of the city. This would perhaps mean not only are smaller cattle selected but are also restricted in their growth due to lack of space and nutrition being available to these cattle. The stature of the cattle from Reinach and Lausen could confirm this theory being of similar size to those observed from the richer areas. There is no evidence of change in the stature of cattle, at the three sites studied here, in coincidence with the 'medieval warm period' of the tenth to twelfth Centuries as observed by Hüster-Plogmann & Rehazek (1999). This appears to suggest that climatic change has less influence on the stature of cattle than anthropogenic forces.

6.2.4. Pathology

The abundance of pathologies in cattle in the sites studied here is relatively low (Table 6.2.4-1). There is however a difference between sites with Kaiseraugst (3.08%) and Reinach (2.10%) having an higher incidence of pathology than those observed at Lausen which is very much lower with less than one percent (0.59%) of cattle showing signs of pathology. At Kaiseraugst the pathologies in cattle that are best represented are arthropathies (84.62%), joints being affected by repeated trauma, which causes a change in the skeleton to compensate (table 6.2.4-2). The phalanges and the hind limb tend to be the areas most affected by arthropathies. The main causes for these arthropathies are probably two-fold, firstly the likelihood of arthropathies increases with age and as mentioned above these animals are living well into adulthood. Secondly the use, to which the cattle were put, as traction animals, would certainly increase the number of arthopathies in the population especially in the skeletal areas observed in the study. The other pathology group that is seen to affect the cattle skeleton repeated in cattle from Kaiseraugst is inflammatory or infectious diseases (11.54%). The range of observations here is very wide from a small patch of periostitis to pus excreting cloacae. There is little evidence for trauma in this species at Kaiseraugst or any of the other sites for that matter. Although if the large mammal group is analysed, it should be noted that there a few healed breaks to ribs. This suggests that if there were signs of trauma in cattle this is probably the area it would be observed. The breaking of ribs could be caused by a number of agents, perhaps the overcrowding of enclosures either through intra-group fighting or just through the sheer density of bodies in a confined space, or perhaps there was some human involvement (i.e. beating the animal) or perhaps just an unfortunate accident. It is perhaps not surprising that there are very few incidences of major trauma in the faunal remains studied here as it is likely that such trauma would have caused the rapid death of the animal and as such the animal would not have made it in to market and thus the food waste, which makes up the majority of the material in this study. A more detailed analysis of pathology, such as horizontal analysis within the site, is not possible due to the small number of pathologies involved.

An unusual case of pathology from Kaiseraugst appears in the fifth to late sixth Century levels of the 'Jakobli-Haus' site. A spongy structure has formed on the internal surface of the proximal part of the diaphysis of a metacarpal; this could be the early stage of haemotogenous osteomyletis (Baker and Brothwell, 1980 p 65 fig.1). A second interesting pathology is a possible case of bone spavin where there is extensive hyperostosis of the proximal articulation and proximal midshaft of a metatarsal although the joint surface still appears to be patent. This would suggest a case of bovine spavin (Baker and Brothwell, 1980 p119).

The results from Reinach show that both arthropathies and inflammatory or infectious conditions are both prevalent. However at Reinach the number of the latter is greater than the former, in contrast to the results of Kaiseraugst. The reasons for this could be numerous. Firstly the sample size is much smaller than that at Kaiseraugst and as such maybe unrepresentative. Secondly at Reinach there are many more noted cases of periostitis than at other sites, this relatively insignificant condition could be drowning out the importance of other conditions that are affecting the cattle at Reinach. The over-zealous recording of minute pathologies by the analyst could also cause this. The low number of incidences of pathology in cattle at Reinach does not allow a more accurate analysis of the place that these pathologies occur but there seems to be a tendency to follow the pattern shown in Kaiseraugst. The arthropathies are observed in the hind limb and phalanges as at Kaiseraugst, and thus the use of the animals is the same as those at Kaiseraugst. There are also a few cases of dental pathologies at Reinach. There is an interesting if not rare case of dental pathology in the 'Altebrauerei' site at Reinach from the seventh Century contexts (fig. 6.2.4-3). In this case relatively broad and smooth groove is formed at the enamel/cementum junction of three cattle incisors. For many years this was observed and recorded but a firm answer could not be supplied as to the cause of the grooving in these teeth, now it is believed that this change in morphology is caused by the repeated pulling of grass between the incisors when chewing.

The very low number of pathologies seen in cattle at Lausen suggests that at least animals with no signs of skeletal pathologies are making it in to the food remains, if not healthy animals. Such low numbers makes it difficult to elude much to the health of the population of the cattle at Lausen. Taking the history of Lausen in to account, as an important site in the region perhaps there is some special attention paid to the condition of the animals brought to the site. Although the arthropathies, inflammations and infections that are present are conversant with those that could be related to draught animals.

6.3. Ovicaprids

6.3.1. Age at Death

6.3.1.1. Kaiseraugst

As was the case with cattle at Kaiseraugst, by far the largest proportion of slaughtered ovicaprids is assigned to the adult/senile age group (table 6.3.1-1). Again as with cattle this probably demonstrates the multi purpose utilisation of ovicaprids. Not only can they be used as a meat source but also for secondary products such as wool and milk. The selection of animals that have reached and passed adulthood suggests that it is economically more viable to keep these animals beyond a point where full carcass size is reached and the meat quality is at its highest. It maybe that wool production was at a premium during all periods. The animals will be kept on after reaching optimal size and produce up to three years of wool clips prior to slaughter while the meat quality had not yet reduced drastically. The proportions of subadults in the population probably represent those individuals slaughtered entirely for supplying meat to the settlement. Whilst the meat quality is at its highest and each individual has produced maybe two years of wool clips and are surplus to requirements for breeding or other herd requirements. There is little evidence of very old or very young individuals within the population studied here.

The proportions of the different age groups at Kaiseraugst remain relatively constant through time suggesting that there is little or no change in the provisioning strategy of this urban centre with regards to ovicaprids from the late Roman period into the early medieval. This interpretation must be tempered as the early data as well as the latest data from Kaiseraugst comes from sample sizes that are small. However, these are similar enough to those of larger samples to suggest that there is little change in strategy throughout the entire period under study here. Considering horizontal variation, similar results are observed, the data from the fifth to sixth Century 'Jakobli-Haus' and 'Gasthof Adler' sites show very similar age compositions (fig 6.3.1-2). Although this is just one period it does suggest that the homogeneity of age structure is seen both across the settlement and through time. Comparison of horizontal variation in other time periods was impossible due to lack of data or insufficient sample sizes.

6.3.1.2. Lausen

The age structure of the slaughter animals from Lausen is difficult to elucidate through time with any certainty due to the small sample sizes involved here, however there appears some consistency of results at least with the larger samples from the ninth to tenth Century (table 6.3.1.2-1 and 2). The ninth century shows a pattern that suggests similar proportions of subadults and adults in the assemblage around the age that the individuals are reaching maximum carcass size and thus high quality meat. This could also be due to the fact the majority of the data comes from the large structure 'Grube 28,' which is thought to be an important structure in this period of the settlement. The tenth Century data shows a broadly similar pattern with similar proportions of subadults and adults. This could suggest that following a meat producing strategy is of greater value than that of a secondary product i.e. wool or milk strategy for these two periods. There is more value and/or need for high quality meat than for allowing the individuals to grow on to produce extra wool clips with reducing quality of meat. These subadult or young adult individuals are probably only supplying one possibly two wool clips. The earliest data however, those from the sixth to seventh Century (* see §2.1.3), show that subadults are the most abundant age group. The eleventh Century (*) material also shows a pattern that is similar to this early assemblage, perhaps reflects the higher status of the site during the eleventh Century. This then suggests that prime lamb or kid were eaten at this time. The settlement has a preference for prime meat animals rather than those that are allowed to grow on and produce more wool and milk. This could also show the workings of the manorial system where rents/taxes that are levied on the use of land owned by the landlord are being paid in prime meat animals, in this case ovicaprids. This would perhaps also be the case for the earlier ninth Century although there appears to be another, second system in which older animals are also being kept or brought to the site during this time. This perhaps reflects the relatively lower status to that compared to the eleventh Century.

Again, for ovicaprids, the across site variation and individual structures cannot be studied due to the lack of sufficient sample sizes. Thus the domination of the eighth to ninth Century data by material from 'grube 28' may not be representative of the settlement as a whole.

6.3.1.3. Reinach

The ovicaprid ageing analysis for Reinach yields very few results due mainly to the small datasets that are present (table 6.3.1.3-1). All time periods produce datasets that are too small to be of use but tentative interpretations are considered here by congregating periods together, here the seventh and eighth Centuries form a group and the eleventh and twelfth another (table 6.3.1.3-2). The latter still shows a statistically small sample but one in which there is more confidence. Observing the earliest data, from the seventh to eighth century, results point to a predomination of adult animals. This could reflect the lower status, rural situation, that secondary products from ovicaprids are more important than the meat. It could also show that the surplus males are being sent to market at the urban centres. Through time the data leans towards younger animals in the eleventh to twelfth Century. This then suggests that there is perhaps a change in strategy in this period where prime meat is more important than wool or milk. It could also show the consumption of the surplus males at the site rather than them being sold at market. However this is mostly supposition and should be viewed with uncertainty.

Studying inter-site variation suggests that the urban centre at Kaiseraugst and Reinach in the early period are utilising a different husbandry strategy with respect to ovicaprids than the Lausen. There are a higher proportion of the older individuals at the former two sites whilst at Lausen data tends toward individuals that have reached optimum size and meat quality, which could reflect the status of the site. This could be corroborated by the fact that in the eleventh Century period, a time when the status is high, more subadult individuals are recorded in the data. There are few similarities between the rural sites. The Reinach material produces little useful data and only tentative considerations but the latter data suggests a movement towards younger ovicaprids in the food waste.

6.3.2. Sexing

Horncore and pelvis morphology can be used to distinguish the two sexes in ovicaprids. However, the sample sizes of each preclude any more in depth interpretations other than to state that both male and females are represented at all sites (table 6.3.2-1). Measurements of the radius and tibia can also be used to distinguish the sexes of this species but, as discussed below (section 6.3.3), the sample sizes here are also very small.

6.3.3. Biometry

There are small samples of measurements of ovicaprids from all three sites meaning that it is difficult to discuss with any great reliability the size and shape of these animals with respect to site (table 6.3.3-1, 2 and 3). It is impossible to talk about changes through time, even when employing the log ratio technique, which has been discussed for cattle and pigs, from the faunal remains due to the highly fragmented nature of the assemblages. This means that the data presented here can only be regarded as a glimpse at the material. Firstly the withers or shoulder height of the animals (after Teichert 1964) from the sites studied here shows that despite the small sample size the ovicaprids of the region are of similar size, more so if the relatively large individual from 'Gasthof Adler' at Kaiseraugst is removed from the data (table 6.3.3-4). Comparing these relatively tight data to other contemporary sites it can be observed that as with cattle the problem lays within the sample size or indeed lack of samples. Altenberg also shows (Marti-Grädel 2008, 115-116) this lack of data, as does the site at Develeir-Courtételle (Olive 2008, 177) although the data suggests at least a similarity with the values obtained in the study here. It appears that the size of ovicaprids in the early medieval were smaller than those of the Roman period (Breuer *et al.* 2001, fig 7) but it is difficult to elucidate further due to the small sample sizes and the problems of successfully separating the sheep and goat bones from each other to gather coherent data. This seems to be the case here, as mentioned above, the larger individual from the 'Gasthof Adler' site has a shoulder height that is very close to the observed values for goat at other sites (c.f. Breuer *et al.* 2001, 176), rather than values for sheep at the same time. Again this is a small amount of data so sexual dimorphism and different breeds and even chronological changes through time cannot be studied.

There are three measurements that can be observed though sample sizes are still small that may allude to the size and shape of the ovicaprid population at the sites studied here. Firstly the radius measurements of the proximal end (Bp vs BFp), these are most numerous at the ‘Jakobli-Haus’ Kaiseraugst and show an almost linear trend which suggests that there is little post-fusional growth (fig 6.3.3-5). However the early fusing proximal radius is affected by age. The measurements from the ‘Gasthof Adler’ site at Kaiseraugst and Lausen tend to fit to this trend also, however there are values that are more to the right of the diagram than at the ‘Jakobli-Haus’ site. This could be attributed to a number of different factors including the different species sheep or goat, different breeds of sheep or goat or differing nutritional status. This figure also hints at differing groups within the ‘linear’ group, this could show the differences between sexes, although the data is far too meagre to make any positive claims about this.

The second measurements that can be illustrated diagrammatically are the measurements of the distal humerus (Bd vs HTC). Again the data set is small and so only tentative comments can be made about the data. The data here is best represented by the data from Lausen and the ‘Gasthof Adler’ site at Kaiseraugst (fig 6.3.3-6). It appears that the sample is split, possibly due to sex as with the previous measurement although it could equally be possible that different breeds are present at the sites. The early fusing nature of the breadth of the distal end of the humerus can also incur variation that is age related (Maltby 1979, 49), although the depth measurement (HTC) is both age and sex independent, so the change in measurements must be related to the breadth measurements. There are larger individuals from Reinach, Lausen and the Kaiseraugst sites. In this figure there is less divergence from the linear pattern, as seen with the radius measurements.

The third measurements that can be observed are from the distal end of the tibia and are relevant to its shape (Bd vs Dd). Again, as would be expected the data point plot in a very lineal fashion but as with the other diagrams the sample is again small, but it does suggest that there is a formation of a larger group and a smaller group (table 6.3.3-7). This again could be due to the presence of the different sexes or possibly different breeds. Although, the distal breadth measurement (Bd) is sex independent and the changes caused by sexual dimorphism must occur through a change in depth. There is an individual from the 'Jakobli-Haus' site that is quite narrow yet relatively deep, this could be an indication of a male or possibly a castrate but the samples are too small to investigate this further.

Comparison of these measurements to other contemporary sites is difficult, as the low proportions of remains identified to either sheep or goat from the region, and in wider contexts means that samples are scarce. The lack of contemporary sites also means that it is difficult to find comparative data. Breuer *et al.* (1999) produced a log ratio diagram to show the progression of development of sheep in the region from the Iron Age to the medieval period, and was developed further by Marti-Gradel 2008 (fig. 207). The results from these works showed that the Roman sheep were much larger than their medieval counterparts although the lack of data meant that it cannot be shown whether this is a stepwise decrease, like that shown in cattle (fig 6.2.3-14) or if it is a sudden drop with the loss of the Roman administration, although the small sample from the sixth to ninth Century at Schleitheim (Rehazek, 2000) suggests a similar stepwise decrease. Further data cannot be added here, as the number of positive identifications of sheep is too low to produce a large enough sample to give a statistically sound base to make interpretation.

6.3.4. Pathology

The small number of cases of pathology on ovicaprid bones from Kaiseraugst suggests that in all likelihood only the healthiest animals are making it to the market at Kaiseraugst (table 6.3.4-1). The data shows that all the signs pathology are recorded from the sixth to seventh Centuries, this is most likely an artefact of the small numbers of ovicaprid bones present. The inferences drawn from the recorded pathologies show that arthropathies and infectious of inflammatory diseases are present. This points towards animals being kept in to older age and perhaps in confined areas. These are similar results to those for cattle, although it is highly unlikely that sheep were used for draughting in any sense. The ovicaprids were mostly kept to old age to provide wool/hair, offspring, dung for the fields, and perhaps dairy produce, the use of dairy products is a contentious point, with respect to the scale and products offered at this time. The small sample size does not allow any in depth analysis of the health of the ovicaprid population at Kaiseraugst. However it appears that compared to cattle the proportions of animals showing signs of pathology is much lower. The analysis of the pathological record cannot be used to produce a horizontal or chronological record of the health of the ovicaprids at the time.

The levels of pathology recorded at Reinach, as a proportion of the total fragments recorded, are much higher at Reinach compared to those at Kaiseraugst (table 6.3.4-2). Reinach also shows a predominance of animals that had inflammatory or infectious types of pathologies (table 6.3.4-1). The abundance of these types of diseases perhaps suggests that at least part of the time the animals were enclosed in a small space that was perhaps overcrowded. Although, the small sample size does not necessarily mean that this is an indication of the health of the living population. Again the sample does not lend itself to analysis of horizontal and chronological analysis of the health of the ovicaprid population at Reinach.

The ovicaprids at Lausen like the cattle appear to have a very much lower incidence of pathology in the population than those at either Kaiseraugst or Reinach (table 6.3.4-2). This then again suggests that the better ovicaprids are being brought to or raised at Lausen. The small number of cases from the site tends to be infectious or inflammatory in nature and occurring on the ribs (table 6.3.4-1). This could suggest penning of these animals at least for a portion of their lives, perhaps in a crowded state. The remaining cases of pathology at Lausen are of a dental nature. It has been observed in Soay sheep kept in a similar way to those of the medieval times that a high proportion of sheep have dental pathologies at the time of slaughter (Clutton-Brock *et al.*, 1990). The very low incidences of pathology at Lausen does not allow for a detailed analysis of health of the ovicaprid population through both time and space.

6.4. Pig

6.4.1. Age at Death

6.4.1.1. Kaiseraugst

Pigs through out time have been used as a source of meat and occasionally skin but unlike cattle and ovicaprids offer little in the way of secondary products. The high fecundity and multiple litters compared to cattle and ovicaprids means that the slaughter of large numbers of individuals before or just after the body reaches maturation or optimum size has little impact on the group size. Pigs are also ideal for backyard rearing; they will forage on household refuse, turning waste into meat and manure. The presence of foetal and neonatal bones of pig at Kaiseraugst indicates that there is some breeding of pigs within the settlement (table 6.4.1.1-1). This attests to the practice of backyard husbandry. The high levels of subadult and juvenile individuals at Kaiseraugst is to be expected, as stated previously this is due to the fact that pigs are utilised for meat only and thus will be killed as soon as the body reaches optimum size, where any extra husbandry or food will not be seen in increased body size. It is also known that the Roman diet consisted of suckling pig and is evidenced by the numbers of individuals that are slaughtered around the end of the first year. The numbers of subadult and juvenile individuals fall in the fifth to sixth Century time period although they still represent the largest two groups. During this period there is a relative growth in the number of adult pigs recorded. This could be due to an increase in the importance of the backyard economy due to the falling of the Roman administration in the area and thus a reduced provisioning of the town by the villa farmstead system. From this point until the seventh Century the age structure remains relatively constant (table 6.4.1.1-1). Also during the fifth to sixth Century time period, the horizontal variation, as with the other species already considered, remains relatively low with the 'Jakobli-Haus' and 'Gasthof Adler' sites showing very similar age compositions (fig. 6.4.1.1-2).

6.4.1.2. Lausen

A similar pattern, with respect to pig age demographic, that is observed at Kaiseraugst can also be observed at Lausen through all time periods with a statistically large sample size (table 6.4.1.2-1 and fig. 6.4.1.2-2). The numbers of subadults and juvenile individuals are by far the most abundant. This again attests to the supply of pork and suckling pigs in the diet. However there appears to be no change in the supply of pig meat with the changing status of the settlement.

Analysis of horizontal variation from the eleventh Century time period at Lausen suggest that 'grube 10' and 'grube 45' show a slight variation in the age composition of the relative structures (table 6.4.1.2-3 and fig. 6.4.1.2-4). The main difference between the two structures is that 'grube 10' has proportionally more subadults than 'grube 45' also 'grube 45' contains more adult individuals when compared to 'grube 10'. This could be an incidence highlighting a slight difference in strategy used in the different structures with regards to the placement of the structures within the settlement. However, looking more closely at the data it can be observed that the majority of the adults assigned to 'grube 45' are of young adult age. This then suggests that there is little or no difference between the two structures in the age profile of pigs in essence (table 6.4.1.2-5).

6.4.1.3. Reinach

At Reinach the earliest material, the sixth and seventh Centuries, shows a broad spectrum of ages represented and all are represented at similar levels (table 6.4.1.3-1 and fig 6.4.1.3-2). Compared to the other periods it shows that more adult animals are being consumed at this time. This could be due to a backyard economy type strategy with each individual household keeping and raising a small herd of pigs. It is also likely that this is a key element of the meat consumption of the Reinach during the resettlement phase of this early period. However after this point the strategy appears to change and a large proportion of subadult and juvenile individuals can be observed. This then reverts to the type of strategy that is seen at both Lausen and Kaiseraugst. Prime and suckling animals are being slaughtered to supply food to the settlement. The twelfth Century material shows higher proportions of yearlings this then suggests that the excess males from the offspring are being consumed on site rather than sent to market. Although it is just as possible that many of the individuals represented here fall along the line of the less than subadult and subadult group, thus making strategies appear different when in fact they are the same. It could with other data mentioned suggest a rising importance of Reinach at the time.

The single use of pig as meat within the diet means that there is little room for manoeuvre with respect to the husbandry strategy that is used. In the sites studied here, two different strategies are noted. Firstly, a backyard type, where all age groups are well represented and the evidence of foetal or neonates adds weight to this. This is seen at both Kaiseraugst in the fifth to seventh Centuries and also at Reinach in the sixth to seventh Century time period. The second strategy consists of high proportions of subadults and younger individuals and may possibly represent a more developed system of meat production. Where pigs are being killed around two or three years of age, the time at which they reach their optimum size and additional feeding does not elicit further proportional weight gains. The fact that neonate and foetal material are found at all sites and to a much higher degree than either cattle or ovicaprids suggests that a mixture of the two aforementioned strategies are being used. The higher proportions of adult aged individuals at Kaiseraugst in the fifth to seventh Centuries and Reinach in the sixth and seventh Centuries perhaps attests to a stronger more widely used backyard economy in these periods when compared to those periods with proportionally few adults represented.

6.4.2. Sexing

There are relatively small sample sizes of individuals assigned sex at all three sites for pig. Although, samples are large enough to show patterns within the data, they not secure enough to make wide-ranging interpretations of the data. Dental morphology at Lausen shows by far the largest sample of individuals that can be assigned sex, 51. However separating this by each time period reduces the samples still further. Despite this, the data is remarkably consistent through each time period (table 6.4.2-1). With the exception of the tenth Century data, all other time periods suggest that there is a slight preference towards male pigs. Conversely, the pattern in the tenth Century slightly favours females. The preference for male pigs seen in Lausen can also be observed in the early periods at Reinach, albeit with very much smaller sample sizes so this interpretation at best is tentative. Kaiseraugst on the other hand shows the reverse trend with females being favoured in the fifth to sixth Century period, whilst this trend is also reflected in other periods where the sample sizes are not large enough to off further interpretations. Similar proportions are also expressed between the two areas of the excavation at this time thus it seems that this is not figure generate by statistical error of small samples but an actual conscious choice by the population within the Castrum (table 6.4.2-3).

Analysis of pubic morphology suggests males and females are present at each site, although lack of data means that this line of investigation can be taken no further (table 6.4.2-2). It must also be mentioned here that castration of pigs has been documented in classical literature (Columella, VII.9.1 and Varro, II.4.1), so is possibly practised throughout the Empire too. Castration of males would be carried out to ensure less aggressive and so more easily manageable individuals, larger carcass conformation and better quality meat.

An intensive meat production strategy would mean that a high proportion of males, those not required for breeding purposes, would have probably been sent to market. In this scenario high numbers of males would expected to be seen, within Kaiseraugst a major urban centre in the region and perhaps Lausen with its elevated status and the more rural site at Reinach showing the killed female breeding population This may reflect the data at Lausen but does not explain the data at Kaiseraugst and Reinach, in fact the reverse trends are observed. The household rearing of pigs as mentioned previously may negate this scenario and the pig population is dependent on choices made from household to household. However, with the sample sizes present these scenarios are no more than speculative and may be a step too far.

6.4.3. Biometry (tables 6.4.3-1, 2 and 3)

The biometrical analysis of the domestic pig remains cannot be so comprehensively carried out as for cattle due to the lack of available data yet the log ratio results give an indication of the progression in size of pig through time (fig. 6.4.3-4).There is little change through the course of time from the data that has been obtained from this work However if this is brought in to line with the previously published data (Breuer *et al.*, 2000) changes can be observed (fig. 6.4.3-5). Firstly it should be noted that the 'indigenous' population at Basel Gasfabrik is highly significantly smaller than all the other populations throughout the time periods studied here (tab. 6.4.3-7). Secondly a similar pattern of change is observed in the pig biometrical data to that of the cattle results albeit it with a much more gradual change through time. There is a gradual increase in size of pig from the influx of Roman people and power into the region, again with a peak in size occurring in the third Century. However these changes are small and not statistically significant from period to period but the overall change from the first Century AD to the third Century is highly significant (table 6.4.3-7). Again as with cattle there is a significant down turn in the stature of the pig populations after the withdrawal of the Roman authority in the region. Although this is not as clear as with cattle and appears to differ from site to site rather than being a region wide change as is suggested by the cattle data. The decrease in the size of pig is probably an indication of the rearing of pigs on household waste in a backyard style economy that is often alluded to in urban contexts of medieval times, and perhaps is especially relevant Kaiseraugst during the period of conflict with the Germanic raiders in the fifth Century. The exception to this down turn is the data from Reinach dated to the late sixth to seventh Century. Here the data shows a similar stature of pig to that observed at the zenith of the Roman period of settlement. However, it is the author's belief that this occurs through different processes. The context of this early material from Reinach is during a period of resettlement at the site. The archaeological data suggests that these settlers are 'outsiders' (Marti 2004). This influx sees a larger proportion of pigs in the faunal assemblage. This higher proportion of pigs, whilst showing a similar age at death pattern to other periods at the site, adult animals seem to be better represented than at any other time at Reinach, this difference could result in the change in size observed in the biometrical analysis (fig 6.4.3-4).Analysis of the histogram from the log ratio data shows that there is a movement towards larger pigs in Reinach at this time. Conversely there is a trend towards small pigs at Lausen during the eleventh Century. This is probably due to a number of early fusing bones from young individuals being measured, as the age profile show a higher proportion of younger animals at the site at this point. The observed pattern results in a higher probability of early fusing bones coming from younger animals rather than fully grown adult animals. On the whole, it appears that the degree of size change in pig is not so marked in comparison to cattle. The omnivorous nature of the beast is perhaps masking the effects of the social changes that are occurring throughout the region and observed in cattle. Nutrition, space and the availability of food perhaps would not be such a limiting factor as it would be for cattle. Also pigs are raised for meat production whilst cattle and ovicaprids also have a value in secondary products, thus relatively more time may be spent on the husbandry and breeding of these animals than on the pigs.

6.4.4. Pathology

The pathology of pigs at Kaiseraugst has a low proportion of incidence of pathology (table 6.4.4-1). However the range of pathology type is wide. There are incidences of all the pathology groups recorded (table 6.4.4-2). Arthropathies of the hind limb especially on the distal end of the tibia, however are the best represented. As stated above the self-sufficient lifestyle of the inhabitants of Kaiseraugst maybe the cause of this representation of pathology. Perhaps the animal is tethered to an area of land by the hind leg, thus allowing some degree of movement yet preventing the animal from wandering too far away. There is evidence of such tethering of animals producing osseous changes in the archaeological record in other places. However this is merely supposition as in reality the sample size is far too low to make a more concrete analysis of the data. The degree of pathological change in most cases is relatively small and probably would not have affected the animal in any serious way during life.

The data from Reinach shows a much greater proportion of the pig remains exhibit some degree of pathology (table 6.4.4-1). In the case here, they are mostly relating to an inflammatory or infectious change; of these most occur in the limb bones (table 6.4.4-2). As suggested above this maybe some kind of attempt to keep the animal confined to a certain area by tethering around certain parts of the leg. Another scenario also suggested above for cattle relates to the possibility of penning of individuals together causing accidental damage or possibly through violent interchanges. Most of the skeletal changes are not severe enough to induce a change in lifestyle of the animal. However the small sample sizes again negates any definitive statement on the causes and nature of the pathologies from the site. This problem also hinders any further analysis of horizontal and chronological changes at the site.

Analysis of the data from Lausen again shows a low rate of incidence in pathology of pig bones from the site (table 6.4.4-1). Again, perhaps the best animals are being chosen for the site or receive a better level of husbandry than those from the other sites. It is also clear that the majority of the data comes from the ninth Century fills but this may be due to the large concentration of faunal material from ‘grube 28’. Also the majority of these pathological records are of an inflammatory or infectious nature, most of which are insignificant in terms of hindering the animal in anyway and probably went unnoticed in the living animal (table 6.4.4-2). This prevalence in inflammation and infection could also indicate the penning of animals in high concentrations causing such pathological changes that are noted here.

6.5. Horse

6.5.1. Age at Death

6.5.1.1. Kaiseraugst

Evidence of horse remains was present in low frequencies in all periods at Kaiseraugst (c.f. 4-a). However this small amount of data means that the age structure of these animals cannot be investigated fully. In fact at the Kaiseraugst site, only ten incidences are available on the age of the horses present within the settlement during the time periods studied here (table 6.5.1-1). The majority are those of adult animals (seven of the ten incidences), which are found through all time periods except the twelfth Century and all areas within the Castrum of the Kaiseraugst excavations. The three remaining age assignations indicate two subadult individuals from the seventh Century and a very young infant from the fifth to sixth Century levels. Analysis shows that a further two individuals have attained an age of at least three and a half years, although a more precise age allocation is not possible. It would be expected that these adult animals would be kept as working animals, most likely pack animals, and as such would probably attain old age, such as with cattle. Evidence of arthritic pathology could be used as supportive evidence to the age data for this idea. Arthritic conditions are usually associated with old animals.

Most of the equid bones recovered were fragmentary in nature, although not so fragmented as that of the similarly sized cattle long bones. There is no evidence of the burial of complete horse carcasses at Kaiseraugst, so it must be assumed that the dead animals were dismembered before disposal, this is supported by the isolated finds of equid bones. There is no reason why the horse carcasses were not butchered for human consumption after they had become too old to work. In fact there is evidence of butchery similar to the filleting makes seen on cattle scapula, as mentioned previously (§5.8.1.2). The fragmentary nature of the equid long bones, could also add weight to the consumption of horsemeat. However, the fragmentation of the horse long bones could also be related to marrow extraction. The hair and skin have in the past also been utilised for various products. The use of the horsehide can be supported by the butchery marks on the equid bones. Similar marks to those assigned to the skinning of other domesticates would also be seen on equid bones when the hide is removed, however there is no evidence at Kaiseraugst to suggest this (again c.f. §5.8.4.1).

6.5.1.2. Lausen

At Lausen there is more data available for ageing analysis than compared to Kaiseraugst, however, there is still only a small sample and as such no concrete interpretations can be made (table 6.5.1-1). Again, equids are found through all time periods at Lausen and throughout the excavation. Although the majority (13 of 25) of those assigned an age are found within the tenth Century fill of 'grube 54'. 22 fragments from a sample of 25 are assigned an age of adult, this includes one assigned as a young adult. The remaining sample consists of a subadult individual, an animal of about one year and finally an individual of around two years. The less accurately aged sample shows one individual of less than 1.5years, five that are older than two years, six have reached an age of greater than 3.5 years and a further two are older than four years.

It is possible to gain an age at death from equids by comparing the crown height to a known range of wild horses, as produce by Levine (1982). The difficulty in identifying loose teeth from equids, especially the difference between the first and second molars and also the second premolar with the third molar, means that here only tooth rows have been studied to ensure the correct identification of the teeth and thus a more assured assignation of age of the individual. The problems associated with assigning age at death to ruminants also apply to equids, specifically the differential wear that can occur due to different foodstuffs being eaten and also the differing substrates from which these came. Additionally, horses that are used as transport will also incur extra wear from the bit that is placed in the horse's mouth. This type of wear is often recognisable and attempts have been made to systematically characterise this wear but as Bendrey (2007, 1048) points out that whilst this is possible in some cases, the variability that occurs makes it difficult to identify in all animals.

Again as with Kaiseraugst it appears that the animals are being used as working animals, although the presence of the younger animals may suggest that there is some breeding of equids occurring at the site. However, to be certain of this the presence of neonates and foetal remains would be needed. It also appears that the fragmentation of bones is probably due to marrow extraction. There is little evidence of equid butchery at Lausen, with a single chop mark found on the distal end of a tibia, this could quite easily be part of the dismemberment process. It cannot be ruled out that equids were eaten at Lausen though it appears less likely given the higher status of the site and the lack of butchery marks from all periods.

6.5.1.3. Reinach

There is again a deficiency of data, with respect to the age analysis of equids at Reinach, of the two fragments that could be assigned an age both are immature individuals; one very young individual and a second of subadult age (table 6.5.1-1). A third fragment suggests that the individual at least survived until the third year of life. This data is probably not indicative of the age of the living or killed equid population at Reinach but is more likely to be an artefact of statistical sample size error. It is probable that, as with both Lausen and Kaiseraugst, that the age structure of the population would be dominated by adult working animals with the presence of a lower proportion of young individuals. There is also very little evidence of butchery of the horse bones from Reinach, although fine knife marks around the head of a femur supposes more than a rough dismemberment for disposing of the carcass.

6.5.2. Sexing

There is very little evidence of different sexes of equids in this study. In fact all the evidence comes from the tenth Century structure 'grube 54' at Lausen. Overall this context contains a large proportion of equid remains compared to other areas of the site. The presence of an equid skull with canine teeth, which are mostly present in males and rarely found in females, gives evidence of male equids. Four pelvic halves and a complete pelvis have all been assigned to the female group with respect to the shape of the pubis. Whilst these results do not give an idea as to the ratio of female to male in the Lausen material, it does show that both sexes are present.

6.5.3. Biometry

The study of equid size and shape and even the separation of the different equid species by biometrical methods are very difficult at the sites studied here due to the lack of data from the faunal assemblages. The deposition of these large animals outside of the normal domestic food waste is seen quite often in the archaeozoological remains and thus reduces the chances of finding adequate equid remains to form an idea of the size and shape. Equids are overall quiet poorly represented in the bone material and then reduce this to the number of measurable elements and the sample becomes quite small. The withers height of the horses (after Kiesewalther 1888) here measure between 1.33m and 1.42m although this is a relatively small sample and can only give an indication of the beasts present (table 6.5.3-2). This compares well with the data from Develier-Courtételle (Olive 2008, 177 and fig 168), which has individuals between 1.32m and 1.44m with one individual greater than 1.50m.

Phalanx 1 has been analysed here as it is the most abundant measurements available but with only six data points, this is hardly a sound basis for any interpretations (table 6.5.3-3). Yet it may allow a glimpse into the make up of the populations. The diagrams illustrated here suggest that there is a difference between the measurements obtained. There are two possible scenarios that could fit these diagrams, firstly the GL vs Bd suggests that the difference is site related with large and more robust species at Lausen compared to Reinach (fig. 6.5.3-4). This would perhaps fit with the data that the site at Lausen is more affluent and perhaps larger horses were more obtainable than for the inhabitants of Reinach. The second inference from the remaining diagrams (Gl vs Bp and Gl vs (SCx100)/GL) suggests the difference is not site orientated but a difference in individuals (fig. 6.5.3-5). That there are larger and smaller individuals present in the populations recorded here, this could be different species or different sized individuals within a species. The lack of data here means that it is not possible to elucidate this further. Hüster-Plogmann and Vezseli (n.d.) identified ass within the material at Lausen so it is possible that this species is present here within these measurements.

6.5.4. Pathology

There are two incidences of pathology in Equus species at Kaiseraugst both come from the same twelfth Century context and being articulating bones are probably from a single individual with an arthropathy of the lower hind leg (table 6.5.4-1). There is a great deal of extra bone growth on the medial part of the proximal articulation of a third metatarsal and a corresponding pathology on the same surface of the centrotarsal. This osseous change along with the pitting on the articular surface suggests that this change is arthritic rather than a joint disease such as spavin, which leaves the joint patent. The change is probably due to the age and purpose of the animal during its life. Horses as a prized possession were probably not used as draft animals, more likely they were used as a means of transport for individuals. As mentioned above the development of the horse harness did not take place until the eighth Century thus the use of the animal, as a plough animal was not possible before this time.

At Reinach, there is a single case of pathology at the site (table 6.5.4-1). This pathology is diagnosed as an arthritic change in the femoral head excavated from the tenth century fills at the ‘Gemeindezentrum’’ site. As with Kaiseraugst this change is probably due to the age and use to which the individual was put during its life. Again it is most likely that the individual would have been ridden.

Lausen has the highest count of pathology in the Equus remains of any of the three sites (table 6.5.4-1). The majority of the recorded cases come from the tenth century fills. Also there is a greater prevalence of arthropathies in the lower trunk region (table 6.5.4-2). This would be consistent with other cases of fusing lumber and thoracic vertebrae thought to be caused by the riding of the animals (fig 6.5.4-3). In most cases the pathology is not severe and probably did not affect the individual seriously in life.

There is a single case of pathology from the tenth Century fills, which shows a female pelvis that has been transformed by hypertrophy, and evidence of eburnation on the pubis bone (fig 6.5.4-4). It is not an unknown occurrence for the femoral head of Equus to dislocate from the acetabulum. This in medieval times would have been almost impossible to reposition due to the heavy muscle mass around the bone thus often a pseudo-joint would be formed most frequently on the neck of the illium. It is possible that the case of pathology presented here could be of similar cause. Although no false joint is formed the eburnation that appears on the inferior part of the pubis is caused by repeated wear on the area. This suggests that the animal was allowed to recover and received some care from the owner. It is unlikely that the animal would have been useful after this injury, possibly only walking on three legs. The importance that a horse conveyed was probably one reason why the horse was kept after the injury but perhaps also the owner held the animal in some kind of regard. This however is merely conjecture and something that cannot be proven. The context in which this example is found 'grube 54' also contains pelves from at least three other individuals and a high proportion of equid remains, which at least suggests that at the time that horse was an important part of the life at Lausen, or perhaps it was just a convenient pit to put the skeletons.

Figure 6.5.4-5 shows the case of a tarsal and its articulating metatarsal the pitted surface and extra bone growth could indicate osteoarthritis but the lack of eburnation on the joint surfaces suggests that an alternative diagnosis is needed. It can also be suggested that this type of pathology could be bone spavin, although in these cases the joint is usually unaffected by the pathology. Here the joint is clearly patent but the pitting shows that there is some affect on the joints surface. Thus the cause of this recorded pathology will have to remain unknown, like many pathologies recorded in faunal material.

6.6. Dog

6.6.1. Age at Death

6.6.1.1. Kaiseraugst

Not enough evidence was accumulated from Kaiseraugst to investigate the age structure of the canid population. One individual was aged less than six months whilst a second was a subadult and a third can be seen to have lived to at least 8 months (table 6.6.1-1). The fragmentation of the canid bones is less than that of other domesticates as analysis suggests that most are larger fragments if not whole bones. This suggests a different role to those animals analysed previously. There was also no evidence of butchery on any dog bones from Kaiseraugst, which suggests that they played no role in the diet of the settlements population. Evidence of skinning of dogs was known to have taken place. But again as there is little evidence of butchery no interpretations can be made here. Although all remains represent disarticulated individuals with no evidence of burial or whole carcass dumping at the site. However, it is more than likely that dead dogs were discarded on rubbish heaps, and reworking and redeposition of this material leads to the disarticulation of the skeletal elements rather than dismemberment being carried out before being discarded.

6.6.1.2. Lausen

The same paucity of data is observed at Lausen, here two non-adult individuals are present, besides two that survived at least the first year and a third that was aged at least eight months (table 6.6.1-1). Again this is probably not representative of the canid population of Lausen. Also as at Kaiseraugst there is no proof of butchery on any canid bones, which again suggests they were not eaten or skinned. However there is also no evidence of whole carcass dumping or of burial of individuals. The fragmentation of the Lausen material is not so marked as at Kaiseraugst, however there are higher numbers of whole bones compared to other domestic species.

6.6.1.3. Reinach

The Reinach material again produces little data in the way of age structures for the canid remains at the site. One infant individual is present, whilst another attained at least 1 and a half years and a third survived its first year (table 6.6.1-1). Again as with the other sites studied there is no evidence of butchery on any canid bones and the fragmentation of the bones is not so marked as with other species. Again this suggests that dogs are not being utilised in the diet, neither is there evidence of skinning for hide.

6.6.2. Sexing

There is no data with respect to the assignment of sex to canid remains.

6.6.3. Biometry

There are just ten individual fragments producing measurements of canid remains from the material studied here. In the Kaiseraugst assemblages, two measureable elements each came from the ‘Jakobli-Haus’ and the ‘Gasthof Adler’ sites. A humerus and two ulnae incorporated the Reinach metrical assemblage the former from the ‘Gemeindezentrum’ area and the latter two from the ‘Stadthof’ area. There were three measurable elements from Lausen (table 6.6.3-1). This small sample means that it is practically impossible to infer anything about the size and shape of the domestic canids that were present at the site. The figure produced here are similar to those that are seen in contemporary sites (c.f. Marti-Grädel 2008). It was known that the size of dogs varied greatly in the Roman period (Peters, 1998, fig 14). There were breeds that were comparable to modern lapdogs through dogs the size of a modern sheepdog to much larger dog such as a wolfhound-sized dog (Peters, 1998, fig 64). This variation, according to Benecke (1994, 226), is carried through in to the Middle Ages. Most likely the dogs represented by the material here are 'average' sized individuals, those that are similar in size to a modern Alsatian. However, the breeding of dogs for aesthetic purposes and hunting dogs was prevalent in the upper echelons of medieval society. Small and aggressive dogs, daschunds and terriers, were bred to chase and hunt various animals into their underground dens. Mastiffs were bred to chase and hunt larger mammals such as boars and bears. While in between these two extremes there were many other types of dog bred all with specific purposes, such as the modern foxhound, which was and still is used to chase foxes through the countryside, over many kilometres.

Pathology

There are no examples of pathological material relating to dogs from any of the three sites studied here. This suggests that either the dogs were extremely well cared for or more likely the probability of finding a pathological bone was low due to the scarce remains of dogs that have been found.^

6.7. Chicken

6.7.1. Age at Death

6.7.1.1. Kaiseraugst

It is difficult to age domestic fowl as their long bones have fused by the age of six months, however a comparison of these mature and immature fowl can be made (table 6.7.1.1-1). Domestic fowl, like pigs, were probably raised and husbanded in the backyards of households in urban centres as well as in rural farming communities. These animals produce meat, eggs, feathers, offspring and fat from very little input by the keeper. The Kaiseraugst sample is by far the largest of the three sites yet, sample sizes with regard to each period means that not all periods can be analysed. The fourth to sixth Century period at Kaiseraugst shows a predominance of mature individuals, with this group making almost three quarters of the sample. A similar pattern is seen in the fifth to sixth Century period where again approximately three quarters of the sample is mature birds. Horizontal analysis of this material also shows this three quarter proportion pattern albeit with smaller samples in both the 'Jakobli-Haus' and 'Gasthof Adler' areas (table 6.7.1.1-2). The later sixth Century material shows a larger divergence than in proceeding time periods, over ninety five percent of the sample being mature birds, although this is a small sample and thus may be and artefact of such.

6.7.1.2. Lausen

At Lausen full analysis in again hindered by the lack of suitable sample sizes. The only sample of required size occurs in the eighth to ninth Century period of the settlement and the sample is dominated by individuals found in 'grube 28'(table 6.7.1.2-1). This sample shows a high proportion of immature individuals. The other time periods hint at these high proportions of immature fowl, although samples sizes preclude any further investigation.

6.7.1.3. Reinach

Reinach has smaller sample sizes still. As with Lausen, only the eighth to ninth Century time period has a sample size considered larger enough to be statistically sound (table 6.7.1.3-1). The result shows a high proportion, over ninety percent, of mature individuals. This is a similar pattern to that seen at Kaiseraugst in the Sixth Century and again maybe the result of a less intensive exploitation of domestic fowl. Other time periods at the site do not corroborate this, though sampling error is the most likely reason for this.

All in all it is difficult to see a pattern to the utilisation of domestic fowl that is common between the three sites with respect to age populations. This could be the result of the household husbandry of the birds each individual household is making unique decisions about the slaughter of these fowl. Thus from household to household different patterns emerge, and larger sample sizes than those found here would be needed to resolve such variations.

6.7.2. Sexing

The assignment of sex to chicken bones can be achieved by four differing methods. Firstly, by assigning sex according to the presence or absence of a medial spur. Male cocks have a high probability of displaying such a spur, whilst in females this is almost always absent. The second method observes the presence of medullary bone, a soft spongy bone that collects in the long bone medullary cavities of female hens whilst in lay. Whilst this only indicates females at specific times of the life cycle it can be a useful indicator. The last methods use biometrical data, there are two methods used here. The first and simpler method plots the greatest length of the tarsometatarsus against its proximal breadth, separation of the data points towards the sexual dimorphism of fowls The second proposed by Lepetz (1996) uses the greatest length measurements for all major long bones and converting them into an index by a factorial multiplier. The resulting index again shows the sexual dimorphism with greater index values assigned to males, with hens having smaller values. The sample sizes are such that all data for the individual sites have been pooled to create the largest sample sizes possible. Unfortunately this means that chronological analysis cannot take place until such a time that other samples are found to enlarge the dataset.

Considering the index of measurements (table 6.7.2-1), by far the largest sample size is recovered from the Kaiseraugst excavations. A total of 45 fragments could be assigned sex due to the index method, 31 of which represent female birds and the remaining fourteen males. This suggests that the average ratio of females to males is approximately 2:1 in Kaiseraugst. This however does not take in to consideration variation through time. Also horizontal distribution cannot be analysed fully as the Kaiseraugst sample is dominated by remains from the 'Jakobli-Haus' site. Although both the 'Jakobli-Haus' and 'Gasthof Adler' site display the 2:1 ratio that is observed in the pooled data. Reinach has just twenty-five individuals that could be assigned sex, with 23 female assignations and two males. This is probably not representative of the true flock composition at the site especially given the small sample size, although it has been suggest that the number of females to males would be higher in rural communities where there is more space for the larger populations of domestic fowl to roam. Lausen has a smaller sample still with five females and just two males again this dataset is too small with which to make any interpretations.

At all sites and time periods, there are just four individuals displaying a medial spur. The presence of medullary bone is exhibited in seven individuals from all three sites throughout time; five from Lausen and two from Reinach, shows that there are also females present in the data. Bivariate plotting of the previously mentioned measurements of the tarsometatarsus shows possibly two groups, a larger probably male group and a smaller group that is like to be female (fig.6.7.2-2). The spurred individuals are also indicated on the plot. It shows that all spurred males are in the larger group, and there are spurred individuals in the smaller group. This could indicate young male birds. The results from looking at long bone greatest lengths against an index of the shaft diameter in proportion to the greatest length (Gl vs (SCx100)/Gl) shows again that there are males and females in the populations from all three sites, there being more females than males present in most cases (fig. 6.7.2-3). This methods also shows all spurred males are in the large group, and thus adds weight to the previous method. Whilst these results show that there are both males and females present at all sites, however, it gives no indication of the ratios of the two sexes present due to inadequate samples at the sites.

The above study does not take in to consideration the possibility that some bones belonged to castrated males, capons. This was carried out to fatten the males for sale at market. There is evidence that caponisation was carried out in the medieval period but how common and widespread this procedure was during this and earlier periods, is uncertain.

6.7.3. Biometry (table 6.7.3-1)

The analysis of the measurements from the sites studied here shows that the sizes of the individuals present are comparative to the populations of other contemporary sites (c.f. Marti-Grädel 2008, 158; Olive 2008, fig. 171). It appears that the domestic fowl from Kaiseraugst are larger than those from Lausen and Reinach, although this is just a tendency and has no sound statistical basis as the sample sizes for each individual measurement is too small. As discussed above, the measurements can be used to distinguish between the different sexes present at the sites. Different breeds could be distinguished by ratios of different measurements but again; lack of data precludes this type of analysis here.

6.7.4. Pathology

There is a single incidence of pathology in all the domestic fowl remains uncovered in the sites that have been studied. This case presents itself as a broadening of the distal articulation and an extosis of the distal midshaft of a tibiotarsus. This occurs in the ninth Century context of ‘Grube 28’. The extosis is most likely caused by a traumatic injury or possibly a secondary infection. The broadening of the articulation is then a likely compensation of the occurrence of such an injury. It may even have affected the way that the animal walked. Given the size of the sample sizes of domestic chicken remains at each site and just the single case of pathology amongst all of them suggest that the health and welfare of the domestic fowl population was good. However, this can only observe results of disease, trauma and other illnesses that leave skeletal markers, so other more virulent disease, such as fowl typhoid or avian Tuberculosis remain a mystery in the archaeozoological record.

6.7.5. Summary

In the three sites studied here chickens would likely have performed a similar role to that of pigs, being kept by individual households in small numbers. The fowl would have probably been loosely penned or even roaming free, turning household waste into meat, feathers, eggs and offspring for little input. The ratio of the sexes present at each site is also difficult to elucidate here as the sample sizes are too small. It is impossible to say how important a commodity like eggs were at this time as no evidence of eggshell has been recovered from any of the three sites, even from within the sieved sample at Kaiseraugst. Year on year laying hens produce fewer and fewer eggs, today a hen produces around 200 eggs in its first year lay after which it is usually slaughtered, in the past this figure would have probably been lower, but with high proportions of immature individuals in the faunal remains maybe similar methods of chicken husbandry were used. Ageing data suggests that the majority of those fowl slaughtered were adult individuals but it is also postulated here that with small household groups of fowl, age of slaughter probably varied considerably from household to household and as such the sample recovered here are much too small to make any conclusive judgements. Poultry farming on a large scale was probably not seen in Europe until the later post medieval period, where selective breeding programs and stock improvements were attempted.

6.8. Other Species

6.8.1. Cat (table 6.8.1-1)

Cat was rarely found at any period of the three sites. Three fragments of cat were found at Kaiseraugst, a single element in each of the three areas of excavation. The ‘Jakobli-Haus’ uncovered a pelvis from a sixth Century level, the individual was of indeterminate age and sex. A femur from the fifth to sixth Century layers was found at the ‘Gasthof Adler excavation again of indeterminate age and sex. The ‘Fabrikstasse’ site identified a single rib from the twelfth Century.

Four examples were found at Lausen, the earliest was a ninth Century radius, the individual was of indeterminate age and sex. Then a tenth Century humerus of a juvenile animal of less than eighteen months old, a eleventh century mandible from an adult individual and a twelfth Century mandible from a juvenile specimen. Eight fragments were identified at Reinach. In the seventh Century deposits two mandibles, two humerii, a tibia, metatarsal 4 and a lumbar vertebra were identified, and an ulna from the ninth Century deposits. All of the seventh Century data except for one of the humerii could come from a single structure so could be part of the dumping of an individual, although this is not certain.

The evidence here is too sparse to make any interpretations about the exploitation of cats. The individual elements probably occur due to the reworking of the deposits in which their bodies were dumped. It is difficult to say whether these are feral/stray cats or house cats or possibly even wild cats. The presence of juvenile individuals could represent the natural mortality or deliberate putting down of unwanted animals. There is no evidence of butchery to suggest that the cats were part of the diet. The small numbers identified suggest that the skin of cats were not in economic demand. This is not to say that the individuals present were not skinned before the carcass was thrown away. Cats in a settlement would have kept down the numbers of vermin which would have been attracted to rubbish pits and domestic waste. There are no incidences of pathology on the cat remains found here, although this is more likely due to the small numbers of bones found rather than any indication of the health and welfare of the domestic felid population.

The single measurement that is available from all the sites studied here is a pelvis from a sixth Century level at the Kaiseraugst 'Jakobli-Haus' site. This is larger than the average for the pelvis measurements in Kratchovil (1976) for domestic cats from the Carpathians, whilst slightly lower than the average for the wild cats in the same paper. O'Connor (2007) shows an overlap in the wild and domestic forms of cat from around Europe, though with both wild and domestic cats living sympatrically, and probably interbreeding it is to be expected that there is an overlap in the species with regards to size measurements as hybrid forms are produced. This especially relevant in late antiquity and early medieval times as cats were perhaps not the companion animals that they are regarded as today, more likely they would have had a role as predator to household vermin. Still here it is regarded that the measurement taken is from a large domestic cat rather than a small wild individual.

6.8.2. Goose (table 6.8.2-1).

Greylag/domestic goose (*Anser domesticus*) was the second most commonly eaten bird, after chicken in the study. Eight fragments are found at Kaiseraugst. A single adult tarsometatarsus was identified from the mid fourth Century at the 'Gasthof Adler' excavation whilst a foot phalange was recorded for the twelfth Century in the same area. An articulating femur and tibia identified to the fifth to sixth Century material from the 'Jakobli-Haus' excavation. Six fragments were found in the sixth Century levels at the Jakobli-Haus site including identification of a juvenile and two adults.

At Lausen a partial goose skeleton consisting of fourteen elements from the tenth Century was identified in 'Grube 54'. Butchery marks on three of the elements suggest that this is the remains of a meal rather than the natural death of a bird or the dumping of a diseased bird. The identification of skull fragments also suggests that the bird was cooked whole. Eleven fragments have been identified from the ninth Century fills, although it seems that an assortment of individuals are present, however is not possible to tell if there is a partial skeleton within these identified fragments. MNI counts from tibia suggest that there are at least 4 individuals, as a juvenile and adult and three other indeterminate tibiae are present. Also there is no evidence of butchery on these elements. Four unrelated fragments were identified from the eleventh Century structures. A single fragment was identified from the twelfth Century fills.

Reinach consisted of three unrelated fragments from the seventh Century including a juvenile. An eighth Century carpometacarpus was identified. An articulating femur and tibia were recorded in the eleventh Century material. Eight fragments from the twelfth century were identified. These identifications included, at the 'Stadthof' excavation, a related radius and ulna from 'grubenhaus J', two juvenile femora and their related pelvis from 'grubehaus H'. The 'Gemeindezentrum' site also displayed an articulating femur and tibia from this period.

The numbers of geese identified certainly does not attest to the wide scale consumption of the bird throughout the time period studied here. Therefore it is difficult to make a case for their intensive rearing, although the presence of a number of juvenile individuals suggests that they were probably kept in similar circumstance to poultry if domesticated. This would also infer that the hunting of wild geese was not required. The presence of butchery marks is rare although the fragmentation of geese bones appears to be greater than that of chicken. This could indicate that the geese were broken up in to more manageable portions. The number of articulating joints identified also corroborates this and could also imply that joints rather than whole birds were sold at market. It is also perhaps due to the length of these bones compared to chicken which tend to be stockier in shape. The presence of what appears to be a whole bird from the tenth Century at Lausen could suggest a festive occasion or possibly the higher status of the site at this time. Goose feathers and eggs may also have been utilised in the settlements although there is no evidence to argue this point either way.

There are two incidences of pathology in the geese populations studied here. Both specimens are from the ninth Century ‘Grube 28’. The first presents as an extosis on the muscle attachment of a distal midshaft of a tibiotarsus. This is most likely caused either by traumatic injury, but it is also possible in conditions of poor hygiene that the bird developed a secondary infection from either mites or ticks. The second case also occurs on a tibiotarsus from the same archaeological structure however this occurs on the posterior and lateral surfaces of the proximal part of the midshaft. The differential diagnosis for the second incidence is likely to be similar to that of the first, most likely due to a traumatic injury.

The small biometrical data collected from the sites studied here, is similar to that of other contemporary sites (c.f. Marti-Grädel 2008).

The economic use of the geese found in the sites here is very much dependant on the type of population from which they came. If the bones are of a wild population then these birds are probably being used for meat and for their feathers, very similar to the exploitation of the wild ducks. The procuring of wild geese eggs is also possible but the supply of eggs would be lower than for a domestic flock. If, however the population is domestic then, perhaps the geese are being used in a similar way to chickens, so that the birds would be kept in a backyard or allowed to roam free in the settlement to pick up food where they can and the householders would reap from the geese for meat, feathers, young and eggs. The presence of juvenile individuals lends more weight to this latter opinion than the former. Thus the results have been put forward here in the domestic animals chapter.

6.8.3. Dove *(Columba spp.)* (table 6.8.3-1)

Dove is only represented in the study here by remains from Kaiseraugst and as the site is seen as a continuation of the Roman styles and traditions (c.f. Marti 1996 and Fünfschilling 1997) even after the departure of the Roman administration, it must be assumed that these birds are most likely from a domestic form of the *Columba* species, as the keeping of doves has often been observed in the Roman period not only through archaeozoological remains but also related structures such as dove cotes (Parker 1998, 205).

Five of the six fragments are dated to the fifth to sixth centuries at Kaiseraugst, of this sample four come from the layers in the 'Jakobli-Haus' area and single specimen from the 'Gasthof Adler' area. The remaining fragment comes from the twelfth Century fills in the 'Gasthof Adler' area, the date of this specimen and considering that the site was little more than a village at this time may suggest that this is a wild individual that was either a natural mortality within the settlement or perhaps brought in to the settlement by a domestic carnivore. All the specimens identified here are adults and both wing and leg elements are represented.

There is a single specimen of pathology in the dove remains studied here. It is from the fifth to sixth Century levels in the 'Gasthof Adler' site at Kaiseraugst. The pathology presents as an extosis of bone on the lateral surface of a tibiotarsus. The likely cause of such an inflammation could be caused by a traumatic injury or by possibly a secondary infection from a mite infestation such as *Cnemidocoptes mutans*, which affects the feet and legs of domestic birds (Brothwell 1992, 41).

The measurements recorded from Kaiseraugst are statistically similar to those recorded by Marti-Grädel (2008). This is perhaps to be expected as these birds are probably kept for aestetic purposes as well as for economic purposes and an increase, or decrease in size, was not necessary to make these birds more economically useful over time (c.f. cattle size change §6.2.3).

Dove's blood, flesh, organs and feathers were all used in various forms for medicinal purposes in the medieval period (Gattiker and Gattiker 1989, 350). Albertus Magnus (Pasda, 2004, 99) hailed dove eggs for heavy digestion and Kathan (1992, 60-62) writes that the flesh of young dove is very soft and nourishing and digestible and also good food for the sick. Doves were also used as lures for birds of prey (Schwenk 2000f, 1810).

Hildegard von Bingen (Portmann 1997, 410) also writes about doves that they are naïve and timorous and fly in large flocks so they are less likely to be taken by other birds. Hildegard von Bingen continues with the meat not being firm and a little dry and gives little juice. The ringed dove and the wood pigeon, the wild forms of the domestic dove, are of the same character except these live in the forest and thus feeding of food in the forest makes them more acerbic in taste and larger in size. However, these wild forms could still be used in medicines.

So in this chapter, the use and husbandry practices related to the domestic species have been elucidated where possible, in others sample sizes are too small with which to put forward concrete hypotheses as to the farming practices of the populations in the settlements here. It appears that apart from chicken and goose, the other animals represented are not part of the diet at the sites analysed here. Cattle populations have been intensively analysed and the results show that not only were the animals used fro draughting but also the presence of subadults and young adults suggest the need for prime meat. The use of pigs at the settlements was it appears primarily for meat however the number of adult animals in the early period of the resettlement of Reinach suggests that meat from older animals was also consumed. Ovicaprids have like cattle a dual function both in supplying prime meat but also a number of secondary product, wool and dung for the fields. It also can also be proposed that prime ovicaprids and cattle are being sent to Lausen as a form of payment of rents due to the landlord. In the next chapter the use of wild species in terms of food and also non-food items are discussed.

7. Wild animals

7.1. Wild Mammals

7.1.1. Cervidae

Venison was held in high regard during the high/later medieval, and was a privilege of the upper echelons of society, where they were managed in parks and hunted. During this period there were strict laws to preserve the hunting rights of deer to the higher classes. Although it appears that such restrictions were not in force during the early periods studied here. Cummins (1988, 85) notes that deer were hunted from boats after being chased into the water. Hunting would have also included the use of spears and the bow. Hunting with nets was also used but Pheobus (Tilander 1971, 251) writes that this method was for the fat, old, idle and churchmen. Even though, deer seemed to have played little part in the day-to-day diet in all sites. Red deer was by far the best represented cervid of the three species that would have been found in the region during the early medieval (c.f. tabs. 4-1a; 4-2a; 4-3a). Roe deer is also represented by a few examples in a few periods. There is no evidence of fallow deer at any time in any of the sites.

Table 7.1.1-1 shows the shows the data present for red deer at all three sites. This is a relatively small sample so it must be borne in mind that these conclusions here are speculative and should be treated with caution. Body part analysis for Red deer shows that both by weight and count that all body areas are reasonably well represented (table 7.1.1-2). The trunk and stylopodium in both cases are better represented than the more extreme areas. These are also the major meat bearing bones in the animals so it is not perhaps surprising to see then well represented in what is a small sample.

Butchery evidence exists on the long bones of red deer at all three sites although there is not enough information to build up patterns of butchery which may divulge techniques (c.f. 5.8.5 and table 5.8.5-1). It is assumed that the red deer would have been butchered in a way similar to that of the bovids and possibly equids. Firstly, the carcass would be brought to the settlement, the head would be removed and the body cut in to large joints. The identification of skull and antler attached to the skull gives evidence that the whole carcass was butchered on site, also chop marks on the axis and atlas attest to the head removal. Then these large joints would be sectioned further in to smaller more manageable cuts. There is also too little evidence to indicate the selection of certain elements. Marrow may also have been extracted from the bones, mainly due to the fragmentary nature of the material. This fragmentation means that there is little ageing information for red deer, evidence of an immature animal is present in the assemblage although this also tends toward the adult age group (table 7.1.1-3). This may suggest a selection in hunting of mature individuals. There is also almost no sexing data, just a single probable male being identified of ninth Century date at Lausen by the pelvis morphology.

In a text by Boke of St Albans in England, the hunted deer was portioned according to the rank of the person in the hunt. The left shoulder would have been given to the hunter, the right to the forester and the high quality meat and the hindquarters to the Lord of the manor (Thomas 2002). In popular and cultured poetry the doe was a symbol of feminine grace (Cummins 1988, 132).

The small number of roe deer bones means that very few interpretations of the data can be made (table 7.1.1-4). The bones of this species are found at all three sites and there seems to be a preponderance of metapodials, although this is most likely caused by sample size and is relatively easy to identify against other small artiodactyls such as ovicaprids. There is no evidence of butchery practice on the bones and age and sex data offer no information on the slaughtered population. In this case it is difficult to offer little more than a presence of the species.

7.1.2. Wild boar

The remains of wild boar are found almost exclusively at Kaiseraugst, (seven of eight fragments) with a single skull fragment found at Lausen in ‘grube 54’ (Table 7.1.2-1). There is little evidence to elucidate age and sex patterns. It was possible to infer an adult age from a radius at Kaiseraugst ‘Jakobli-Haus’ during the fifth to sixth Century period. There is a single observation of butchery from the eight fragments identified a radius with chopping and knife marks from the fifth to sixth century levels at the ‘Gasthof Adler’ site within Kaiseraugst. It is difficult to discuss body part proportions here, as the sample is so small thus rendering all interpretations highly tentative.

Wild boars, especially male boars, were hunted throughout Europe, not just in the medieval period but for thousands of years before, however in later periods, this wouldn’t have been through necessity as food but for sport. Wild boar would have been considered a foodstuff of the upper classes of society. It would probably have come under the same hunting regulations that possibly restricted the hunting of deer during the medieval period. Therefore it would have played a minor part in the day-to-day diet of the people of region but Kathan (1992, 9-13) writes that the wild boar was a highly prized commodity for the table and the head was a particular luxury. Boars were hunted between the middle of September and the end of November as it was said this was when the flesh was at its richest. Methods of hunting the boar are sparse but probably included the use of bows, crossbows and boar spear (‘saufeder’). Cummins (1988, 101) writes that boars were often chased into water to reduce the threat of attack. Male boars were particularly hunted for their speed, bravery and aggressiveness (Reichstein 1974, 75). Albertus Magnus also wrote about the boar’s ferocity. Hildegard von Bingen (Riethe 1996, 107) was more complimentary to the wild boar stating that wild boar had the same temperament as a domestic pig, only purer. Boars were incorporated into many myths and sagas. Germanic folklore portrayed the wild boar as a symbol of fighting spirit and fertility (Heinz-Mohr 1981). Boars were also known to represent passion and devastation as well as being demonic (Riethe 1996, 146). Medieval literature portrayed the boar as massive and ugly. ‘They were black in coat and character and without fear’. Ferrières and Pheobus (Schwenk 2000b) wrote that on the hunt it was a chance for a man to show his skill and bravery as a hunter as they were a serious threat to dogs and horse as well as the hunter. Bringing down a boar brought great glory upon the hunter. In 756, the Langobard king Aistulf, and also in 884 Karlmann, son of Lugwig des Sammlers, were both killed whilst out on the boar hunt (Schwenk 2000b, 121-122).

7.1.3. Hare

Here all fragments identified as either hare or rabbit/hare are grouped together as it is extremely unlikely that domestic rabbits would be found in the assemblages. Rabbits were domesticated sometime in the Medieval around the twelfth or thirteenth Centuries, probably a little too late for the time frame of the assemblages here. Hare is identified at the Lausen and Kaiseraugst ‘Jakobli-Haus’ sites. There is too little information to observe the age and sex demographics of this lagomorph population (table 7.1.3-1). There is also only a single incidence of butchery of the hare bones, a tibia from the fifth to sixth Century levels at the ‘Jakobli-Haus’ excavation. This lack of butchery is not surprising as with chicken it would be possible to pull the cooked meat from the bone. Again as with deer and wild boar, hare played a small or no part, with respect to Reinach, in the diet of the three settlements studied here.

Again as with the other species hare was a luxury food item and only the wealthier classes being able to consume them regularly. Rackham (1986, 119) notes that, in England, the presence of hare at the table is indicative of a higher social position in Medieval times. It must also be considered that hare was important for its skin and fur as well as its rich meat. There were various methods for hunting hare including hounding and hunting with nets (Zörner 1996, 146). Falconry was another method of hunting hare especially amongst the wealthier classes. The type of bird of prey was also very much a status symbol, with rare species of predatory birds being used by the noble classes and more common hunting birds used by those lower in rank. Brüll (1997) writes that female hawks were ideal for training by falconers.

Benecke (2000, 67-68) shows that there are higher proportions of hare being caught in the Middle Ages than at any time previously, perhaps this was caused by the clearance of the woodlands, creating more fields and meadows and thus producing a similar habitat to that of the original steppe environment of the hare.

Hare also has a mythological symbolism put upon it (Cummins 1988, 115). Alongside its high fecundity, it was also thought that the animal could change its sex at will and it was thought that it could magically appear and disappear out of nothing. The changing nature of the sex of the hare was 'known' in classical times and it appears that Hildegard von Bingen (Riethe 1996, 108, 146-147) in mentioning this in a text was influenced by the likes of Pliny and Aelian.

7.1.4. Other Mammals

There are other wild mammals that are also represented by single or a small number of bones in the assemblages from the three sites. These species are unlikely to have played a major role in the diet of the people at the time. However, most appear to have some other economic value such as fur or skin.

7.1.4.1. Bear (*Ursus artcos*)

There is a single fragment of bear recovered from the eleventh Century fill of 'Grube 36'. This second metatarsal is from an adult individual (Table 7.1.4-1). Archaeozoologically bear finds are commonly related to manorial and higher society settlements in Southern Germany (c.f. Pasda 2004, 50). The exception being a humerus diaphysis from the seventh to ninth Century fills from Kelheim (Schäfer and von den Driesch 1983, 20). Many of the recovered fragments are from the paws, namely the carpals, tarsals, metapodials and phalanges, of the animal, which may add further weight to the following discussion as this part was considered the best part of the animal to eat. This would sit well with the presence of the bear fragment in the eleventh Century a time when Lausen is socially at its peak and is also an element found in the paw. It was also customary to present bear paws as gifts to guests and so maybe this is the also part of the animal that has a more symbolic meaning. For example, Wolf von Rabenstein gave four bear paws to the Bamberger bishop Weigand in1548 (Reddig 1993, 116). Also the wide range of beliefs relating to the paws of this animal throughout the whole of Europe may suggest a deeper-seated symbolism perhaps due to the anatomical similarities between the bear's paws and the human hand.

During the middle Ages the hunt for bears was already regulated. Only the owner of the forest was entitled to hunt bear within the hunting season. This might have contributed to a certain protection of the animal. In the high Middle Ages the bear was still very common but became a rarer sight after this point. Bears had in Roman times been trained to perform tricks and into the Middle Ages the animal became 'master Petz,' a name from fables led around by showmen, if the interferences from reports of the ninth Century are correct. Many cities had bear pits or structures that housed the animal. In addition, they were also known to be held in castle ditches (Butzeck *et al.* 1988, 44-45).

There was often mistreatment of these captive and trained animals, as an example of pathology from the eighth to tenth Century period from Gars-Thunau shows that the individual was malnourished (Czeika 1199, 178, 184). Albertus Magnus writes about the danger to those who were put in charge of these beasts (Pasda 2004, 49).

Apparently the hunting of bears did not play a particularly large role in the hunting season in Germany (Cummins 1988, 120). There are only a few mentions of bear hunting. The bear hunt was not an easy task, the animals were usually well hidden or in dense forest. Therefore the beginning of the hunt included first finding an individual. The large and physical nature of the bears also meant a danger to the lives of valuable hunting dogs and even for the hunters themselves (Cummins 1988, 120-131). The hunt was carried out in the form of the agitation with heavy mastiff-type dogs; the hunters were probably armed with spears. In addition to these weapons traps would probably also have been utilised particularly pits were dug and fitted with spikes (Schwenk 2000a, 1423). In particular the hunt with bow was dangerous, since an individual arrow did not often kill the bear outright, which then turned on its aggressor. These difficulties and dangers make these acts of hunting appear particularly heroic and probably conferred a certain status on the hunter.

Galton Pheobus (Cummins 1988, 122) writes 'that the meat from bear was not frequently eaten, because of it was unhealthily regarded and that only the paws were considered as edible'. Lozza (1998) and Kathan (1992, 7-8) also write that the best meat is in the bear paws, whilst the latter also suggests that 'young bear meat, the haunch of old, fattened animals, the hind-quarters, the piece of back, the bear ham and the bear head are also of high quality'. Ehlert (2000, 223) described in the medieval cookbook from the 14th to 16th Centuries the preparation of the bear head, which ranks among the speciality dishes. Lozza (1998) suggests that there maybe some recognition of a relationship between an illness and the eating of bear meat (c.f. comments by Pheobus above). The trichina parasite is found predominantly in muscle meat of wild and game animals. Since paws possess essentially sinews and less muscle mass, there is less likelihood of being infected with this parasite. Not that this should suggest an awareness by people of this period about this parasite or even parasites in general, but more from linking an illness to the eating of tainted meat. Also Hildegard von Bingen (Riehthe 1996, 89) writes 'the meat of the bear is no good food for humans because it inflames the desire in humans in such a way that is in opposition to water quenching the thirst of humans. Also pork and the meat of certain other animals work in a similar way, but not as strongly as the meat of the bear'. Written sources from the monastery at Saint Gallen around the year 1000, however bear meat is mentioned expressly as a meal (Hartmann-Frick 1975, 35).

Medicinally, bear fat was used against gout and hardening sinews. Between May and December the hunting of bears was most favourable because of its fat content. Also the bear became regarded as a 'walking apothecary'. Hildegard von Bingen (Riehthe 1996, 89) for example recommends 'bear fat as means against hair loss. Furthermore it is useful to mix with other ointments and cures. Hildegard continues 'Its skin when put between the ears, on breastbone and the heart of the patient, is well stress and angst, because it warms humans and makes them bold. However the sweat of the bear on the skin must be removed beforehand'. The most commonly used product was bear bile. Gesner (Lozza 1998) writes that it was used to heal ulcers, toothache, gout, jaundice, eye injury and more by either ingesting or being outwardly rubbed in. The welfare effect the bear bile is not all based on superstition, suggests Lozza (*ibid.*) but also due to the Urso-deoxycholic acid contained within it, which can cause the dissolution of gall stones, however this should not suggest that these people were aware of such compounds but attests more to the awareness of the results of application of these natural products. Bear skin was popular not only in a medicinal sense but also as a pelt for warmth in clothing or other type of covering.

7.1.4.2. Wolf *(Lupus lupus*)

A single first molar found in 'grube 11' at Lausen is the only indication of wolf at all the sites presented here (c.f. tabs. 4-1a; 4-2a; 4-3a and table 7.1.4-1). This context is dated to the early eleventh Century. The length of the tooth (23.31cm) falls into the boundaries observed by Stubbe and Krapp (1993) for wolves from known medieval contexts. The tooth from Lausen is a little above the median value for their data (22.25; n=10). The wolf would have been present in the woods and countryside around Lausen during this period. However, it is likely that the wolf would have avoided the settlements and people unless it was at starvation point. This then suggests that the wolf was either hunted or the already loose tooth was found and brought to the site. The animal would not have been part of the diet of the inhabitants of the region but would have been a concurrence to the agricultural population perhaps feeding on the livestock. This fits well with Cummins (1988, 132), who surmised from the writings of Galton Phoebus, the wolf was a threat to the rural community and was likely to kill animals up to the size of a cow or a horse. Not only was this a problem but it was also a threat to human life, and as such Karl the Great paid a premium for each cull of the animal. Albertus Magnus wrote about the hunting of wolves by baiting hooks with pieces of meat (Pasda 2004, 47). Hildegard von Bingen also wrote about the dangers of the wolf (Reithe 1996, 109) and went as so far as to suggest that even keeping a wolf pelt, hair or bone in the house caused the inhabitants to gladly bicker and argue, which would not bode well for the happiness of the occupants of the 'Grube 11' structure at Lausen. However this text also suggests that wolf fat was good for gout and wolf extract would help with insanity. This then suggests that the hunting of wolf for its pelt would have been seen as inadvisable, which goes against the increasing trading in furs of many species especially in the northern and eastern parts of Europe.

The wolf was shrouded in myth and mystery, during the medieval period, even until today the characterisation of the wolf has negative connotations. Albertus Magnus wrote of the wolf's wiliness and cunning (Pasda 2004, 47). The story of the werewolf is also believed to have it's origins in the medieval (Zimen 1980, 282).

7.1.4.3. Fox (*Vulpes vulpes*)

There is a single mandible fragment assigned to fox, this was uncovered in 'grube 28' and is dated to the ninth Century (c.f. tabs. 4-1a; 4-2a; 4-3a and table 7.1.4-1). The fox would have been present in the countryside around the rural settlements of Reinach and Lausen and perhaps even the urban settlement at Kaiseraugst. The number of chickens, geese and their eggs in the settlements may have attracted them and over time become emboldened enough to attempt to feed on them. However, these hunting raids would have been tempered by the presence of the domestic dogs in the settlements. This then leads to the conclusion that the fox find here was probably part of the natural mortality of a wild animal in the region. Also if they are a problem to society, rather than feared, perhaps they were treated as vermin. This was perhaps due to the fox's nuisance close to the home, unlike the wolf, which hunted the lambs in the fields and hills, away from home causing mystery and fear (Cummins 1988, 141-143).

Hildegard von Bingen argued against the eating of fox as it fed on unclean food, thus it was not suitable for human consumption. However he did advocate the use of fox fat to combat scrofula. The fox was also hunted for its distinctive red pelt as 'the warmth of the animal's fur was ideal for clothing,' according to Hildegard von Bingen (Reithe 1996, 112-113). Although, there are no indications that this was the case at Lausen, more bones in a large concentration would be needed to consider this as a likely scenario. In France and England fox hunting until recently, when it was outlawed in the latter, was a pastime of the social elite, in the rest of Europe it was considered a pest (Cummins 2002, 39). In many literary texts including the Bible, the characterisation of a person or persons as fox-like was to impart a negative view of the subject (Riethe 1996, 149).

7.1.4.4. Stoat (*Mustela erminea*)

There are two fragments of stoat, a third metatarsal and a first phalanx, from the assemblages analysed here (table 7.1.4-1). Both are found in the early eleventh Century fill of 'Grube 11'. The stoat or ermine is a small mammal of the family Mustelidae. Mustelidae also includes other weasels, mink, otters, ferret, badgers, and martens. It eats insects, small mammals, small reptiles, fish, birds and their eggs and young. Although it inhabits northern latitudes, the stoat is built long and thin, the advantage of this shape is that it is one of the few species able to follow burrowing animals into their burrows. It partly compensates for this shape by having short legs, small ears, a fast metabolism and, in winter, thick fur. The stoat's coat is a rich medium brown with an off-white belly. In winter, the coat is thicker and in snowy regions the colour changes to clean white. This white fur is known as "ermine". In Europe these furs are a symbol of royalty. The furs would be sewn together making a pattern of black dots. A version of this pattern is used in heraldry as ermine tincture. Both the animal and the heraldic tincture are symbols of Brittany. The winter ermine has been used in art as a symbol of purity or virginity. In the Renaissance era, legend had it that an ermine would die before allowing its pure white coat to be besmirched. When hunters were chasing it, it would supposedly turn around and give itself up to the hunters rather than risk soiling itself.

7.1.4.5. Polecat (*Mustela putorius*)

Three fragments of polecat were recorded by Huster-Plogmann and Veszeli (n.d.) in the filling of the seventh to eighth Century ‘grube 26’. Like the stoat, the polecat is also a member of the mustelid family. It is mostly carnivorous feeding largely on small mammals such as voles, rats and frogs and toads. They have also been known to eat small birds and insects. It is highly likely that these animals would have been living in the woodland and watercourses close to the settlement. It is most likely that this is a natural mortality of an individual.

Although the first use of polecats are thought to occur around the first Century BC where there hunting skills were used to hunt hare, mice and rats. A domesticated form (*M. putorius furo*) followed either from the steppe polecat or the European polecat. Alongside this Polecats have also been hunted for their pelt, although not as highly regarded as the pelt from their close cousin the stoat (c.f. §7.1.4.4).

7.1.4.6. Badger (*Meles meles*)

A single fragment of badger was discovered in the filling of ‘grube 26’ a pit fill which was dated from the late seventh Century to the late eighth Century (Huster-Plogmann and Veszeli n.d.). Again with a single fragment from this species it is difficult to elucidate a further use for badger here. In all likelihood this fragment is the remains of a natural mortality from the environs of the settlement.

In the past the badger was held in higher esteem than perhaps today with the pharmacies of the medieval and modern times used badger fat against illnesses such as rheumatism. The badger was also known as a universal medicine (Kitchell and Resnick 1999, 1475). It was also known to warn off mischief either by wearing a badger pelt or a badger paw.

The nocturnal badger prefers areas of wooded flat and hilly countryside that has a heavy covering of undergrowth. Their setts give them protection from both man and dogs. Specially bred dogs (dachshund –literally badger dog) were designed to follow the animals down into their sett. Badger baiting and digging have been a big problem and is now officially outlawed in Great Britain. However throughout Europe farmers see the animals as a threat to livestock through the transmission of bovine tuberculosis and hunters argue that the animals are causing problems for the game bird species, such as grouse and pheasant by eating the young and eggs.

Badger would have been prized for their pelt with the contrasting colours of white, black and grey. Today the best shaving brushes and hairbrushes are made from Badger hair. In the past the badger beard would have been a hunting trophy. It is also possible to eat the meat of badger although it can be infected with the trichina parasite as many other wild game species are. Recipes often advise long periods of marinating in sour- or buttermilk before cooking (Kathan 1992).

7.2. Rodents

The analysis of the rodent material has to be carried out in two parts as part of the material comes from hand collected remain (n.=14) and a second portion from the sieved remains (n.=69). Of the 73 rodent elements that have been identified, just 19 could be identified to species and a further eight to genus and one to family. The fifty identified only as rodent elements, all coming from the sieved material, consisted of fragments of long bones and skull that did not contain identifying features with which to further identify them (c.f. 3.6-1 and table 7.2-1). Not surprisingly the material that has been hand collected consists solely of the medium-sized to larger types of rodent, whilst the sieved material includes both medium and smaller rodents in the assemblage. This is due to the fact that larger bones are easier to locate in the soil and thus the hand collected assemblage is biased in the direction of these larger bones, not only in the terms of rodent bones but for all the bones in general. The rodent bone elements represented in the hand-collected material also tend to be those that have a higher density compared to other bones in the skeleton (e.g. femur, tibia).

7.2.1. Squirrel (*Sciurus vulgaris*)

There is a single fragment of squirrel bones from the entire study here. This fragment was recovered from 'grube 20' at Lausen (table 7.2-1). This pit is dated to the eleventh Century. No doubt, this single remain could be present due to the natural mortality of an individual that lived around about the settlement at Lausen. These animals were known to be collected for their pelt and large proportions of such remains may suggest a furriers activity, however this is not the case at Lausen. It is suggested by van Dam (2002, 92) that squirrel pelt was more available than rabbit fur as late as the 14th Century. However, historical sources suggest that squirrel was also eaten as a reference to baked squirrel is noted in the travel journal of Santonio in 1485 indicates (Kugler and Maier 2001, 119). Albert Magnus described the meat as a sweet and full flavour and is digestible (Kitchell and Resnick, 1999 1533). It is unlikely that squirrel formed a major part of the diet, but perhaps on feast days this animal made it to the table of the social elite. However, Kugler and Maier (2001, 119) showed that squirrel was observed in the shopping lists of Monasteries and recipes of the medieval period, so is perhaps more often eaten than is recognised but perhaps within the realms of a higher social class. There are also possible archaeozoogical references to the consumption of squirrel in the region (Marti-Grädel 2008, 152; Rehazek and Nussbaumer 2006).

7.2.2. Mole (*Talpa europaeus*)

The presence of mole is observed in both the rural Reinach and Lausen settlements but not in the urban settlement of Kaiseraugst (table 4-1a). There are five fragments of mole in total at all sites. Four of these come from Reinach, three fragments, two mandibles and a scapula, from the seventh Century fills in the 'Altebrauerei' region and a single scapula fragment from early seventh Century fills of the 'Stadthof' area. The single skull fragment in Lausen is also dated to the late sixth to seventh Century period in 'grube 50'. There is no evidence of butchery or cut marks that can further elucidate an intended use, if any by the inhabitants of the settlements. This suggests that the individuals are probably part of a natural mortality of the animals that inhabit the countryside around these settlements. Hildegard von Bingen suggests that the meat of mole is not suited for human consumption. However it can be used for medicinal purposes (Riethe 1996, 75-76).

It is also possible that these animals are intruders into the contexts here from later periods or possibly even modern times. However, the suggested sealed nature of the contexts counters the argument of this later intrusion. Also if these bones were modern then it is more likely that at least a large portion if not a whole skeleton would be found, rather than the specific elements noted here.

7.2.3. Meadow Voles (*Microtus* sp.)

These stout rodents have short tails, legs and ears. The latter are giving the name to this genus. These animals inhabit grassy areas and feed on green vegetation, such as grass and sedges in the summer and grains, seeds roots and bark at other times of the year (Musser and Carleton 2005, 894). They also hibernate during the colder months sometimes up to six months in cold spells.

There are twelve fragments from *microtus* species found in the excavations here (table 7.2-1). Ten of these are identified in the sieved remains from the sixth Century 'Gemeindezentrum' area of the Reinach excavation. The two remaining examples are found at Lausen and both come from the eleventh Century pit fills ('grube 10 and 45'). These hand collected bones are represented in both cases by a femur and thus are cannot be further identified to species. Three fragments of maxillary bones containing teeth from the sieved remains could also not be further identified. However, two species could be identified from the teeth and mandibles from this material. They were the common vole (*Microtus arvarlis* Pallas) and field vole (*Microtus agretis* Pallas).

7.2.3.1. Common vole (*Microtus arvarlis*)

There are, from the sieved remains, six specimens of the common vole identified based on tooth morphology. The common vole has a primary habitat of meadows, heath lands and fallow land. They are also found on agricultural land, it secondary habitat, where it will feed on crops grown in their home range. This then is probably the reason that these creatures are found in the Reinach material. Stored grain from harvest would have been tempting and plentiful supply of food for these animals.

7.2.3.2. Field vole (*Microtus agretis*)

Just a single specimen of field vole is identified in the sieved material, again through its dental morphology. The field vole prefers grassy habitats such as woodland, marsh and river banks. They are a common prey for owls so are often identified in scats. However other birds of prey, adders, foxes, boar, stoats, weasels and polecats will also prey on this and other forms of vole. Dogs and cats that are present in the settlement would probably also have preyed upon these rodents when caught in and around the settlement. Again these would have probably entered the settlement to look for food sources such as stored grain and other cultivated plants, fruit and vegetables.

7.2.4. Field Mice (*Apodemus* sp.)

Ten exemplars of field mice have been identified in the excavations in this study (table 7.2-1). Three of these specimens come from the hand-collected remains from Lausen and seven from the sieved remains at Reinach. All the specimens from the sieved remains have been identified to two species, the yellow-necked mouse (*Apodemus flavicollis*) and the wood mouse (*Apodemus sylvaticus*) through tooth morphology. However, only a single specimen from Lausen could be assigned to species by this method. The other fragments (n.=2) consisted of long bone elements which were difficult to further identify. The two species identified here are difficult to separate by phenotype alone although they have specific tooth morphology as with other species of rodents. The hand collected long bone elements are those that are more dense and robust by nature.

7.2.4.1. Yellow necked mouse (*Apodemus flavicollis*)

There are two identified teeth relating to the yellow necked mouse from the sieved material at Reinach and a single tooth from the 'grube 11' in the early part of the eleventh Century at Lausen. These are nocturnal animals that do not hibernate over winter. They are most frequently found in mature broad-leaved woodland but have also been known to inhabit buildings in rural areas, orchards, hedgerows and field margins (Macdonald and Tattersall, 2001). They feed on fruit, seedlings, buds and invertebrates. This diet then suggests like the other rodents mentioned above that they would be living in close proximity to the settlements, maybe even within them and thus under darkness attempt to find grain and other stores of food stuffs. These animals may have also been brought into the settlements by dogs and cats that have been hunting around the settlement boundaries.

7.2.4.2. Wood mouse (*Apodemus sylvaticus*)

Five tooth fragments solely from the sieved material at Reinach give evidence of the wood mouse. These animals, like the yellow-necked mouse are nocturnal creatures that do not hibernate over winter. They inhabit a wide variety of habitats from woodland to agricultural land, though they prefer hedgerows and have a diet similar to that of the yellow-necked mouse. This then suggests that these animals are either coming in to the settlement to find food or that they may even be commensal and living in the buildings of the settlement. Wood mice are also extensive burrowers and thus could be part of a modern infiltration of the archaeological levels. However, the sparse nature of the number of elements perhaps suggests this is unlikely.

7.2.5. Water Vole (*Arvicola amphibius*)

The European water vole (formerly designated *Arvicola terrestris*) is identified in two contexts in the Lausen material. The earlier specimen is found in 'Grube 56' from the sixth to seventh Century, and a later examplar from 'grube 10' in the eleventh Century. This animal inhabits the banks of rivers, ponds and other waterways and is mainly herbivorous, eating grass and other waterside vegetation. This creature is generally timid and prefers the coverage of the lush river vegetation. Whilst the Birs valley in which Lausen sits has the Birs River running through it is difficult to envision this animal coming in to the settlement of its own accord thus, it is likely that it was brought to the settlement by a cat or a dog living in the settlement. Perhaps this animal was caught in a trap designed to capture other riverside animals.

7.2.6. House mouse (*Mus musculus*)

House mice thrive under a variety of conditions. They are found in around homes and other structures, as well as in open fields and agricultural lands. Mice are mostly active at night and feed on plant matter. House mice have been known to live alongside humans in Europe since about 1000 BC and it is often argued (e.g. Clutton-Brock, 1999) that the domestication of the cat was to combat house mice numbers. This is partially also due to the damage caused by feeding on harvested grain. Again this is the likely reason that the house mouse is represented, by two fragments of tooth, in the sieved material from Reinach (table 7.2-1). The house mouse bones are likely to be too small to be found amongst the hand-collected material.

7.2.7. Rat (*Rattus* sp.)

There is a single specimen of the rat genus identified from the hand collected remains in the eleventh Century pit ‘grube 20’ at Lausen (table 7.2-1). This is a medium sized rodent and thus the femur would be relatively easy to find. The only species of rat that are found in Europe are the Brown or Norwegian Rat (*Rattus norvegicus*) and the Black Rat (*Rattus rattus*). These animals would have been and still are commensal with humans. They cause a wide range of damage to structures and food supplies. The storage of grain and other foodstuffs is the likely reason for the appearance of rats in the Lausen material

Wild rats can carry many different zoonotic pathogens, such as e.g. Leptospira, *Toxoplasma gondii* and Campylobacter, and may transfer these across species, including to humans (Meerburg, Singleton and Kijlstra, 2009). The Black Death is traditionally believed to have been caused by the micro-organism *Yersinia pestis*, carried by the Tropical Rat Flea (*Xenopsylla cheopis*) which preyed on Black Rats living in European cities during the epidemic outbreaks of the middle ages; these rats were used as transport hosts. Today, this cycle still exists in many countries of the world and plague outbreaks still occur every year. Besides transmitting zoonotic pathogens, rats are also linked to the spread of contagious animal pathogens that may result in livestock diseases such as Classical Swine Fever and Foot-and-mouth disease. The human population would have undoubtedly considered these animals a pest. The rat population was likely kept down by the presence of dogs and cats with in the settlement at the time, as large numbers of rat bones are not found at any of the sites.

Rats are edible by humans and are sometimes captured and eaten. Reasons as to why rat meat is not more widely eaten includes the strong proscription against it in Halal and Kashrut tradition, also in Christianity (c.f. Leviticus 11:29) rats are prohibited as food. The fact that rat is not socially accepted in many cultures as a food source is another reason why it is not widely eaten. Another argument against eating rat is the risk of Weil's disease.

7.2.8. Dormouse (*Gliridae* fam.)

There is a single incidence of *Gliridae* in the material studied here (table 7.2-1). It is found in the seventh Century fills of ‘Grubenhaus A’ within the Stadthof area of the Reinach excavation. A single femur represents this animal. Dormice are omnivorous, typically feeding on fruits, berries, flowers, nuts and insects and are mostly arboreal and nocturnal creatures.

The edible dormouse (*Glis glis*) was considered a delicacy in ancient Rome, either as a savoury appetizer or as a dessert dipped in honey and poppy seeds and is mentioned in Petronius' *Satyricon*. The Romans had a special kind of enclosure known as *glirarium* used to rear dormice for the table (Holden 2005, 819-841). Dormice to this day are eaten in Slovenia. Dormouse hunting season lasts from late September until the first snow, and each hunt is a ritualized event that involves setting traps and waiting all night. This is today a more social event than ritual but there is a mythical significance too, in that the devil himself is said to be a shepherd of dormice (Freedman, website 2). It is, however unlikely, that the specimen represented here is part of the diet and more likely the prey of hunting cat or dog that was living in the settlement.

7.3. Wild Birds

7.3.1. Stork (*Ciconia ciconia*)

The remains of stork are found only at Lausen and then in a single pit filling from the ninth Century ('grube 28') (table 4-3b). The remains are mostly wing bones yet there is also proof from the skull (Fig. 7.3.1-1). There is evidence that the remains come from at least four different individuals, this being calculated from three left ulna bones of adults and a juvenile individual. Stork were widespread throughout Europe in the time span studied here, thus it is likely that the storks represented here inhabited the settlement for at least part of the year. The presence of the juvenile bone suggests that this individual died or was killed during the summer months after fledging. It is unlikely that stork played a role in the diet of the people at Lausen, due to the superstitions that followed the bird (see below). There is no evidence of butchery on the bones and the animal was so steeped in folklore, myth and legend from much earlier times that it probably was not considered as food; also biblical edicts banned the consumption of Stork.

However despite the widespread population of stork in Europe and the close contact with the people, the archaeozoological finds from this species is rare. The superstitions and taboos perhaps protected the animal in some way. These perhaps raised the status of the animal in the eyes of the population thus perhaps the bones found at Lausen have a symbolic meaning, as the stork is the symbol of the Alsace today. Maybe they were a decorative wall hanging, as can be observed at other times with other birds (Serjeantson 1997, 257; Parker 1988, 201), maybe they were just the simple act of natural mortality. Despite this, such a large number of stork bones from a single context is an important find and needs further analysis as to how this fits with the evidence of stork from the medieval period throughout Europe. There is evidence of a stork wing at *vicus viturdurum* in Oberwinterthur (Morell, 1991). Examples of other finds can be found in southern Germany at Unterregenbach (Kühnhold 1971), Wülfingen (Hartl 1971, 45) and at Constance (Prilloff 2000, 195-196).

This taboo on the consumption of Stork did not deter people as (Gesner 1669, 144) described the meat from a young stork as soft and juicy. Although Gattiker and Gattiker (1989, 543) noted that various literary sources suggested that the meat of stork was suited not for human consumption and that it was hard and not tasty, and that stork flesh had similar problems to that of crow, another food banned as taboo in the Christian world. Despite stork's absence from the menu of the people throughout Europe, there is a wide range of medicinal products that were made from various parts of the stork's anatomy to cure various disease ailments and conditions. The physicians in the classical world knew the healing powers of the stork's stomach against all poisons. Pliny (*nat. hist. 8,4*) also noted that storks used marjoram when they were ill. Gattiker and Gattiker (1989, 543-546) cover the whole gamut of medicinal use to which the stork and fledgling storks were used in the medieval and later periods. Stork ointment was a common favourite that was thought to cure pestilence and gout.

The stork was present in much of Europe throughout the time period here although they were not known in Medieval Great Britain (Gesner 1669) and is absent from the archaeozoological record in Scandinavia before the post Medieval period (Ericson and Tyrberg 2004). However there is a single find of stork bone in Roman Silchester in Great Britain (Parker, 1994 table 2), which either suggests the presence of stork in the wild or an imported part of an individual, such as the later trade in wings of raptors (§7.2.4).

There is also a great deal written about stork in many languages throughout Europe these include factual and mythological texts from Pliny in the first century AD (*nat. hist. 8,41; 10, 31-32*) into the medieval period with (Gesner (1669). Although care must be taken when referring to ancient texts as often storks are included as, or mistaken for, cranes, which in the medieval was considered a regal bird; herons were also often grouped with these birds.

Pliny the Elder (*nat. hist. 10, 31-32*) wrote about the migration of stork in the first Century AD, stating that they arrived and left at night on a certain day with no one knowing where they had come from or where they went. He also noted that storks are highly territorial, returning to the same nest each year and that the young birds would care for their elderly parents. This is perhaps in reciprocation to the care received by the young fledgling by the brooding parents as noted by both Pliny and Isidore of Seville (*Etymologies 12, 7:16-17*). This latter text also noted that storks flew across to Asia proceeded by two crows, although this is perhaps recanted from reading earlier Latin or Greek texts, although the source of Isidore's idea was not found by this author in any of the more well known classical literature. In Great Britain, Bishop Aldhelm of Sherbourne (Lapidge and Rosier, 1985) also wrote about the Stork in his Enigmata of the seventh Century. It is in Enigma XXXI that stork is mentioned for their ability to kill snakes. This particular skill is also referred to in allegories and morals, which state that as the stork is the enemy of the snake so the righteous should be an enemy of the 'snakes' of evil thoughts. Alongside this the distinctive clashing of the beak was likened to the 'weeping and gnashing of teeth' of those proclaiming their guilt at confession. Biblical directives on food in Moses (3:11) forbid the consumption of stork, similarly to bat and heron. This taboo was passed down into the Middle Ages. Although there were also may superstitious reasons that the stork would not have been killed and eaten in the medieval.

Aeneas Sylvius (Gattiker and Gattiker 1989, 527) writes in a letter to Cardinal Julian de St. Angeli in 1438 regarding Basel and the stork population; that the storks are mostly left to come and go as they please as the people of the city believed that interfering or hunting the storks and their young will 'bring fire to the houses'. The superstitions over the stork is also reiterated by Leopold Cysat the official city writer of Luzern in the 17th Century, although even more severe, it was thought that if a man killed a stork then they could count on themselves being killed.

Many such other superstitions are linked to stork throughout Europe. One such story suggests that a pair of storks nesting on a house will protect it from a lightening strike, and if this pair does not return then there is an increase risk of strike in the house (Gesner 1669). This was so widely held that people would facilitate the storks in building their nest by adding a wagon wheel to the roof of the house, even to today in Bern and places in France the tradition continues. It was also thought that the stork would pay it rent for nesting on a building, the first year a feather, the second an egg and the third an offspring and as such would throw the first born from the nest as payment to the Landlord and dwellers of the property (Gesner 1669).

The stork is also related to the Germanic goddess Holda, goddess of housewives ('hausfleisses'), good manners and love and it is probably due to this relationship that the belief in the stork as the child bringer is based (Gattiker and Gattiker 1989, 533). Stork as the bearer of children is not known in the classical world before this point (Lenk 1966, 380-381).

In Kuraviya, Eastern Pomerania, the stork is replaced in winter by the crow as the child bringer. However, in Switzerland in earlier periods the stork did not bring children. This myth was not adopted until the turn of the century and most likely came from Germany (Gattiker and Gattiker 1989, 533).

Storks are also represented in the farming calendars of the medieval period. In Basel the belief was that if stork migrated early then one would expect and early winter, if however the stork waited longer before migrating then winter itself would also wait. This meant that a late spring would also be expected. These farming rules varied from place to place For example, if the stork returned dirty and late in spring then it was believed in western Germany that it would be a bad year (Gattiker and Gattiker 1989, 541). Cummins (1988, 191) also makes reference to the hunting of storks with falcons, although with the superstitions that the protected the stork this was perhaps a rare activity.

7.3.2. Passeriformes

The small-unidentified passerines that have been noted here are all found with in the fills of the fourth to sixth Century levels of the 'Jakobli-Haus' site at Kaiseraugst (c.f. tabs. 4-1a;and table 7.3.2-1). These small songbirds are particularly difficult to elucidate to species due to their similar morphologies. Many of these passerines would not have been resident in the larger urban conurbations of the time period studied here, as they are today. This fact means that these birds must have been actively hunted either as food dishes or for collection as pets. It was known in the Roman period and in the medieval period that these birds were caught and kept in cages for their songs (Parker 1988, 203). Alongside this it is also known that they were considered to be part of the diet. Archaeozoological data from Altenberg (Marti-Grädel 2008, 193-194) exhibits marks of fine butchery that suggest these birds were eaten in the region. However it must also be noted that there was an indigenous population of these birds and it is more than likely that all or part of these collections of small songbirds is due to the natural mortality of the wild population.

Hildegard von Bingen (Portmann 1997, 417-419) wrote that sparrow (*Passer domesticus*) was a good foodstuff for both the healthy and sick man because the meat was soft, likewise the Yellowhammer (*Emberiza citrinella*) had good meat due to its feeding on pure and bitter foods (Hildegard von Bingen in Portmann 1997, 426). Medicinally, it was used against jaundice because of its colour (Gattiker and Gattiker 1989, 48). Similarly Hildegard von Bingen (Portman 1997, 419) wrote that the tits (*Parus sp.*) were also good food for both healthy and sick alike due to their healthy flesh and liking of clean air. The text suggests that those suffering from gout should boil the tits in water and butter to make a soup; this should then be eaten often to have a healing effect. The hunting of these small birds would have required very fine and a small mesh nets or specialist traps to catch such small birds.

7.3.2.1. Turdidae

This family represents the blackbird (*Turdus merula*) and thrushes (*Turdus sp.*) and again as with the passeridae, there is great difficulty in distinguishing the species from each other with single elements. Blackbird (*Turdus merula*) are absent from urban settlements in large numbers until the twentieth Century instead prefering their natural habitat of the forests of Europe (Pasda 2004, 101). There is a single fragment of this family found at the 'Jakobli-Haus' site in the fourth to sixth Century levels. Similarly to the passeridae they may have been caught as food for the table or as a decorative and vocal addition to the home (Parker 1988, 203).

Hildegard von Bingen (Portmann 1997, 419-420) described the blackbird as good for healthy men but the flesh is too dry for those that are sick. In addition the drying of the liver, storing it in a bone and carrying it about ones person will protect you from the horrors and illusions of the devil because He hates the purity of the blackbird. Unlike other birds of black plumage the blackbird was not seen as an unlucky or evil bird (c.f. §8.2.2.2). However, the blackbird was considered a sacred yet destructive bird in Greek mythology (Cooper 1992, 38). Whilst commenting on thrushes Hildegard (Portmann 1997, 420) wrote that when cooked and eaten and in the form of a compress, the thrush helps against colds and the liver will prevent pain in the lungs. The fieldfare (*Turdus pilaris*) was held in greater esteem than the other thrushes although it was best to eat in the autumn whilst it was feeding on fruits from the forest rather than only insects, which makes the flesh tasteless (Pasda 2004, 101).

7.3.2.2. Corvids

The corvids are found at all three sites studied here (table 7.3.3.2-1). There are three fragments of corvid from Reinach all dated to the twelfth Century, with two from the 'Gemeindezentrum' area and the other from the 'Stadthof' area. All three fragments are from leg bones. There are similarly three fragments found at Lausen. One fragment each found in the levels dating from the late seventh to late eighth ('grube 65'), the ninth Century ('grube28') and the early eleventh Century ('Grube 11'). There are nine fragments of corvid found in the Kaiseraugst site all from the 'Jakobli-Haus' area and all except one are found in the fourth to sixth century fills. This exception is humerus occurring in the fifth to late sixth century layers. The difficulty in distinguishing the members of the corvid family (c.f. §4.1.1 and Tomek 2000) meant that only one individual could be identified to species level that being an example of crow (*Corvus corone*) from fourth to sixth Century fills from Kaiseraugst. The rest have been identified either to only corvidae, to the Corvus genus, or a group of the corvid family e.g. Corvus corone/cornix.

It is no doubt that they were present in the town and urban centres of the late Roman through to the medieval period due to the large amounts of domestic refuse that would have been produced by such centres of population.

Hildegard von Bingen (Portmann 1997, 406-407) writes 'that corvids are cunning, bold and not afraid of man. The flesh of the bird was not good to eat as the bird had the characteristics of a thief and a robber. The feathers of ravens smelt a great deal and this is supposedly because the meat of the bird also tasted unpleasant.' Gattiker and Gattiker (1989, 162-163) also attest to the medieval belief that the crows and ravens were 'thieving riff-raff'. They were also known as harbingers of bad luck. The corvids were also known as the animals of the executioner, graveyard and the slaughter field. In Switzerland and the Alsace, these birds are known as the gallows birds ('Galgenvögel'). Also they are linked to the search for eternal youth due to their relative longevity (Gattiker and Gattiker 1989, 156).

The president of the zoological society in Paris wrote in 1870 (Pasda 2004, 104) about the delicacy that was crows and the well-known making of raven soup. Kathan (1992, 43) also noted that crows were prepared like partridge and also commented that the eggs were eaten but they were not often as good as those of lap-wing.

In Christianity, white birds represent or were symbolic of the sinless, whilst the black birds were synonymous with criminals. However, there are incidences of white corvids. These albino birds were a symbol of rarity and the unprecedented. Juvenal (Gattiker and Gattiker 1989, 153) suggested that these birds were an indication of an exceptional man and also a princely status symbol. However, contrary to this there is a piece of stone work in a church at Kastelburg in Oberpfalz, Germany. The stonework depicts the Earls Friedrich, Berenger and Otto and Berenger, who died in 1125, having a raven in his left hand. The stories suggest that the bird brought a golden ring to the Earl that financed the building of the cloisters at the church.

Hildegard von Bingen (Portmann 1997, 407) also writes that corvids should not be used as medicine, like any other bird or animal that has the cunningness of man, as it will not act as a healing agent but the opposite acting as a criminal in society.

7.3.2.3. Jay (*Garrulus glandarius*)

There are four fragments of jay from the sites covered here, three from the 'Jakobli-Haus' site at Kaiseraugst, from contexts all dated between the fourth and sixth century, and a single find from the eleventh Century 'grube 45' from Lausen (table 7.3.2-1). The jay is a forest dwelling bird and perhaps is the least likely of the corvidae to move away from this environment. It would not be uncommon to find this species within the waste of such settlements as Kaiseraugst and Lausen due to their proximity to such forest environments. This suggests then that the finds in these sites are no more than the natural mortality of birds that are present around the settlement perhaps attacked by the domestic dogs and maybe even cats. However it is possible that this species was also eaten. Though a member of the corvid family, which as mentioned above were taboo, the brightly coloured plumage of this bird probably set it apart from its near cousins.

7.3.2.4. Woodpeckers (Picoides)

There is a single incidence of the woodpecker family (*picoides Sp.*) being represented in the faunal material (table 7.3.2-1). This comes from the material dated to the fourth to sixth Century at the 'Jakobli-Haus site in Kaiseraugst. The woodpecker by its nature is linked inextricably with the forest. It is impossible to say whether this bird was part of the diet although it is unlikely, due to the few remains that are found here. The proximity of the settlement to the forest probably suggests that this is a natural mortality of a bird resident close by. Gesner (1669 p125) suggests that woodpecker could be used medicinally to fight exertnal and internal haemorrhoids by applying a dead salted woodpecker ointment over the affected area; this follows the teachings of Aetius.

7.3.3. Grey Partridge (*Perdix perdix*)

Three bone fragments of partridge, all of which were found in the ‘Jakobli-Haus’ site at Kaiseraugst, and are dated between the fourth and sixth Centuries (table 7.3.2-1). The habitat of these birds was originally a steppe environment, however the partridge seemed to benefit greatly from the opening up of the countryside during the medieval (Beneke 2000, 56). Hildegard von Bingen (Portmann 1997, 402) wrote that the bird was not thought to be healthy to eat because it did not benefit the healthy man and the sick would make worse but it was recommended that partridge fat was good for lice. Gattiker and Gattiker (1989, 402-404) concurred that partridge was a good medicine for different illnesses and bodily changes. Albert Magnus (Pasda 2004, 93) also wrote about the ‘well known’ partridge, suggesting that it should be domesticated following the example of Karl the Great who adopted a similar idea. Remains from the kitchen at Augusta Raurica included partridge among fifteen other wild species of bird and were no doubt part of the diet (Schmidt 1969; 1972). So despite the misgivings of Hildegard von Bingen, they were almost certainly eaten in earlier periods and most likely in the periods studied here. Partridge being a low flying species was probably caught using fine nets in places that the birds were known to inhabit frequently. Communal drives or round-ups may have also been used to funnel the birds in to such traps (Parker 1988, 203).

7.3.4. Waterfowl

The only identified species of waterfowl was the duck. A total of six fragments were identified in all sites and time periods (table 7.3.4-1). Three fragments being recorded at Kaiseraugst and three at Lausen. The mallard was known to have been domesticated in medieval times and it is possible that they were kept in a similar fashion to chicken in the Roman period (Parker 1988, 203). Interbreeding amongst wild and probable domestic species is also a problem that occurs so as suggested above all duck here have been labelled as wild.

That along with the relatively sparse remains and the fact that all the aged fragments represent adult birds suggests the individuals represented here are likely to be wild birds. There is no indication of butchery practices and most bones were complete. This suggests that hunted individuals were sold and possibly cooked whole in a similar manner to poultry. Ducks could have also been an important source of eggs and feathers although the suggestion that these birds are wild negates the idea of a widespread demand. The dabbling ducks are quite catholic in their habitat preferences and are likely to reside wherever aquatic vegetation and waterways are found. The river running bordering the Kaiseraugst site would have provided a perfect habitat for these ducks, thus making them easily accessible to the inhabitants of the site. These wild birds would have been caught using a wide array of nets, traps and snares alongside many other means of catching birds. Drives and round-ups may also have been used and formed an important part of the social calendar that involved the whole community (Parker 1988, 203). Though until today there are no known items in the late roman and early medieval archaeological record that could be considered as fowling equipment.

7.3.5. Birds of prey (table 7.3.5-1)

7.3.5.1. Common Buzzard (*Buteo buteo*)

There are only three observations of this bird of prey, the common Buzzard (*Buteo buteo* L.), in all the faunal assemblages in the study. These occur perhaps surprisingly at Kaiseraugst (n=1) and Reinach (n=2) during the sixth and seventh Centuries respectively, the two elements found at Reinach are likely to be from a single individual. It is highly unlikely that the any birds of prey were part of the diet, although (Parker 1998, 204) suggests that buzzard was served at the table in some places. This species identified at both Kaiseraugst and Reinach is widespread throughout Europe in the wild and parts of Asia and Africa in a variety of subspecies. In Europe they are often found in forested areas, ideal for their nesting requirements. This type of environment would probably have been observed around Reinach and perhaps Kaiseraugst at the time frame considered here. So these finds could be the result of the natural mortality of a wild bird living close to the settlements. However, the elements represented here are wing bones, again as with the stork and leaving taphonomic destruction aside, this could be because only the wing bones are being brought to the settlements. This would fit well with the evidence of Mulkeen and O'Connor (1997, 443) that wings of raptors are being transported throughout Europe for the trade of feathers especially in the use of fletching. The common Buzzard during the medieval periods was also known as a hunting bird of the lower classes. So it is possible that this individual is a trained hunting bird used for sport by the wealthier inhabitants of Reinach and Kaiseraugst, perhaps to distinguish themselves from the rest of the society in these settlements, although the dates of the contexts from which these birds come, are a little too early as falconry was believed to have been practiced by Germanic people from around the seventh Century (Müller 1993 432-433). However, there is earlier evidence of Falconry in China and Japan at an earlier time. It is believed that the practice of falconry travelled west through time, although evidence is sparse and questionable (Müller 1993, 432). There is no evidence of raptors at the higher status site of Lausen. It should be considered that birds of prey maybe more likely at Lausen as the training and hunting with falcons is commonly associated with the upper echelons of society during medieval times.

7.3.5.2. Tawny Owl (*Strix aluco*)

There is just a single occurance of owl in the assemblages studied here. This is an example of tawny owl from the sixth to seventh Century dated 'grube 56' at Lausen. It is highly unlikely that this bird played a part in the diet of the people at the site. However they were used for medicinal purposes, for example as an ingredient against gout (Gattiker and Gattiker 1989, 340). It is possible that owls could have been used as a falconer's bird (Schwenk 2000, 1810). Which given the status of the site is a possibility although as stated above, the dating of the find is a little to early in the development of falconry to be likely. More over it is like to be a natural mortality of an individual that was either using barns or other uninhabited houses around the settlement or residing close to the settlement. The tawny owl like other owls is often seen as an omen of bad luck, this is perhaps to do with its nocturnal activity and its hooting calls (Armstrong 1958, 114). Virgil uses a vision of an owl as a premonition of Turnus' death in the Aeneid (Book 12 trans. Lombardo). Today it can still be observed in many countries that owls are nailed on to houses and stables to protect them from illnesses, unholy and magical forces.

7.4. Fish

The bones of fish are very small and fine and the lack of sieving in the excavations means that very few fish remains were found at any of the sites studied here. This also means that the fish remains that are found will be biased towards the larger species. This is very evident from the data (table 7.4-1). Also the small bones from smaller fish species are less likely to be preserved in the soil due to the greater effect of attrition by destructive taphonomic forces in the soil. Selection of certain sizes of fish and the method by which the fish are caught and even the use to which the bones of certain species are put after death can affect the range of fish species found even before the post depositional forces take affect.

The consumption of fish was an important part of life in the early medieval period and therefore the catching, preparation, storage and cooking played an equally significant role in everyday life (see Rippmann 1994). It is also noted that fish and fishing played an important part by the need to make numerous references to fisheries in the Domesday Book.

Much of the archaeological evidence for the consumption of fish has come from latrine and soil excavations of sites from the period. There is also a wealth of evidence, through manuscripts, carvings and 'fishing' artefacts, to establish the fact that fishing took place. It is by making use of these two major areas of evidence that we are able to piece together exactly what varieties of fish were eaten and how they may have been caught.

It was also quite common to see, until quite recently, a much wider acceptance of the eating of a much wider range of freshwater fish: roach, bleak, perch, pike, carp, gudgeon, to name but a few. It was perhaps the clean, fresh, free-flowing rivers teaming with an abundance of aquatic life. The rivers were a natural larder that supplied fresh sustenance throughout the year.

7.4.1. Fishing Methods

There are many techniques used for catching fish in the medieval period, line and hook, fishing traps and weirs, nets and also the use of spears has been noted. In the archaeological finds from Switzerland, there includes fishing equipment such as hooks, net floats and fish spears, as well as evidence from wooden framed traps with netting.

The use of hook and line to catch great quantity of fish is an unproductive method to use. However, this is a method that was used in the early medieval for many of the same reasons as it is used today: it is less demanding upon materials. Today the sporting fraternity mainly employs the use of rod, reel, line and hook, whilst the early medieval period the use of hook and line was part of the livelihood. Although there is some evidence to suggest that reels were not in common use until late 13th-early 14th century. There is, however, a Byzantium illustration depicting what appears to be a fishing rod or pole. It is, of course, possible that the use of lengths of wood to aid in the practice of fishing actually took place, but this has not been documented as being a common exercise.

Of the many hooks that have been discovered from the period nearly all have been relatively large compared to modern hooks. This might suggest that the smaller hooks would be more difficult to unearth and would also be more likely to disintegrate during the passage of time, perhaps only the larger species of fish were sought with this method. The hooks tend to show a simple round bend design with either an open eye or a spade end and have been made from iron (Ginella and Koch 2006 fig. 59). The actual design differs little from that of hooks that were used by the early Romans. The barb seems oversized by today's standards but this may be due to the need to keep the fish secure on the line whilst 'long-lining' or perhaps because it is, as experimentation has shown, by far the most difficult part of producing a hook.

The line itself would have to be strong, not too effected by water and easily obtainable. It is still unknown as to the exact material that would be used to make fishing line, though there is some suggestion that nettle or Salix (ivy) hemp possesses the right qualities to be used. These fibres would be spun in a similar way to flax or wool. The resulting 'yarn' would then be used in the making of fishing line, nets and bowstrings. The two main methods employed with a hook and line were simple hand lining for single fish and long-lining. The tackle used for simple hand lining is basically an iron forged hook, nettle-hemp line and stone weight for a sinker. This method would be useful for catching the larger fish in enclosed waters, rivers and from the seashore. Long-lining involves, as the name suggests, a long line to which several hooks are attached to by short snoods. The line could be fixed to solid points at low tide and baited at the return of the following low tide the fisherman would then go and collect the caught fish. This method gave the fisherman the opportunity to set out more than one long-line, in different locations and without too much concern for weather conditions. Long-lining could also be carried out from a small fishing boat where the line could be either floated upon the surface for top-feeding fish or sunk to the bottom for bottom-feeding fish.

The catching of fish on a larger scale involved the use of fishing nets and from evidence of finds at Birka (Wigh, 1997) and Ribe (Müller-Wille, 2002) these were also made from nettle-hemp. The construction of fishing nets is similar to that of recent years. The netting needle can be made out of wood, bone or antler. It would also appear that the nets that were made were not exclusively for the use of fishermen, they would be used for trapping and be a convenient method as bags for storage and carriage. The size of the mesh determined the size of fish that could be caught, with a wider mesh selecting only fish above that mesh size, whilst allowing smaller fish to swim free. Conversely a smaller mesh would have been much less selective. There are collections of fish remains that show such selectivity of larger fish.

Lead weights have been found that have been attributed as net sinkers from a Roman harbour in Mainz (Ginella and Koch 2006, fig. 56). There are also examples of stone being used. These weights would have had a hole or holes bored into them and help, with the aid of buoyant floats, keep the net vertical in the water. There is evidence of net floats from the Zugersee (canton Zug) (Bossart and Flockart, 2006, figs. 87 and 88) dated to the tenth Century. An alternative style of net sinker has been found at Hedeby in Northern Germany, where the sinkers were not holed but tied to a pole and secured with a length of bark. Nets would have been used to net off sections of rivers or even complete rivers to trap migratory fish such as salmon, trout and sea trout. They may also have been used to section off breeding areas as the Romans did a few centuries earlier.

Little has been recovered in the way of wicker fish traps, although there appears to be such an example from a Roman context in Valkenburg (Ginella and Koch 2006, fig. 72) also a find from the tenth Century Zürichersee (Amacher 2006a fig. 78). However, they are referred to in Anglo-Saxon texts and from illustrations from the period. The traps would have mainly been used in flowing rivers and tidal estuaries to catch all manner of fish including eel, salmon, trout, dabs, and flounders. The Roman example above is approximately 100cm long, there is a spiked opening of about 4cm, which would allow entry but not exit. It is likely that these traps were flat bottomed to allow it to lie on the river or sea bed without rolling with the current or tide. For eels it would need to be baited with a dead fish, this would attract the carnivorous eel into the funnel and once inside, they would find it difficult to escape. There are examples of multi- and single chambered fish traps with the later most likely in use in the early medieval period. The main advantage of these traps was that smaller fish could be caught, there was little danger of the fish swimming away from them as in the case with a net and they were relatively easy to maintain. The traps themselves would be made from willow that had been cultivated for at least three years. In the early medieval period the majority of the basket work was functional and there was no need to add extra work to the making of fish traps and baskets. To weave the willow it would need to be soaked so as to make them pliable, they would need to be left to soak overnight.

Similar but much larger structures are seen in many places throughout medieval Europe. These fish weirs would have funnelled a multitude of fish from up stream or on the tide using wattle fences as a barrier to escape. The fences were laid out in a series of V-shapes with nets at the apexes. There is an example of such wicker fencing that is thought to be fish weirs in a ninth to tenth century context from Steinhausen in canton Zug (Bossart and Flück 2006, figs.

85 and 86). These would have yielded a large supply of fish perhaps too many for a single community, suggesting that the trapping was carried out for commercial purposes. The fish caught in these traps would have been salted, dried and, presumably, sold to other communities. There are also references to 'fish factories' in the Domesday Book, one of which has though to exist in York, Northern England.

A number of fishing spears has been identified and these have taken a number of different styles depending on the period and function. Some very large specimens of four pointed harpoons have been found in a Roman site in Haut-Vully (FR) (Ginella and Koch 2006, fig. 65). The type of fishing that would have taken place with the use of spears would have involved the larger top-feeding fish and mammals. The finer spears would have been used for fish such as salmon and eel. Eels were a favoured fish of the period and these could be caught by spear too. During the winter months the eel buries itself into the mud together with other eels. By using a spear one can poke around into the muddy bottoms of river or estuary until an 'eel nest' is located. This method would yield a large number of eels in a single trip. There are examples of larger and more robust spear but these would probably have been used in a marine environment to hunt for species such as whale, porpoise, and seal. It is possible that in a riverine environment sturgeon were also hunted with these much larger spears.

7.4.2. Fishing trade

Although it can be seen from the fishing techniques above that large scale fishing did take place in Europe and as such it must be remembered that the site the fish remains are found are not necessarily the place of capture. Since the techniques of preservation of fish by salting, smoking or drying were highly advanced transport over a wider area was possible. In terms of fish remains, the transport of fish is difficult to prove except where exotic species are found or where a species that requires an environment different from that found locally. All the fish finds collected from the sites here, can be found in a relatively close proximity to the sites.

The trade of the fisherman was not held in high esteem. In Basel and Zurich in the fifteenth Century, the fisherman were often found in the lowest tax class and in Basel also lived in the poorest part of the town and close to the Rhine (Amacher 2006, 100-101). However, in the later part of the Medieval almost every town had a fish market usually placed close to large fountain or source of water, benches would be set up to allow the fishermen to sell their catch.

This was often curtailed by the heat and the sun, so that the stock quality was not lessened (Amacher 2006, 101 fig 49).

7.4.3. Fish and Fasting

Almost half of the religious calendar in Christian Europe was taken up with fasting (Rumm-Kreuter 1997, 236). Although it must be made clear that some days involved fasting, the reduction of the amount of any food consumed and days of abstinence, where certain foodstuffs were given up completely. The latter is where the role of fish in the diet was intensified during these periods of the Middle Ages. In periods of abstinence from meat, fish would almost have certainly been a direct replacement, and it was unimaginable to be able to survive these periods without the aid of fish in the diet (Arbesmann 1969 499-500). Although this statement must be taken relatively as in non-fasting periods meat would have not been consumed everyday (Amacher 2006, 96). Although there were many tricks used to avoid the abstinence of meat. Albert Magnus, states that with the help of alchemy there are ways to 'turn' meat into fish, this probably related to the colouring of meat to resemble fish Pasda 2004, 106).

7.4.4. Identified Fish (Table 7.4-1)

7.4.4.1. Barbel (*Barbus barbus*)

There is a single specimen of barbel from the excavations studied here. This very large specimen measured between 50 and 60cm long and was found in the fifth to sixth century layers at Kaiseraugst 'Jakobli-Haus'. The barbel inhabits clear, oxygen rich, flowing water with a sand or gravel bottom (Steinbach 1984, 108), the likes of which were probably found close to the *Castrum* at Kaiseraugst. Bergbauer and Frei (2000, 87) recorded that the roe contained a poison and that the poison caused nausea, severe vomiting and other symptoms. Kathan (1992, 87-88) noted that the roe was at its most poisonesspoisonous during the spawning season, which lasts from May to August. However the flesh from the fish is at its tastiest and best in the cold months. It appears that these properties of both the roe and the meat were known in the Middle Ages as many authors wrote about them including Hildegard von Bingen alongside the poison from skull and brain. It was also noted that eating the head and throat of the fish that carried some kind of 'dirty poison' caused increasing headaches and other feverish illnesses of the head (Riethe 1991, 73-74). Nostradamus (1557) also mentions the barbel:

"He who was buried will come out of the tomb,

he will make the strong one out of the bridge to be bound with chains.

Poisoned with the roe of a barbel,

the great one from Lorraine by the Marquis du Pont."

Les Propheties, century VII, 24

7.4.4.2. Pike (*Esox lucius L.*)

A single specimen of pike is found at Lausen in 'Grube 28'. Pike is an excellent food fish and occurs in clear vegetated lakes, quiet pools and the backwaters of small to large rivers, they are solitary and highly territorial (Wheeler, 1992). A similar type of aquatic environment would probably have been found around the region and so the bone identified was probably of local origin. The flesh is white and mild tasting however it can be considered bony, especially due to the substantial epipleural bones. The larger fish are more easily filleted, and pike have a long and distinguished history in cuisine and are popular fare in Europe (Frimodt, 1995, 136-7). Historical references to cooking pike go as far back as the Romans (André 1998, 90). In spite of numerous attempts to acculturate this species, it was never entirely domesticated and does not accept artificial food (Billard 1997, 10). Pike can also be heavily infested with parasites, including the broad tapeworm which infects humans, if the flesh is not thoroughly cooked. Although, today it is generally acknowledged as a sporting quarry, it is said to be very exciting due to their aggressive hits and aerial acrobatics, most anglers will release pike they have caught. In the Middle Age's Hildegarde von Bingen (Riethe 1991, 72) noted the aggressive nature "like a wild animal in the forest" alongside the healthy flesh of the creature. The liver of the pike was also thought to help the digestion of food and the pulverised bones against worm infestation noted the same author. The hunting of pike was forbidden in the months of April and May.

7.4.4.3. Salmonidae

Salmonidae is a family of ray-finned fish, the only living family of the order Salmoniformes. It includes salmon, trout, chars, freshwater whitefishes and graylings. The Atlantic salmon and trout of genus *Salmo* give the family and order their names. It appears that the fish present in the material here are from either the Atlantic salmon or the trout. A single specimen from Reinach that was probably around 80cm in length was identified and a second specimen of approximately the same size was also found in the 'Jakobli-Haus' site at Kaiseraugst. The former was dated to the late sixth to late seventh Century, whilst the latter was dated earlier in the fifth to sixth Century. Again Hildegard von Bingen had something to say about the trout noting the healing nature of trout on the sick when eaten (Riethe 1991, 80).

The salmon is also an important creature in several strands of Celtic mythology, which often associated them with wisdom and venerability. In Irish mythology there is a creature called the Salmon of Wisdom. Salmon also figure in Welsh mythology. In the prose *Culhwch and Olwen*,. In Norse mythology, Loki transforms himself into a salmon.

7.5. Amphibians (table 7.5-1)

Amphibians have been identified in all three sites excavated. All the identified specimens, surprising come from hand collected remains with no evidence of amphibians from the sieved remains of the 'Gemeindezentrum' at Reinach. There were 57 elements identified to amphibian and all except eight were further identified to the anura order, either frog or toad. The eight that have not been additionally identified tended to be fragments of long bone that had no further identifying traces but are also most likely either frog or toad. Of these eight bones, six came from the Reinach excavation, two in the 'Stadthof' area and four from 'Altebrauerei' area. Single specimens were found at the 'Jakobli-Haus' excavation in Kaiseraugst and 'Grube 56' at Lausen. The elements from all amphibians represented here, in most cases tend to be from the more dense parts of the skeleton (e.g. hind legs, pelvis). However, these are also often the areas which are eaten in populations that consume these species. This then makes interpretation difficult as both taphonomy and culinary practices leave similar signatures in the faunal remains. The one feature that could distinguish the two practices would be the evidence of knife marks on the bones. Unfortunately this is not seen here although there is archaeozoological evidence in the region of frogs being eaten. The castle at Altenberg shows evidence of butchery on frog bones from the site (Marti-Grädel, 2009, 214 and fig 315).

The lack of frog from Kaiseraugst is surprising especially in the 'Jakobli-Haus' area as the presence algae and concretions on the bones alongside the disrepair of this part of the settlement maybe an ideal natural hiding place for these species especially in times of hibernation. Although a single specimen designated as amphibian is found at the site, thus offering a tantalising glimpse that this species may have been present at the site. The fact that the material comes from layers is perhaps a reason for these species being absent, as they would prefer pit structures which are more likely to be damp and dark. The methodology of hand collection or the experience of the excavating personnel may be a factor in missing these small bones.

7.5.1. Frog (*Rana* sp.)

There are eight specimens designated at least to the genus Rana at the Lausen site and are found in nearly all time periods. Of these, half could be further identified to species. Two species are present in this assemblage, namely *Rana temporaria* and *Rana esculenta*. As mentioned above the body parts tend to be those that are relatively most dense and thus survive better after deposition, so there are six tibia/fibula and single specimens of humerus and radius/ulna.

Twenty-two of the 34 amphibian species are identified as frog in the Reinach settlement. Seven of theses specimens could be further identified to species. Just a single species is identified at this excavation, *Rana temporaria*.

Seventeen are found in the 'Altebrauerei' area and the rest from a single context in the 'Stadthof area (n.=5), which suggests that these elements are from a single individual dated to the late twelfth Century. The 'Altebrauerei' sample shows twelve tibia/fibula, two femur and single specimens of humerus and pelvis. This then suggests that there are at least six individuals here. These body parts are likely due to taphonomic destruction of the less dense elements leaving those represented here in the soil, although as stated above it is possible that these remains could also be part of the food waste, albeit not an extensive part.

7.5.1.1. Common/European Common Brown Frog (*Rana temporaria*)

There are ten specimens of this species found at the three sites here, although they only occur in the Reinach and Lausen excavations. They are most abundant at the 'Altebrauerei' area of the Reinach excavation (n. =7). All of these specimens are dated to the early eighth Century. The body parts represented are tibia/fibula (n. =5) and pelvis (n. =2). Lausen has few bones but are split over a wider time period. Single specimens are found in the late sixth to seventh Century pit 'grube 50', the tenth Century pit fills of 'grube 10,' and 'grube 19/52' from the eleventh Century. In the earlier two pits examples of tibia/fibula are found, whilst in the latter a radius/ulna has been identified. These animals are probably found due to the dark damp nature of the environment in and around the structures of the settlement, which would be ideal hibernating spots. Common frogs are active almost all of the year throughout most of central Europe, only hibernating when it gets very cold and the water and earth are consistently frozen. Where conditions are harsher, such as in the Alps, they can hibernate for much longer periods, eventually emerging as late as early June. They are known to hibernate in running waters, muddy burrows but also in layers of decaying leaves and mud at the bottom of ponds (no author, website 2). Adult Common Frogs will feed on any invertebrate of a suitable size including insects, especially flies, alongside snails, slugs and worms. The diets of Common Frogs change significantly throughout their lives; whereas the oldest frogs will feed only on land, younger frogs will also feed in the water, Although they will not feeding throughout the breeding season (no author, website 4). Predators include crows, grass snakes, hedgehogs, foxes, otters, polecats and rats. Of these species four have been identified within the three sites studied here. Domestic cats also kill a large number, although they rarely eat them.

7.5.1.2. Edible/Common Water Frog (*Pelophylax* kl. *Esculentus*; formerly *Rana esculenta*)

This frog is an offspring of a mating between two species of Pelophyrax, *P.ridibundus* and *P.lessonae*. There is a single identified specimen of tibia/fibula from this species found in the excavations studied here. It occurs in the tenth Century pit fills of 'grube 10.' This hybrid occurs where *P.ridibundus* and *P.lessonae* both occur, which are found all over central Europe generally in the northern parts, from France to Russia, their southern limits are the lower third of France, northern Italy and northern Croatia, They live all year round in or around the water, they are the most common in calmer sections of rivers and slow flowing waterways, but also found in isolated ponds and other wet areas with a preference to more open areas. They feed on ground invertebrates, spiders, insects, water insects, moths, flies, fish, newts, and sometimes even there own species. They are active by day but, in contrast to other water frogs, they can be seen further from water whilst hunting or migrating. They also hibernate during winter on land and this could be the reason that the specimens here are found. The damp and dark conditions in and around the structures of the settlement, especially those that are no longer in use, make ideal places for hibernation, for these and other species of frogs and toads, although as mentioned previously it is difficult to rule out the fact that they could have also been part of the diet of the inhabitants of the settlement. The relative paucity of finds suggests that this is probably not the case or if so not to so greater extent.

7.5.2. Toad (*Bufonidae*)

There are thirteen specimens designated at least to the bufonidae at the Lausen site, with nearly all time periods represented. Nine of these could be further identified to species. The two species present in this assemblage are *Bufo bufo* and *Epidalea calamita*. The body parts tend to be those that survive better after deposition, so there are four femur, two tibia/fibula, two pelves and a single specimen radius/ulna, all those that are relatively most dense.

Just six of the 34 amphibian specimens can be identified as toad in the Reinach settlement. Of these three could be further identified to species. Just a single species is identified at this excavation, *Bufo bufo*.

Five toad specimens are found in total between the two time periods in the 'Altebrauerei' area, all are examples of femur. Additionally there is a single element of pelvis in the 'Gemeindezentrum' area, which is dated to the early eighth Century. The 'Altebrauerei' sample contains five femur and single specimens of humerus and pelvis. These body parts are likely due to taphonomic destruction of the less dense elements leaving those represented here in the soil, although as stated above it is possible that these remains could also be part of the food waste, albeit not an extensive part of it.

7.5.2.1. Common Toad (*Bufo bufo*)

The species is widespread in Europe. The Common Toad is associated mainly with the forest zone, where it prefers conifer forests with marshes or other fairly wet sites with dense vegetation but large open areas are avoided. In the south of the range, the toad lives in insular forests in the forest steppe and in wet and dense riparian vegetation. Spawning takes place in available water sources with relatively clear water. In most habitats, as with other toads, *B. bufo* is active mainly in twilight and *B. bufo* is not very abundant, although sometimes up to 70 specimens per 100m of pond shore or land are found.

There are eight specimens of common toad in the assemblages studied here. The majority (n.=6) are found in the Lausen excavation. In which one come from the late seventh to eighth Century pit 'grube 65,' a further three from the early eleventh Century pit 'grube 11' and two from 'grube 19/52' from the eleventh Century. The elements represent from these bones again suggest a density related survivorship and are represented by pelvis, tibia/fibula, femur and radius/ulna commencing with the best. These individuals are probably in search of a damp and dark place in which to hibernate and the conditions in and around the settlement's building would no doubt be ideal.

The toads hibernate over winter either singly or in groups, depending on the altitude and latitude. Hibernation occurs on land and occasionally in streams and springs. Common Toad forages exclusively on land, mainly on crawling invertebrates. As in other species of toads, consumption of ants is very typical. This results from the sit-and-wait foraging tactics in this species (Kuzmin SL, website 5).

Like the frogs, the toad population would have more than likely have been hunted by the local wild and domestic carnivores although as mentioned above cats and dogs are unlikely to have eaten such animals.

7.5.2.2. Natterjack Toad (*Epidalea calamita* also *Bufo calamita*)

There are just three specimens of Natterjack toad in the excavations here. All are femur, with two dated to the eleventh Century in 'Gruben 19/52 and 57' and an earlier exemplar in 'grube 65' dated to the seventh to eighth Century period.

The species lives in the South western and Central Europe and inhabits mainly open, well-warmed landscapes with light, sandy soils. There it lives in sand dunes, glades of pine forests, gardens, parks, fields, sand and gravel quarries and meadows. In the daytime it hides in heaps of stones, in sandy soil and under debris. These toads hibernate over winter, which occurs on land by burying itself in the soil. Populations are not usually very large but similar to that of the common toad (Kuzmin SL, website 6).

So in summary it appears that the amphibian remains presented here are species that would have been found living naturally in the water courseswatercourses close to all three settlements. The absence of frog or toad from Kaiseraugst is likely due to the excavation techniques used and the layered structure of the sediments at the site. The absence of amphibians from the sieved remains is also likely due to pure chance rather than any specific human occupation processes that have taken place as the sieved material come from a specific point in a large area and the amphibian remains are not so frequent to be found throughout the settlement.

In all likelihood the remains found here are due to the animals looking for a place to hibernate and the damp dark nature of the soil around the structures in the settlements would have been almost ideal. Carnivores at the settlement may also have predated some of these animals. There is no evidence of butchery on the bones and thus it remains a question mark as to whether any of these amphibians were part of the diet.

So in the last chapters the exploitation and use of both domestic and wild species recorded in the sites studied here have been elucidated. It is clear from this data and data from preceding chapters (chapter 4) that domestic animals are in the overwhelming majority, especially cattle, sheep/goats and pigs. However it can be seen that there are wild animals being found in the diet (c.f. boar, hare and fish). Red deer antler is also being used for making tools, at least in the Jakobli-Haus area of the Kaiseraugst excavation. The wider representation of wild species in the eleventh Century fills at Lausen also hint at a wider use of wild animals in the time period studied here, however the data is too sparse to put forward more concrete ideas. Now that all the data collected from the faunal assemblages has been presented in the last five chapters, it can now be pieced together to hopefully form a coherent and interesting overview of the diet in terms of meat of the people of the region from the mid fourth Century through tot the twelfth Century in the next and final chapter. Comparison with contemporary material and sites could help further understand the sites that have been analysed here. Comparison could also provide a wider perspective of the rural and urban societies during the early medieval of Northwest Switzerland.

8. Discussion and Interpretation

In this chapter, the results and few interpretations from the previous chapters will be drawn together to hopefully produce a coherent synthesis of the archaeozoological remains from the three studied excavations. Following this, the sites will then be put in to a wider context by comparison to sites from the previously published literature within the region of North West Switzerland and it neighbouring territories including those from modern day France, Germany and the Swiss midlands. This will then help identify relationships between the regions with respect to the faunal remains and will allow the investigation of the wider and more complex interactions between these communities. The last section in this chapter will make recommendations as to the direction of future research aims and goals within the themes covered here.

8.1. The analysed sites

In this section the aim is to bring together the disparate results from previous sections in a way that links in with the archaeological information in an attempt to convey the changing nature of the early medieval settlements.

8.1.1. Kaiseraugst

8.1.1.1. The problems of residuality

Residuality is the observance of material from earlier periods in those from much later periods. The problem is caused by reworking of deposits, thus material, especially ceramic can appear out of context. Evans and Millet (1982) produced a detailed review of the problems linked to this process. Residuality is a particular obstruction in urban contexts, as there tend to be many small layers that are frequently reworked. This can be a major problem in artefact analysis, especially ceramics. The discovery of residual pottery can act as a guide to the mixing of other materials in an assemblage.

In the study here, the problem of residuality is greatest at the Kaiseraugst sites, yet there is also a degree of residuality at Lausen due to the lack of space in which to develop the site. At Reinach there were no such constrictions, the site grew outwards rather than on top of the existing structures and so the effects of reworking were minimal. Typological and quantitative analysis of the ceramic wares from Kaiseraugst showed that in some contexts up to twenty percent of the ceramic wares were of residual material and thus the dating of these layers were tentative at best (Marti, 1996 fig. 2; 2000 fig. 132). Whilst the ceramic material dates itself, thus making residual material identifiable, bone relies on indirect dating and so residuality cannot be observed from fragment to fragment. Bone and ceramic become incorporated in to a deposit in many and varied ways. Dobney *et al.* (1996, 18-19) tried unsuccessfully to link the deposition of bone and ceramic wares through Taphonomy. This then suggests the problems of residuality observed in the ceramic ware by Marti (1996 fig. 2; 2000, fig 132) are not necessarily applicable to the faunal assemblages.

Where it is shown that the residuality occurs, the proportions of the three main domestic species are similar throughout the fifth to seventh century period independent of the area of the excavation studied (fig. 4.2.2.3-4). This consistency either suggests the faunal material is not so greatly affected by the residuality problem or conversely that the residuality problem is affecting the individual levels in a similar way. Comparison of the species proportions from other sites both in this study and from the published literature also show that proportions are similar both for the late Roman period and the fifth to seventh Century material. The similarity to other sites then suggests that the reworking of layers at Kaiseraugst is not greatly affecting the faunal material. To add greater weight to this, the progressive size diminution observed in cattle shows that there is little in the way of larger measurements present in the late Roman and early medieval layers to suggest reworking of the deposits, in fact the late Roman period tends toward smaller cattle not larger individuals. However, the sixth century 'Jakobli-Haus' material does show a number of larger measurements. Whilst it must be acknowledged that they are present, the affect on the results appear negligible as the histogram (fig 6.2.3-11) shows no deviation from the normal curve expected. The results from other sites that are free of the residuality problem but of a contemporary period, namely Reinach, Schleitheim and to a lesser extent Lausen show comparable sizes to those observed at Kaiseraugst, which suggests on the whole the data is robust.

8.1.1.2. The First to Fourth Centuries AD

The large urban centre of *Augusta Raurica* at Augst would have been provisioned by large villa farmsteads from the hinterland, organised and controlled by the Roman administration of the region during the first century AD. This highly populated city, out on the border of the Empire was also a thriving manufacturing hub of the region (Marti 1996, Schwarz 2010). The results from previous archaeological work on the city paint a picture of a highly affluent, yet a highly standardised organization and administration. The archaeozoological results also show this highly standardised 'Roman life' with similarities of results when compared to other sites (c.f. Benecke figs. 96 and 102 and Deschler-Erb *et al.* 2002, fig 166). A high proportion of cattle, a relatively high proportion of chicken remains and the presence of doves is indicative of such a 'Roman lifestyle' from an archaeozoological perspective (Deschler-Erb *et al.* 2002 fig 166; Schibler and Furger, 1988 tbl. 58; Lehmann and Breuer 2002, fig 66). The age structure of the cattle, the majority of which are adult (Schibler and Furger, 1988 tbl. 59; Lehmann and Breuer 2002, fig 40), also suggests that in this period they were more likely to be used for their secondary products such as dairying and traction than primarily for meat production (Deschler-Erb *et al.* 2002, 167). Zeder (1991, 39) suggests that urban populations that are separated from the agricultural processes and the population is provisioned by an administration will receive meat from animals that provide the most meat weight per individual, thus cattle and pig are highly sort. The cattle in this situation would likely be older too, past their prime and thus cheaper, meaning there is little or no choice for the consumer. However results show (Schibler and Furger, 1988; Breuer and Lehmann, 2002) that there is variation within the settlement depending on status and function of the area of the settlement. Wealthier parts show higher proportions of young pig and fowl, whilst the manufacturing parts and taverns tended towards a higher proportion of cattle. Work by Breuer *et al.* (1999) compared the size of cattle from the Iron Age into the Late Roman period. Results from this method suggest that in the period of their study, there was an initial increase in cattle massiveness in the late first century AD (c.f. fig. 6.2.3-17). This perhaps indicates that there was importation of cattle, probably bulls, from larger Roman breeds. Alongside this, the advanced husbandry techniques known to the Roman world would probably have also played a part in the increasing size of the cattle. These large cattle, possibly bearing Roman maternal DNA, were brought to the early Iron Age Munsterhügel in Basel possibly as gifts to the heads of the indigenous population to facilitate the expansion of the Empire. The Roman agricultural and trade systems were reliant on large numbers of cattle for traction both on farms and within cities. Analysis of the body parts found in these excavations shows that the whole animals would have been brought to the site and slaughter and butchered probably by professional butchers (Deschler-Erb 1992; Deschler-Erb *et al.* 2002). The methods of butchery in Roman towns is discussed at length by Seetah (2008), and shows that there is the same standardisation that exists in many other areas of the empire controlled by the Roman management.

Pigs would have been less numerous than cattle, in this the most prosperous time of the Roman city (Deschler-Erb *et al.* 2002 fig 166; Schibler and Furger, 1988 tbl. 58; Lehmann and Breuer 2002, fig 66). Pigs would have also been slaughtered much younger than cattle, probably at a point around two years of age, where the meat is of prime quality (Deschler-Erb 1992; Deschler-Erb *et al.* 2002, 167). Younger individuals would suggest an increased standard of living. This is advocated by Lehmann and Breuer (2002, 379) in the earlier periods of the *Castrum* in Kaiseraugst (Third Century AD). Pig is the only other domesticate that has sample sizes large enough to analyse stature, and in this case the size increase and decrease are not so marked and not statistically significant (c.f. fig. 6.4.3-7). This is perhaps to be expected from an omnivorous species, whose nutritional husbandry is difficult to manage, as they are probably 'foraging' domestic food waste within the settlement. Foetal pig remains attest to the fact of breeding within the city. High proportions of adult pigs are observed at a First Century villa site in Neftenbach. These are probably female pigs that were kept for breeding purposes whilst the unwanted males were taken to the markets of the region (Deschler-Erb 1999, fig. 784).

The third of the main domestic species, ovicaprids, would have comprised of much lower proportions. Age structures suggest, as with cattle, that the high proportions of adult individuals meant the used of secondary products rather than primarily meat, most likely wool production. Again this can be observed in the villa at Biberist, where a high proportion of ovicaprids, probably sheep, are recorded (Deschler-Erb, 2006, 659). The roles of other domestic species such as equids and dogs would perhaps not have been included in the diet of the population of the Roman city. The equids would have comprised of horses, mules and donkeys. Mules would most likely have worked as draught animals pulling wagons and transporting goods from one place to another. Horses on the other hand would have been used as riding animals and perhaps used in the hunt. The equid proportions, at Neftenbach, are highest at a point where hunting and venison are also important (Deschler-Erb 1999, 452-453). Adult and older animals would dominate the age profiles of these equids. Dogs varied greatly in breed in the Roman world, from very small lap dogs to large dogs (Peters 1988, fig.64). This suggests that there was a mixed role for the dog in Roman life, as a working dog and perhaps as a pet, the role was very much dependant on the breed and morphology of the dog in question. Dogs in urban centres tend to be smaller than their rural counterparts. This was probably due to the space available in cities and the role as working dogs in the rural environment (Deschler-Erb *et al.* 2002, 168).

The preparation of the meat for sale, slaughtering and butchery, would have been carried out quickly and efficiently. The evidence of butchery techniques appears to be similar for both small and large animals. Firstly the animal would be eviscerated and skinned. Then the carcass would have been split dorso-ventrally, and the limbs removed. The limbs would have been portioned into large joints, which may or may not have been further reduced into smaller joints of meat depending on the species and requirements of the joint (Seetah, 2008). Smoking and salting of meat is also known to have taken place in the Roman period with evidence from both *Augusta Raurica* (Deschler-Erb, 2007) and the villa farmstead at Neftenbach (Deschler-Erb, 1999).

For nearly two centuries, the archaeological data suggests that the city is prosperous and life for the population is stable. Then in the late third century AD times become more unstable. The Roman Empire as a whole is being destabilised from within and military forces are being withdrawn from the borders to protect Italy. Life becomes more violent on the borders of the Roman world and at Kaiseraugst the protective *Castrum Rauracense* is built close to the site of *Augusta Raurica*, as attacks from the Germanic tribes and civil war disrupted 'normal' life. The *Castrum* at Kaiseraugst was involved in much conflict during the fourth century. The Roman population from the surrounding hinterland moved to the relative safety of the *Castrum*. However, this would come at the cost of abandoning the large villa farmsteads and the efficient provisioning of the people within the walls of the *Castrum*. The destruction of the *Castrum* by fire in 350AD is thought by some to have been caused by a raid from across the Rhine (Demandt, 1998). After this point few larger structural changes were seem within the *Castrum* (Schwarz, 2010, 4-7; Marti 2000, 266-269).In time, alongside the decreasing military presence the Roman administration of Kaiseraugst is also withdrawn.

The archaeozoological data from the Late Roman period suggests that the *Castrum Rauracense* at Kaiseraugst is at first similar in the results to those seen in at the height of the Roman occupation at the preceding *Augusta Raurica* mentioned above and in the region. There appears little in the way of change to the faunal remains, adult cattle proportions appear to remain high. Pig and ovicaprids also remain in the same proportions. Likewise the age structures of both suggest that there is no change in the roles of these animals. The proportion of chicken remains is reduced to levels that Lehmann and Breuer (1997) suggest were indicative of the lower stratum of society. The appearance of the domestic rat has also been used to indicate a sign of possibly decreasing standards of living at this time (Lehmann and

Breuer 1997, 493).During this disruptive period in the region, cattle size structure also appears to be decreasing, firstly in the mid-fourth century (c.f. §6.2.3 esp. fig. 6.2.3-16). The results of the cattle stature analysis from Biesheim (Ginella n.d.) and Strasbourg (Ginella, n.d. fig. 24a), both still under Roman rule, show that large cattle are still predominant in these sites. There was the loss of superior husbandry knowledge and administration needed to provision the *Castrum*.

1.1.1.1.The downfall of the Empire and migration (Fifth – Seventh Centuries)

In the preceding centuries the Roman military and administration brought about centralisation and standardisation, In the fifth and sixth centuries everything became more regionalised again. However, life in the *Castrum* was much less violent (Furger, 1996). Archaeozoologically, this is an important time in the *Castrum* as change is observed in the faunal assemblages. The relatively high cattle remains in the third and fourth centuries (c.f. Schibler and Furger, 1988 fig. 58) are reduced replaced by an increase in pig remains during the fifth Century (§4.2.2.3). It could be argued that people needed to become more self-sufficient with the collapse of the Roman system. Pigs are omnivorous, reasonably easy to handle and also need less space and food than cattle. This makes them a better alternative within the walls of the *Castrum*. The age structure of pig shows a movement to older animals, although there is a suggestion that these animals are still being killed for meat rather than kept alive for breeding purposes (fig 6.4.1.1). The role of cattle also appears to remain the same, with adult animals dominating. The stature of which is at least comparable to those in the mid fourth Century data from the *Castrum*. The number and role of ovicaprids appears to remain relatively constant through these changes.

There also appears little in the way of horizontal variation with the areas of 'Jakobli-Haus' and 'Gasthof Adler' showing few differences outside of normal variation between assemblages. There is evidence of hunting, with cervids, boar and hare being sought. In the 'Jakobli-Haus' area of the excavation there appears a deposit of antler remains, one that is distinct from the small fragments found in the 'Gasthof Adler' area. The meaning of this accumulation of antler has already been discussed in depth in chapter 5.3. The greater part of this material comes from sawn tines and crown sections that are un-worked, suggesting that these are waste products as opposed to sectioned raw material (Frosdick 2008, 120). From the data available at Kaiseraugst it is difficult to identify a specific area or indeed workshop for antler production. At this time there is an influx of Germanic people into the region and a related changing of cultural identity. This is observed through the amendment of place names and also by the changes in material culture i.e. ceramic wares and grave goods (Marti, 2000 327-343). Another piece of this identity could have been the production of goods from antler. The manufacture of items from antler is suggested to be a typically Germanic trade (Koch 1994, 223-225) and in this case was re-established in fifth century Kaiseraugst. However, the earliest proof of bone and antler working in the locale of Kaiseraugst dates from the middle of the first to the early second century in *Augusta Raurica* (Deschler-Erb 1998, 88-92 esp. figs 147 and 148). Finished antler products are found in both burial and settlement contexts (Martin, 1991). The butchery of animals, on the evidence here, also appears to remain constant through this period and there is still evidence of smoked meat being produced, with knife marks appearing longitudinally on the shafts of some ribs (c.f. 5.8.1.3).

From approximately 600AD new influences particularly from the Frankish areas of eastern France and the northern upper Rhine area are seen (Martin 1991, 337-343; Marti 2000, 327-343). This may be partly due to the fact that Kaiseraugst orientated itself more strongly toward Burgundy, where the Gallo-Roman culture remained unaffected by the political upheaval and the threat from the east side of the Rhine and the Alamannic people. During this time despite many changes in society, the preceding Roman styles remained present in both the form of glass objects (Fünfschilling, 1996) and ceramic tableware (Marti, 1996). This observance of Roman style goods is the complete opposite to that seen with domestic food waste, as discussed above. A self-sufficient lifestyle, with pig proportions still on a par with those of cattle. However, it appears that the stature of cattle have again been reduced in this early seventh Century period. The cattle at the rural settlements of Reinach and Lausen in the late sixth to late seventh Century are of similar size to those at seventh Century Kaiseraugst (fig. 6.2.3-16). These results suggest that the change in the size of cattle observed is probably due to a regional or wider influence rather than a site-orientated pressure. The fact that Kaiseraugst is an urban centre and that both Reinach and Lausen are rural sites suggests that this change is also not a site-type orientated change. As through other periods ovicaprid's proportions and role are unchanging. Fowl are also found in similar proportion to those in previous periods. The roles of these animals also appear to be fixed with little change in the age profiles. Dog and horse are still represented at low levels. The self-sufficient lifestyle in Kaiseraugst also disputes the definition of early towns as described by Christlein (1979) where production concerns are orientated in a direction away from agriculture i.e. ceramics, glass, metal, bone or antler working or even a mixture of all these, so that the town has to be provisioned from other sources. However, at this time Kaiseraugst is a city on the wane and thus perhaps not representative of the description by the author.

In the following periods evidence of settlement activity becomes more meagre. This is probably due to the rise in status of the city of Basel helped by its orientation to the region of the Alsace. The development of the Birstalstrasse provided much improved communication and the enhanced the geographical location. This movement of trade and industry away from Kaiseraugst to Basel causes Kaiseraugst to go from being the manufacturing hub of the region to a small village in a very short space of time. The Episcopal seat of the region, which had also been based in Kaiseraugst from the late Roman period, moved to Basel, sometime before the eighth century (Marti and Fellner 2005). This shows that the rich and powerful have an influence on the supply of goods and services within a region. Windler *et al.* (2005, 119-137) also state that the important medieval towns in the Upper Rhine region are formed around the Episcopal seats of the Early Medieval period and earlier.

8.1.1.3. A special deposit from the 'Jakobli-Haus' area (fourth to sixth century)

There is a lack of horizontal variation in the two areas of the excavations within the *Castrum* walls, despite the differing functions. The 'Jakobli-Haus' area falling in to ruin and disrepair whilst the 'Gasthof Adler' site is thought to still be inhabited during the period studied and perhaps an area in which crafts are being carried out. However the data from the fourth to sixth century 'Jakobli-Haus' area shows differentiation from the results presented previously (c.f. 8.1.1.2) alluded to above. This material shows a high degree of young pigs, an extremely high proportion of chicken remains and also a high degree of small passerine birds and corvids. The nature of the body part analysis and the butchery show similar results to those of other periods. The meat bearing bones being most predominant and butchery marks showing gross dismemberment and jointing present, which suggests that specific joints of meat are preferred. The ruined nature of the structures at the 'Jakobli-Haus' site suggests that this domestic waste is either not from the area around the point of deposition or that it comes from an earlier period when this area is not so deteriorated. This idea is lent weight by the fact that a similarly dated, albeit a considerably smaller and statistically insufficient sample, from the 'Gasthof Adler' area contains a greater degree of cattle remains rather than pig. This may then be comparable to the data on socio-topographical distribution of the faunal data presented by Schibler and Furger (1988) and Lehmann and Breuer, (1997 and 2002).

8.1.1.4. Twelfth Century Kaiseraugst: Life outside the *Castrum*

The sample sizes for the identified species in this period and outside the Castrum ('Fabrikstrasse' area) are small but comparison with the contemporary 'Gasthof-Adler' area; (fig 4.2.2.3-1&2) shows differing results. Outside the walls ovicaprids make up over half of the main domestic species present. These results then suggest that either the sample sizes are too small and biasing factors are affecting the results or that there is a different kind of lifestyle in this part of the Kaiseraugst excavation at this time. The sample from the 'Gasthof-Adler' area is also small and is more comparable with the preceding data than that from the 'Fabrikstrasse' area. The latter area is more comparable to the contemporary material in Basel Barfüsserkirche (Schibler and Stopp 1987). This lack of statistically sound data makes inferences about this material near impossible.

8.1.2. Lausen

8.1.2.1. The Early Medieval Settlement (late sixth and seventh Century)

The settlement at Lausen had long been inhabited before the early medieval dated faunal material from this excavation (§1.1.4). Although there is a lack of faunal data from the preceding periods, as the site is important to the region it is likely that the diet of the population of Lausen would have been similar to those at *Augusta Raurica* and the *Castrum raurencese*. There are also similarities when the early material (late sixth and seventh Century) from Lausen is compared to the contemporary material from Kaiseraugst. The late sixth and seventh Century material from Lausen shows that the proportions of pig and cattle are similar (fig 4.2.2.4-2&3). The age structures also suggest that there are similar roles for these animals (fig 6.4.1.2-2). Cattle are again used for traction and dairying and killed as adults, whilst similar proportions of subadult and adult ovicaprids suggest a dual role that includes these animals being used not only for secondary products probably wool and diary products but also to supply high quality meat. Pigs also appear to be killed as sub adults and thus provide the settlement with prime meat. In these early phases, the composition of body parts suggest that the whole animal is being brought to settlement and thus butchery marks are also comparable to those at Kaiseraugst. However, here there is no evidence of the marks that suggest salting or smoking of meat is being carried out. These results then suggest that the communities at Lausen and Kaiseraugst in the early medieval are using similar husbandry techniques and meat preparation practices (c.f. figs.5.2.1.1-1; 5.2.2.1-1; 5.2.3.1-1). This probably due to the continuity of the Roman population in the region, life on a day-to-day basis is continuing as previously. There are relatively high proportions of dog and equids at the early period of the data here. This suggests that even in this time that Lausen is relatively affluent although the proportions of chicken remains do not corroborate this as proportions are relatively low (fig.4.2-3).

8.1.2.2. Increasing investment and social status (eighth to ninth Century)

This living style in terms of the food consumed remains the same up until the eighth Century, where there is heavy investment in the infrastructure of the settlement. Stone buildings including a church and other structures are erected. This increase in wealth of the settlement or the inhabitants of the settlement is similarly reflected in the faunal remains. There is an increase in the proportions of pigs consumed at the site (figs. 4.2.2.4-2&3). These tend to be sub-adult animals as with the preceding times at Kaiseraugst. Perhaps it would be expected with the increase in wealth of the site that a comparable increase in the consumption of younger pigs would also be observed, here it appears that more sub-adult to old pigs are eaten. However there it is observable that there is an increase in the consumption of lamb/kids, although the proportions of adults and sub-adults still out weigh this juvenile proportion. This would then suggest that there is either an increase in the demand for meat or that the demand for higher quality meat has increased. This latter suggestion would attest well to the increasing wealth of the site indicated by the archaeological data. The number of young calves slaughtered also increases in this period, although the proportions of cattle plummet compared to previous periods to point that is comparable to that of ovicaprids. Chicken is also an indicator of increasing wealth of a settlement, however here there is little indication that chicken is being eaten in greater quantities than before, in fact the converse is true.

The analysis of the butchery marks does not show a significant change in the marks seen in this period thus suggesting that there is no selection of specific cuts of meat, also the fact that all body parts are present suggests that the animals are brought to the settlement to be slaughtered rather than being slaughtered elsewhere and selected cuts of meat are then transported to the site. In this period it is also seen that the increasing proportions of pig in the assemblages means that this now rivals cattle and beef as the main supplier of meat in the settlement and this adds weight to the evidence of a settlement that is increasing in status.

However it must be pointed out here that the majority of the results presented here pertain to 'Grube 28' from the ninth Century at Lausen. This structure is large and many of the artefacts recovered from it suggest that the structure was of some importance. This large assemblage biases the results from this period and may cover up the variation in the horizontal plane, for example the results from ‘Grube 9’ show that there is a smaller change in the species proportions from cattle to pig than those observed in the contemporary ‘Grube 28’ (fig.4.2.2.4-5 and 4.2.2.4-5a)

‘Grube 28 also contains a relatively large number of stork bones (c.f. 7.3.1). The finds here represent four individuals, both young and old individuals. These consist mostly of wing elements, although the presence of beak fragments suggests that not only wing elements are being found at the site. The wings were most likely wall decorations of ‘grube 28’, although the sale of feathers on the wing is known to occur in birds of prey (Mulkeen and O’Connor, 1997), so it could also be argued that these are an alternative source for fletching. Stork bones are relatively rare in the faunal remains of archaeological sites throughout northwest Europe. Where they do appear, it is often single fragments, despite being large birds that are commensal for at least part of the year. However, much more abundant commensal avifauna is found in similar proportions on archaeological sites. This then perhaps conveys more importance to the stork bones found here as an exceptional find.

8.1.2.3. The status peak of the settlement (tenth to eleventh centuries)

This increase in the proportions of pig continues from the ninth Century and into the tenth, following the rise to prominence of the settlement. These results show that pig is now the major source of meat at the settlement. This further increase places the proportion of pig into is similar category as those seen at Altenberg (Marti Grädel 2008; fig.348a) and in the contemporary castle sites of the Bayern region (Pasda, 2004, 115). This would then suggest that the inhabitants of Lausen are perhaps very well connected people and perhaps linked to royalty. Marti (2000, 271-276) reports that the written sources allude to Lausen being perhaps an estate of Rudolph von Rheinfelden. However, the young animals that were recorded in the preceding period have now all but disappeared. The age profile of the slaughtered pigs shows a high proportion of sub-adults used for meat consumption. The juvenile ovicaprids are non-existent, replaced by adults, although the levels of sub-adults remain consistent. This suggests that the dual role of high meat production and secondary products has been forsaken and replaced with a system that is more interested in the wool, dung and dairy products. The lower proportions cattle that are now observed also tend to be of adult individuals, although the small sample size of the data adds some uncertainty to these interpretations. Chicken remains are also constant at this time despite the continued increase in the wealth and status of the site. The butchery and body part analysis also suggest that there is an unchanging methodology in the transport and slaughtering of all the three main domestic species at the site.

In the tenth Century proportions of equid bones across the site have increased with a predominance of equid bones is observed within ‘Grube 54’ (c.f. tab. 4.2-3). This is capped by the presence of four more or less complete pelves, whilst the other body parts are mostly the distal ends of the limbs or fragments from the head region. The presence of these bones with a relatively higher proportion of cancellous tissue shows that this structure was relatively undisturbed. It could also suggest that these elements were intentionally placed in the structure. This then would make the structure more significant, this alongside the data from the other species, which is dominated by pigs with a high proportion of young individuals. This certainly suggests that the filling of this pit is from relatively high status food waste, although it is unlikely that the equids were included in the diet. It also suggests that the equids had an important standing in the lives of the people within the settlement. As an example one of the pelves exhibits a debilitating pathology (§6.5.4-4) rendering the animal useless in terms of riding and working. Alongside this the animal would have needed a great deal of care and attention thus must have had some perceived ‘other value’ to the owner either status or an emotional value. Horse has been considered a status symbol since its domestication and thus more equids means a higher status of the inhabitants. The proportions of equids also add weight to the hypothesis that Lausen was an estate, as hunts were often carried out on horseback (§7.1.2). Riding pathologies recorded bring more evidence to this argument (c.f. 6.5.4).

The proportions of pig in the bone assemblages at Lausen decrease in the eleventh Century, perhaps a sign that the settlement has reached its peak. This is not to say that the food waste has changed dramatically, on the contrary. The age spectrum of the pigs at Lausen shows similar proportions of young animals to those observed in the tenth Century. To add more weight to the idea of the importance in the site in to the eleventh Century, the number of different wild species present at the site is the broadest of all the sites and time period studied here (c.f. fig 4-1a, 4-2a and 4-3a). Alongside the wild species that are most often represented, namely cervids and hare; wolf, bear, ermine, squirrel and mole are also present. Some of the large animals would have been hunted for sport and possibly their fur, whilst the smaller creatures may have been trapped for their fur. Although there is little evidence to show that these are large-scale crafts at the site due to the low number of elements identified to these species.

Body part analysis also shows that there is also little in the way of change in those areas that are represented during this period and others with the bones with high quality and quantity being best represented.

The butchery at the site shows little variation to that of other periods, there are still signs of primary, secondary and joint-sizing butchery evidence, thus the live animals are brought to Lausen before slaughter rather than ready jointed meat being purchased and cooked at the site.

8.1.2.4. The downfall of Lausen? (Late eleventh to twelfth century)

The species representation of the three main domestic species suggests that in the twelfth Century there is a move to a lower status diet, the number of wild species that is elevated in the eleventh Century is totally absent in the following Century. In the Thirteenth Century the settlement moved across the valley and river to re-establish itself in Liestal. Rudolf von Rheinfelden died at Meresburg in 1080 AD from wounds sustained in a victorious battle at Elster. This led to the slow dissolution of the rebellion against the German throne (Struve 1991, 473). This may then be the reason for the observed decline in status foods in the twelfth Century and the settlements later move from its original position.

8.1.3. Reinach

8.1.3.1. Settlement foundation and meat choice

The settlements at both Kaiseraugst and Lausen show continuation of settlement from the late Roman period and on into the early medieval. However at Reinach, from the archaeological finds, there appears to be no such continuation but periods of habitation and abandonment (Marti, 2000 278-279). In fact there is ceramic evidence of people from outside the region coming and starting a new settlement at the site during the late sixth Century (Marti 2000, 278; 2004, 193-205). This difference in settlement dynamics compared to the other sites studied here is also observed in the faunal remains. In the sixth and seventh Century periods, unlike Kaiseraugst and Lausen, the proportions of pig remains are high at Reinach. Whilst in later periods at Lausen this identifies a period of prosperity that matches the archaeological finds, these types of high status finds are not recorded at Reinach and thus an alternative hypothesis should be found. West Stow is an early Anglo Saxon site in the UK, where the author (Crabtree 1982, 1992, 1996) believed that such high proportions of pig remains identifies the beginnings of a new settlement. The argument follows that pigs are relatively easy to transport from one place to another and no special food requirements. They are just as likely to rummage through domestic waste as root for food in the undergrowth of a wood. They are also high fecund and a breeding population can be built up relatively quickly. It can be postulated that these new inhabitants of Reinach are pursuing a similar system of agriculture. This then indicates that breeding of pigs, and the building of a stable population, may be as important as pork production at this time. However, despite the relatively low proportions of cattle at the site, the age structure suggests young cattle are just as important in the supplying prime meat, as the older animals are in providing traction and offspring. A similar pattern is also observed in the ovicaprid age structure, again suggesting that there is equal need for meat and the secondary products at this point in the settlement history. This then all points toward a generalist production strategy, balancing the need for meat alongside a breeding programme with the idea of building the populations of these animals at the new settlement.

The body part representation for these three species like the other sites shows that the animals are slaughtered at the site, with all body parts present. The butchery analysis also shows all stages of butchery practices. Primary, secondary and joint sizing marks show that the animals were slaughtered, jointed and eaten on the site, in a similar way to those at the other sites.

Chicken at this time seems to play an exceedingly minor role in the food supply in the early part of the settlement at Reinach. Equids are present in this early period, yet not in seemingly large numbers. The presence of dogs is also attested to in this period, again in small numbers. Their scarcity means it is difficult to make comparisons about their role in the economic and every day life of the earliest part of the settlement at Reinach.

8.1.3.2. Stability and ‘standardisation’ (eighth to twelfth Century)

The site at Reinach, after this early founding period, becomes settled and permanent. In the eighth to ninth Century period the construction of the majority of the kilns uncovered at the site takes place and was perhaps part of wider ceramic industry in the region (Marti 2004, 205-206). Again this suggests a permanence and stability of settlement. This stability brings with it changes in the faunal remains compared to the preceding period of high proportions of pig and a generalist pattern to the economy and husbandry of animals. The proportion of the three main domestic species become much more even, although pig is still the larger portion of faunal remains. There is also a change in the age structure of these domesticates. There are greater proportions of adult cattle and ovicaprids, alongside and a decrease in the proportions of adult pigs. This then suggests that there is a move away from a greater need for meat from cattle and ovicaprids and that the secondary products from these animals are now more important. The draughting of cattle and wool from sheep mirrors the roles observed at both Kaiseraugst and Lausen. It could be suggested that this regime is an ideal employed by stable and permanent settlements. The type of butchery marks and the proportions of the body parts remain the same as in the preceding periods. The animals are brought to the site, then butchered and eaten within the settlement. This period also exhibits the highest proportions of chicken and horse remains at the site, which suggests a relatively prosperous time for the settlement. This could then link back to Reinach being part of a successful regional ceramic industry.

The three main domestic species remain in the following centuries remain at a consistent level and similar to the eighth and ninth century period. There is a reduction in the numbers of equids observed. The chicken remains continue to be elevated in to the eleventh and twelfth Centuries. The number of dog remains is variable and probably due to partial skeletons that could be assigned to single individual in a specific context (§4.2.3). However, there is a number of juvenile cattle and pig being slaughtered at the site. Ovicaprids and chicken show a trend that is similar, however, sample sizes for these species are small. It is difficult to explain these observed results. It could be that higher proportions of meat are required in the settlement thus the need to slaughter young animals, probably males that are not required for herd maintenance. This could perhaps point towards the necessary payment of taxes or tithes to the local landlord or church. The animals that would normally be consumed on-site have been given up as payment and thus alternative meat supplies need to be found. The presence of adults and subadults shows that there is not a complete removal of these older individuals at the site. As in preceding periods, animals were being brought to the site and slaughtered and then distributed in the settlement as there appears to be little in the way of missing elements other than from taphonomic destruction, for example, ribs and vertebrae.

8.1.4. Site comparison

The previous sections brought together a vast array of data from the previous chapters and integrated the results into the archaeological conclusions to hopefully provide a coherent analysis of each site through time. However, there needs to be some synthesis of these results. In terms of similarities and distinctions in the faunal remains between contemporary periods at the three sites. Comparison of the sites studied here is made problematic for a number of reasons, although later in this chapter an attempt will be made to try and compare or at least reconcile the differences observed both between and within the sites. However, first the complications that prevent a clear and simple comparison of the sites must be laid out. Perhaps the most important factor is the type of settlement being studied, Kaiseraugst is at the time of the material analysed here a relatively important manufacturing urban centre (Marti, 1996; Fünfschilling 1996), whilst Reinach and Lausen are rural settlements, with greater or lesser degrees of social importance. Higher social status allows access to a wider range of food products that would be unaffordable to the less socially empowered. Hunting rights in the later periods of this work would also be conferred on those groups of a higher social status, which again would open up a wider range of meat products such as venison, boar and hare. There are also differences in the type of structures that the faunal material has been removed from. Material from Kaiseraugst is taken from settlement layers, often 'dark earth' layers found within the Castrum. The material from outside the *Castrum*, Reinach and Lausen is taken from 'grubenhäuser' like structures. This makes comparison difficult in terms of taphonomic histories of the different structure type.

It maybe expected that there are differences in the food waste from an urban settlement to that of a rural site, due to the economies of the different sites. A manufacturing centre may have moved away from an agricultural based economy, as hypothesised by Christlein (1978), depending more on the manufacture of goods and the supply of animals and animal based products to be brought to the site. Zeder (1991, 39) states that this will lead to reduced consumer choice at the sites that are provisioned by a local administration. Cattle will be the meat of choice as there is a greater meat weight per individual compared to the other domesticates. The results from the fourth Century levels in the 'Gasthof Adler' area of the Kaiseraugst excavation perhaps fit with these two ideas and the preceding late Roman assemblages from the literature (Lehmann and Breuer, 1997 and 2002; Schibler and Furger, 1988). Perhaps these results are to be expected with the continuation of the settlement and to a greater or lesser degree the same cultural population through the first to fourth centuries AD, despite the departure of the Roman administration and the upper echelons of society. The manufacturing nature of the settlement at Kaiseraugst is attested to not only by the production of glass (Fünfschilling, 1996) and ceramic (Marti, 1996) during this period but also perhaps by the antler waste that has accumulated in the 'Jakobli-Haus' area (§5.3).

The rural sites are likely to still have an agrarian based economy and all the dependency on the agricultural processes that go along with it. It is perhaps also expected that some of the produce of the rural settlements will be traded with or sold to the urban settlements in the vicinity. The payments of rents and tithes, to landlord and church, must also be considered in the later part of the time frame of this work. However there are also differences between Reinach and Lausen. Lausen remains settled from late antiquity through to the early medieval period. Even in the late Roman period the site was considered an important point in the landscape. Reinach, however, was intermittently settled in the same period, eventually being settled by immigrating Germanic people. This suggests that the resources and geographical situation of the site were poorer than Lausen and thus not such a focal point in the landscape. The different economic backgrounds of the sites also need to be considered when comparing the two sites. The stable site at Lausen and Reinach where there is more uncertainty, at least in the early periods of this work. This is perhaps evident in the sixth and seventh Century period at Reinach with the influx of new people into Reinach creating a new settlement and thus using a different economic model than those at the more established settlements. This could be due to particular preferences of the immigrants coming in to the region or perhaps more likely out of necessity for feeding the population of the settlement. It appears from the kill age of the animals at Reinach that there is a more generalist approach to meat production at this time. It is interesting to look at the differences in strategies of the stable and new settlements, which suggests the former has prime pig, alongside adult cattle and ovicaprids, whilst a new settlement leads to older pig with more young cattle and ovicaprids consumed.

It is also necessary to consider the differences in social status, with respect to Lausen compared to the other sites here. Whilst the settlement at Lausen sees large-scale investment, the opposite is happening at Kaiseraugst with the investment moving from the *Castrum* to Basel. Reinach also becomes part of what appears a ceramic industry in the region (Marti, 2004) and thus increases it's standing in the region, but not to the extent that is observed at Lausen. Higher status sites, such as Castles often show a high proportion of pig remains, these are often young suckling or juvenile pigs (Marti Gradel, 2008; Pasda 2004). Wild animal proportions also tend to be higher at socially elevated sites because of the hunting practices and laws in the high Medieval and later (Pasda 2004, tab. 56). These types of changes are observed at Lausen in the ninth to eleventh Century periods and in particular the tenth to eleventh Century material at which point the settlement appears to be at its peak. There also appears to be remains of high status food waste at Kaiseraugst from the imprecisely dated fourth to sixth Century levels. This domestic waste is either not from the area around the point of deposition or that it comes from an earlier period when this area is not so devastated. This idea is lent weight by the fact that a similarly dated, albeit a considerably smaller and statistically insufficient sample, from the 'Gasthof Adler' area contains a greater degree of cattle remains rather than pig.

In the eighth to ninth Century period at Lausen there is a high proportion of yearling ovicaprids. This then suggests that prime lamb or kid were eaten at this time. This could be due to the fact that the majority of the data comes from the large structure 'Grube 28,' which is thought to be an important structure in this period of the settlement. However in the periods after this there is little or no evidence of these yearlings thus it begs the question as to where these probably surplus males went. The higher status in the tenth Century would suggest that the eating of these young individuals would increase too but this is not the case. This then suggests that perhaps the young ovicaprids present in preceding times where due to another reason rather than a status meal.

The higher percentage of chicken remains from the eighth to twelfth Century structures at Reinach compared to the other sites is difficult to elucidate. Alongside increasing pig proportions, higher chicken proportions are often quoted as being an indicator of increasing status. Therefore it could indicate a certain level of prosperity at the site. However, these proportions of chicken are greater than those observed at the highpoint of status at Lausen. The absence of the increasing pig proportions makes it difficult to pursue this hypothesis. An alternative suggestion may indicate breeding of chickens or egg farming at the site although with the lack of data pertaining to sex and age it is difficult to put this forward as a concrete suggestion.

The sites also differ in terms of the structures types from which the material was excavated. Kaiseraugst contains material that mostly came from layers, which in an urban context one would expect to be disturbed both horizontally and vertically and thus causing residuality effects in the material studied (c.f. Marti, 1996 150-159; 2000 figs 131 - 134). The nature of the deposits at Kaiseraugst, namely layers, could also be the reason for the higher proportions of cattle remains in the areas researched here. Higher density bone elements and larger animal elements are likely to be better preserved in such contexts than other elements of smaller and less robust nature. This would then mean that fewer younger cattle element also survive and thus this group would be underrepresented in the death population, and perhaps is the reasoning behind the different age structures to those at Reinach and Lausen. However there would also perhaps be differential deposition of the non-food waste due to the lack of space, i.e. outside of the settlement, and this is perhaps the reason that lower proportions of equids are observed at Kaiseraugst compared to the other sites studied here, as well as *Augusta raurica* (Schibler and Furger, 1988). Differential deposition has also been proven in other sites in northern Europe (c.f. Kunst, 1997, 75; Maltby 1985, 104). Reinach and Lausen, both contain material that comes from 'grubenhäuser' and are thus more comparable. It must be borne in mind though that there is some residuality of material at Lausen, due to space constraints, although not to the extent that would be expected at Kaiseraugst. The size of samples and the comparability of smaller samples with larger samples is a problem that must also be considered and is discussed in more detail below (§8.3.3).

The easiest analysis to compare in terms of the three sites studied here is the species comparison of the three main domestic species. Similarities are observed in the material dated to the early medieval in particularly the fifth to seventh Century data from both Kaiseraugst and Lausen, and the ninth Century data from Reinach. This then suggests that there is a region wide economic system that is set up that produces such results (fig 8.1.4-1). This idea is given further weight by the data from the seventh and eighth Centuries in Basel (Morel, n.d.) and Pratteln (Marti-Grädel, n.d.). Further a field similar results are also observed at Berslingen (Rehazek 2000, 162-166) and the results from Benecke's summary of the late Roman (1994, 150-156) and Early medieval (1994, 195-202) in Germany and Switzerland. This then suggests that perhaps there is a wider scale process going on here. This is discussed further below (§8.2.1).

Age differences can also be observed with respect to the different main domestic species in the three sites studied here. Figure 8.1.4-2a shows that there are higher proportions of adult cattle at Kaiseraugst compared to the rural settlements of either Reinach or Lausen. These adult animals are probably being used as traction, dairy or breeding animals, however the lack of sexing data means that it is difficult to observe which is more important. The reduce numbers of adults in the rural sites is substituted with a higher proportion of subadults and juveniles that are probably used for meat rather than traction or breeding purposes. Ovicaprids (fig 8.1.4-2b) tend to have similar proportions of adults throughout the sites although there is a lack of data from Reinach. Pig age structures are also relatively constant throughout time and space (fig 8.1.4-2c); however there tend to be higher proportions of adults at Kaiseraugst and Reinach in the time period from the fifth to seventh Century. This may reflect the importance of breeding stock during this period or that some animals are being consumed much later and that quality of meat is a less important than another factor, perhaps affordability. The levels of subadults, the high quality meat animals, tend to remain similar throughout the data presented here.

Body part representation and thus the inferred butchery practices i.e. the same elements showing similar marks of butchery; suggest that there is a continuity of practice throughout the sites studied here and also a chronological continuity (c.f. tables 5.8.1 to 5.8.3-7). The fact that it appears the live animals are brought to all three sites to be slaughtered makes this similarity more plausible. The presence of all body areas and elements attest to this fact (c.f. figs 5.2.1.4-1, 5.2.2.4-1 and 5.2.3.4-1). It is perhaps also due to the limited ways in which an animal can be disarticulated in primary and secondary butchery phases (c.f. Seetah, 2008). Smaller jointing of meat can be more variable but is perhaps hidden not only due to the highly fragmented nature of the material analysed but also partly due to the extraction of marrow from the long bones.

This then lists the main differences and similarities that can be observed between the three sites studied here. This list is not exhaustive in anyway but sets out major differences that occur within the sites through the comparison, and hopefully an explanation of most of them.

8.2. Wider regional perspectives

A discussion of the changes and progression of the settlements through time is a good way of understanding the individual settlements in isolation. However, this does not help with the understanding of the interactions of these settlements within its surroundings and interactions with other settlements in close proximity and perhaps further a field. This subject is perhaps especially interesting in terms of the rural sites provisioning the early urban settlements of the region and in terms of uniformity of settlement economies across the landscape. This necessitates the comparison of the data presented here to previously published work from a similar time frame. The comparative sites used here are based on the publication of Hüster-

Plogmann and Rehazek (1999, tbl. 1), further suitable sites published after this article have also been added to form a reasonably comprehensive thousand year dataset ranging from the late third to the thirteenth century (table 8.2-1). This then includes not only all the published data from the time periods encompassing the work here but also results that occur in the time periods immediately preceding and subsequent periods. This will then allow observation of the starting point from which this works data has come and also the possibility of what it will lead into. There are many changes, social, political and cultural observed in the time frame considered here: the end of Roman control in the region, the influx of the Germanic peoples, the introduction of the manorial system, the increasing dominance and specialisation within urban centres. This last point leads on to the fact that the type of settlement may be important in the role of animals in past settlements, thus assemblages from rural, urban and castle sites must be considered. In the later periods, the assemblages have been kept to those containing domestic waste where possible to be able to make solid comparisons. During this time urban settlements are becoming more organised, with specific areas relating to specific trades and crafts, akin to the organisation of the larger Roman conurbations. These craft wastes can be mixed with domestic rubbish, thus producing results that are not comparable to those of other sites where domestic waste is predominating. Of course it is possible that craft and domestic waste are mixed in other sites and not observed although the proportions are probably small and as such do not greatly influence the results.

8.2.1. Towns, castles and villages: A comparison of the regional sites

Comparing the proportions of the three main domestic species from the various sites in the region shows that together there is little in the way of patterning that is observable, just a large cloud of data that is situated on the right hand side of the diagram (fig. 8.2.1-1). If this data is split in to three general time periods, late roman, early medieval and high medieval, then the data from the late roman period appears separate from the other two. The late roman material consists of a high proportion of cattle, as is typical for Roman period settlements (fig. 8.2.1-2). The only point that deviates from this, Schiers (Hartmann-Frick 1975) is a site from canton Graubünden, where not only the landscape is different, thus the need for a different strategy for provisioning the population but also the political landscape is much different. In this alpine area it is much easier to tend sheep and goats rather than pigs or cattle. This exception does show that one must take care when comparing sites from different geographical areas. Peters (1998, fig 14) has shown the difference that geographical region play in species composition. The early medieval data up to the eighth Century shows a much more centre-right distribution of the comparative data (fig. 8.2.1-3). The cultural upheaval that is taking place at the end of the late Roman period is the likely source of this change from high cattle proportions to a more equal use of the three main domesticates. The uniform practices of Roman agriculture that was introduced to many places in North West Europe during the reign of the Empire meant that many places show similar proportions of animal remains. The end of the empire led to the termination of this uniformity across wide areas due to the lack of political and administrative powers to see over its continuation. This then perhaps led the populations involved to take up a more generalist strategy, due to the lack of a centralised market or organised trade. The exceptions to this appear to be the Develier-Courtételle material which remains under Roman influence much longer than the sites studied here which may mean that results are similar to the Roman period until much later. Also two sites from the midlands and east area, namely Winterthur and Schleitheim both from the sixth to seventh Century show results that are similar to those observed in the late roman results, this may also suggest that the results from this region are still being influenced by Roman culture later than can be observed in the data from the Northwest region.

Despite the resolving out of the late Roman material, the early medieval and high medieval still form a large cluster in the diagram (fig. 8.2.1-4). This is perhaps due to gradual change being introduced rather than the major changes that are observed in the cessation of the empire and the beginning of the early medieval. The uptake of the manorial system is observed during this period, probably from systems that had already developed in the Mediterranean region (Sarris 2004) and more likely through a continuing rather than an abrupt change in system. The fact that there are no distinct transformations in this time means that perhaps rather than using time as a method to separate the material, the different settlement types in the society may afford a better observation point to the early and high medieval data as Albarella and Davis (1996, fig 40) showed at Launceston castle in the UK. In their work from the fifteenth and sixteenth century castle site it was possible to separate the different castle sites from the urban and rural sites by the faunal material, however it failed to elucidate further on the differences between urban and rural settings. The more up to date and relevant work by Marti-Grädel (2008 fig 348d) also showed that the castle sites of Northwest Switzerland and into the Bayern area (Pasda, 2004) had different proportions between the settlement types. Using the same comparative data to that of Marti-Grädel (2008, tbl. 347) expressed in a different way, using triangle plots, it is hoped that new observable patterns will emerge from this analysis. Firstly it can be established that the castle sites with a few exceptions are grouped in to the bottom left hand corner that indicates high proportion of pig remains at the expense of both cattle and ovicaprids (fig 8.2.1-5). Those castle sites that do not fit into this grouping tend to be those that are in marginal environments and are of lower social status or parts of castle complexes and thus perhaps administered by subordinates (e.g. Riedfluh, Löwenburg and Oedenburg). Burg Schiedberg is situated in the southeast of the country, canton Graubünden and like Schiers above the different geography probably plays a role in the difference between the relationships of the three main domesticates. Consideration must also be given to the fact that the mechanics of the diagram means that the three variables must be dependant on each other, so that when one variable increases the others will decrease. In the case of most sites presented here, the main domesticates make up over 95% of the total faunal assemblage and thus fulfil the requirements for the plotting of the data. However some of the castle sites have high proportions of wild animals and/or fowl thus this reduces the suitability of the data.

Interestingly, the urban sites and rural sites also show different proportions of the three main domestic species. In the urban sites (fig. 8.2.1-6), there appears to be a possibility to group the sites due to certain criteria. Firstly the Roman 'urban' sites are grouped as previously shown (c.f. fig. 8.2.1-2). It then appears that there is a consistency of results between the comparative sites, where the proportions of pig remains almost constant, within the boundaries of variation, and the other two species can be considered as variables. There is a single exception to this pattern, the eleventh Century Barfüsserkirche material (Schibler and Stopp, 1987), which shows high proportions of cattle, remains. Closer examination shows that the a great proportion of the fragments are horn cores and thus probably does not represent wholly domestic waste but more likely craft waste perhaps a horn worker (Schibler and Stopp 1987, 323-326). This reiterates the point that care needs to be taken when choosing comparative sites. Further investigation shows that it is possible that there are two groups of data, a second smaller group that has a higher proportion of pig remains, yet appears to follow the same pattern as the better populated though lower proportioned group. The higher group perhaps indicates an improved style of living, as it appears that the group consists of urban areas that the archaeological evidence points toward being higher status or more influential. If it is considered that the *Castrum* at Kaiseraugst is the Episcopal seat of the region and a major trading hub then it would also fit in to this improved status type site. This is certainly the case with the material that comes from the cathedral mound (Munsterhügel) in Basel, both the Reischacherhof site (Morel, n.d.) and the latrine material from Augustinergasse (Schibler,

1996) shows signs of wealthy landowners at the sites. However the Cathedral courtyard in Zurich (Csont, 1982) seems to disprove this hypothesis with high proportions of young lambs being consumed by the wealthy inhabitants. The group with the lower proportions of pig remains can perhaps be interpreted as the level of pig consumption that is needed to sustain an urban, perhaps, self-sufficient lifestyle. More data is needed to elucidate whether this is indeed two groups or a single cloud of data. However, here it will be assumed that there are two groups.

As speculated above it is difficult to interpret these results as within the two groups lay diverse sites both geographically and temporally. The triangle diagrams use transformed data to plot the points, so perhaps the actual proportions may help elucidate this problem. Analysis of the interaction between the two variable species in this case, cattle and ovicaprids (fig. 8.2.1-7), the low correlation (low R-squared value) of the whole data further suggests that two groups from the triangle plot can be observed and should be able to be separated out (fig 8.2.1-8). These data then shows that the second tentative group is a more realistic scenario than it being one large diverse group, the R-squared values are quite high for these data sets adding weight to this idea (fig. 8.2.1-9). In fact this data causes even more problems because it appears that there is some overlap in the middle of these two data sets, thus perhaps rather than two groups this data should be three groups, the high R-squared values for the three groups support this idea (fig. 8.2.1-10). Again there appears no apparent reason for the groupings, although the upper group relates to the material from Barfüsserkirche and Schneidergasse (Reich 1985) both in Basel. These are thought to be areas with craftsmen and the lower status areas of the city. The group also consists of the material from the Münsterhof in Zurich but as explained above the high proportions of ovicaprids are young individuals. The lower group consists of those with higher proportions of pig remains and thus form the tentative second group in the triangle plot. However the data from the eleventh and twelfth Centuries at Reischacherhof (Morel n.d.) and the material from Zug Kaufhaus (Rehazek, n.d.) have joined to the remaining material to form a third transient group between the former two. The reason for the split between these two groups is not immediately clear. The differences in the groups withstanding, the fact that each group contains data from different time periods and geographical regions means that this practice was long lasting and wide-ranging thus it is probable that there was an important underlying purpose to it. The differences noted between the sites mentioned above could be due to variation in many factors, some recordable others invisible to the archaeological record and that these relationships between sites and species are not black and white but a greyscale of different economies depending on amongst other things, cultural choices, social status of the site and the environment in which the site sits.

Analysing the rural data in similar manner shows that the ovicaprid proportions are constant, albeit at low levels rather than the pig proportions as seen in the urban data (fig. 8.2.1-11). This then suggests that a different mode of provisioning is used in the rural settlements when compared to the castle and urban settlement types. Again looking at the two variable species, in this case cattle and pig, it can be seen that the data fits quite well to a single line and the R-squared value is also relatively high suggesting that the data are falling within a single grouping (fig. 8.2.1-12). It can also be seen from the geographical distribution of the sites that the pattern is occurring across vast areas of Switzerland, probably in south west France and the Bayern region of Germany too, although these regions are represented by single sites (fig. 8.2.1-13). It could be suggested that the data from France is at the top left of the diagram, whilst there is a tendency for the midlands and eastern data to group towards the bottom right, however the northwest and Jura data spans across these areas thus it may be due to a lack of data that these separate out (c.f. fig. 8.2.1-13). Chronologically there seems to be little separation either with data from all periods spread along the range of data (fig. 8.2.1-14). This then suggests that the reason behind these choices in proportions of the three main domestics is one that is based deeply in the system of agriculture to be so far reaching both geographically and temporally. However, the reason as to the constancy of the ovicaprid proportions is difficult to elucidate, it could be suggested that this is related to secondary products either wool production or dairying, although there is no archaeological evidence to suggest that either of these are any more important to the rural communities than to those in an urban setting. The data from rural sites is a little sparser than the urban data and it is a prerogative that more data is added for the earliest periods to fill these gaps in the current research.

- *Castles in detail*

This relationship of pig and cattle and thus a constant proportion of ovicaprids can also be displayed for the castle sites of the comparative sites, although the correlation is not as tight as for the rural sites (fig. 8.2.1-15). The plot also acted as a check for the ‘inter-relatedness’ of the data in the castle triangle plots (c.f. fig. 8.2.1-5).indeed the plot indicated that those castle sites that have high proportions of wild animals and/or fowl (open symbols), shows that the data is secure and that those sites with high fowl or wild animal proportions tend to fit better to the observed trend than the higher status castle sites such as Altenberg, Frohburg and Burg

Rickenbach. These higher status castles tend to exhibit higher proportions of cattle compared to the other castle sites. In fact a second plot shows that in all likelihood the relationship between cattle and pig at urban sites, albeit with a very loose correlation, is to some extent the inverse to that seen at castle and rural sites in so much as cattle and pig increase proportionally rather than substituting each other (fig. 8.2.1-16).

The roles of equids and dogs in the different site types have been discussed fully by Marti-Grädel (2008, 271-272; figs 357.). It has been shown that there is a higher proportion of equids in rural sites compared to urban sites in the early medieval and high medieval. Marti-Grädel (2008, 271) suggests that this is perhaps due to the differential burial of the equids at castle sites and that the relative poverty of rural sites means that equid meat may have been part of the diet compared to the urban sites. These hypotheses seem reasonable for the data reproduced here. However the fact that large animal remains tend to be deposited on the edges of urban centres reduces the likelihood of discovery at urban sites, whilst the excavation areas uncovering rural settlements tend to be much greater and encompass a larger proportion of the settlement than in urban contexts which tend to be spot excavations covering a small and focussed area and thus the likelihood of uncovering equid bones in an urban context is much reduced. The evidence of butchery on equid bones is also hard to find given the relatively low proportions of the animals. In addition, dismemberment of the animal probably took place before deposition thus making it much more problematic in proving butchery as an aid to food preparation without a large sample of data. Splitting the data for the castle sites by the relative status of the site it can be observed that the equid proportions are greater in those sites which have an unknown status compared to those of higher or lower status (fig 8.2.1-17).

The observation of the results from the dog proportions appears to show a picture that is similar to the equids with higher proportions in the unknown status sites (fig 8.2.1-18). This then suggests that the designation of high and low status to these sites is not precise enough as there is a whole gamut of variation around these two discrete points.

The proportion of chicken remains at a site is often quoted as having quite a good relationship with the social status of the inhabitants, much like the proportions of wild animals (Schibler and Furger 1998; Lehmann and Breuer 1999; 2001; Marti-Grädel 2008). Indeed it has been used in the text here as a signifier of increasing wealth or social standing with regards to certain areas or time periods at Lausen and Kaiseraugst. However the relationship with regards to status and proportions of chicken remains does not stand out when the data from the comparative sites are fed into a box plot (fig. 8.2.1-19). Although there are a proportion of castle sites that have relatively higher proportions of chicken remains, the average is very similar throughout all site types (c.f. Marti-Grädel 2008, 269-271). However if the castle sites are split by status, it can be recorded that there is a tendency for elevated proportions of chicken in the higher status sites, although these samples are relatively small and therefore must be treated with trepidation (fig. 8.2.1-20). Similar observations can be made for the goose remains too although the difference between the high status and the other status castle is more exaggerated (fig. 8.2.1-21 and fig. 8.2.1-22). This then suggests that the presence of a high proportion of domestic fowl at a castle site is a good indicator of high status.

The wild species proportions however do remain statistically higher for the castle sites compared to either urban sites or rural sites (fig. 8.2.1-23). Whilst the different status castle sites also show a variation in the proportion of wild species present, which probably represents the rights of the wealthier households to hunt on their land to the exclusion of others and that they had the time to pursue these sports (fig. 8.2.1-24). Splitting these wild species in to the two main recorded wild animals, red deer and wild boar a similar pattern is also observed in these species. The red deer show significantly higher proportions in castle sites compared to the other site types(fig.8.2.1-25), whilst the social status of the castle is also important with lower status sites showing almost an absence of red deer (fig. 8.2.1-26). The castle sites with undesignated status show similar patterns to those seen in high status castles. Wild boar results follow much the same pattern as red deer, where there is a significant difference between the castle sites and the urban and rural sites (fig. 8.2.1-27) and that despite the small samples there is a tendency for higher status castles to exhibit higher proportions of wild boar (fig. 8.2.1-28).

- *Urban sites in detail*

It is possible to produce similar plots for the urban settlements from the published literature. Ovicaprid proportions show a tendency to increase in proportions from the early medieval to the high medieval (fig. 8.2.1-29) whilst there is also a gradient of difference between the higher status urban sites and those of lower status, with the lower status sites having greater proportions of ovicaprids present, whilst the more ‘Romanised’ site at Kaiseraugst shows results that are lower than those in the higher status sites (fig. 8.2.1-30). This then suggests that the meat and secondary products of ovicaprids became more important over the time period studied here. In the high medieval wool production becomes more than just a cottage industry of earlier times. Dung and offspring are probably not major concerns of the urban dwelling inhabitants, although dairy products may also be of importance here but this would be difficult to observe in the archaeological record.

The remains of pig show the inverse transition to that observed in the ovicaprids. Pigs become less important to the inhabitants of the urban sites from the early medieval to the high medieval (fig. 8.2.1-31). The social status of the sites also shows that pigs are most abundant in the Kaiseraugst material, whilst the high and low social statuses have similar proportions (fig. 8.2.1-32).This is perhaps the follow-on for the increasing proportions of ovicaprids in the faunal remains at the urban sites. The cost and availability of pig and pork products may have been prohibitive or perhaps cultural and fashion proclivities dictated the pattern observed.

Chicken remains tend to remain constant from the early to high medieval (fig. 8.2.1-33), although there is a propensity for there to be higher proportions of chicken remains in the higher social sites compared to the ‘Romanised’ sites and the lower status sites (fig. 8.2.1-34). The lower numbers of sites used in the analysis makes this no more that a trend in the observed results but adds weight to the fact that higher proportions of chicken are a good indication of a socially elevated food waste.

The observed wild species proportions shows comparable results to those of chicken, with perhaps a slight downward change in the proportions from the early medieval to high medieval (fig. 8.2.1-35). There is also a wider range of wild species proportions in the high status urban sites (fig. 8.2.1-36), which may reflect the purchasing power of these wealthy people, perhaps this is also the result of limited hunting activities on owned land outside the towns. Other species not mentioned here show similar tendencies both through time and social status for example the cattle and equid remains.

- *Rural sites in detail*

The same analysis with respect to the different sites and status cannot be applied to the rural sites as there is a dearth of archaeozoological information on these sites and was partly the reason for the study here. However it can be seen from this work alone that there are differences in the status of the rural sites, Lausen and Reinach for example, archaeologically show a wide variation in the lifestyle of the inhabitants thus it would be expected that as more sites are uncovered and analysed that a pattern of status and animals remains could be built up much like that of castles and urban centres.

- *Age and Butchery*

The discussion of the age structures between sites of different authors is difficult due to the use of different methodologies. Whilst the developmental stages of both teeth and bone are relatively well set, many of the tooth wear stages are highly subjective and thus different authors have different interpretations of different stages. However, the gross changes in age structure can be discussed further. Observing the slaughter ages of domesticates from rural sites through the early Medieval shows that Berslingen (Rehazek, 2000), Devellier-Courtètelle (Putelat, 2005) and Courtedoux Creugnat (Olive, 2008) all have a majority of adult cattle and ovicaprids whilst pigs are younger, of prime meat quality. This reflects the secondary products available from cattle and ovicaprids and the meat nature and high fecundity of the pig.

The methodologies of studying butchery and body part are also rarely published in the literature thus it is difficult to know how comparable data are from different sites by different authors. Body part analysis and butchery comparisons between sites is difficult to make as often the methodologies are not published and it is possible that differences in methodologies can produce differences at sites rather than difference in the practices being observed. All the animals tend to be brought in 'on the hoof' so it is probably difficult to see differences in butchery patterns. Also with butchery it is also difficult to understand the methodologies of dismemberment when to little data is recorded about the placement and type of mark that is observed (c.f. §5.8). It may be possible to observe the difference between hired skilled butchers in the rich quarters and home-made butchery through the quantification of repetitive marks on the skeleton, with a higher incidence likely to occur in the poorer, unskilled areas of settlements.

These results then show some of the variation that can occur within the sites that have been recorded from the literature. The main point to take away here is that there is no predetermined way in which high status will assert itself in the food remains, there tends to be higher proportions of chicken and wild species but this is site dependant and the choices made by the inhabitants.

8.2.2. The Eleventh Century: A case study

As mentioned above it is difficult to compare the work, with respect to age, body part and butchery, from other authors mainly due to the different methodologies that can be used and the lack of explanation of the methodologies used due to space constraints in publications. However, at the IPNA there is an attempt to standardise many of these data so that comparison of the material at least within the research group is as far as can be expected comparable. This does not mean the removal of all variation as inter-observer error will still be a factor in areas where character traits are subjective. Also the changing nature of the recorded data, new research, methodologies and theories makes the system more fluid over time, even if the basis of recording is kept similar. This then means that with the data recorded here it is possible to create an overall view of the different types of settlement and social standing from sites that have been recorded at the IPNA. Thus in this section it is hoped that with the results from the eleventh Century a view of the regional economy and settlement dynamics can be put together. High status sites such as Altenberg and Lausen, diverse urban settlement areas within the city of Basel and the lower status rural site of Reinach. The eleventh Century has been chosen firstly as it gives a picture of all three site-types, rural, urban and castle and secondly because this is the time at which the populations within cities are increasing. People are moving into urban centres from rural sites. Piecing together this information may lead to interesting insights in to the provisioning of the different sites and social levels. The details presented here are in no way intended to be a definite picture of the meat economy that existed at the time but a first step in to recreating this part of the past society in more detail than has previously been attempted. However there are gaps in the data due to different recording methodologies for example the data for body part analysis at Reischacherhof and Schneidergasse in Basel were both recorded using the number of fragments rather than weight of fragment that is now carried out at the IPNA. The age data are also difficult to compare, being that numerous authors from an earlier research point present these data differently, for example, Reischacherhof is missing parts of the data that could further elucidate the meat economy. The differentiation within the walls of medieval Basel has long been recorded and understood (Schibler and Stopp 1987; Hüster-Plogmann and Rehazek 1999; Morel n.d.). The sites situated along the river Birsig within the city tend to be inhabited by the lower echelons of society, craftsmen and such like. Whilst on the Munsterhügel the higher society is looking down, probably both figuratively and literally, on the rest of the city. It has been shown in previous work that the size of cattle differs significantly between these two areas. Hüster-Plogmann *et al.* (1999, 336) suggests that the residents on the Munsterhügel brought in larger forms of cattle from rural sites of which they owned. These cattle would have had more space and forage than those animals being kept within the city walls by the lower classes and grazing on common land around the city. The results from rural site show that the size of the cattle from the hinterland of Basel is similar to those found on the Munsterhügel. The lower society of Barfüsserkirche and Schneidergasse both contain smaller cattle. In the eleventh Century it is known that there was a Horner's workshop on the Barfüsserkirche site, which may also affect the results drawn from the morphometric data.

The species proportions at each of the sites show that there are higher proportions of pigs at all sites that are considered socially elevated, in this case Altenberg, Lausen and Reischacherhof (fig. 8.2.2-1). Altenberg shows a high proportion of pigs around one year of age (fig. 8.2.2-2). This castle site also has a high proportion of wild species and chicken remains (c.f. tab. 8.2.2-1). The urban sites tend to have higher proportions of ovicaprids, including the Reischacherhof site which has a relatively higher proportion of ovicaprids compared to the other high status sites (fig. 8.2.2-1). The age of the ovicaprids at urban sites are mostly adults although there is no evidence from the Reischacherhof site so only lower status sites are represented (fig. 8.2.2-3). The ageing data for Schneidergasse shows slightly raised proportions of subadults compared to Barfüsserkirche but on the whole the same pattern is observed. The higher proportions of subadults are also seen in the data for cattle too. This may then suggest that the data from Barfüsserkirche is biased because of the craft processes being carried out in the area (fig. 8.2.2-4). The low status urban sites show very few wild animals and variable proportions of chicken remains that perhaps relate to the sample size or the differing waste samples (c.f.tab.8.2-1). Reischacherhof shows a proportion of wild animals that are similar to the rural sites and lie somewhere between the Altenberg value and those of the low status urban sites. This then suggests that there is a greater opportunity for the wealthier inhabitants to obtain slaughtered wild animals either through hunting on their own rural lands or through the ability to purchase such meat at market.

The rural sites show similar proportions of cattle and pigs at both sites (fig. 8.2.2-1). Cattle display ages from year old calves to old adults (fig. 8.2.2-4) whilst pigs tend to come from one year old pigs to prime meat pigs (fig. 8.2.2-2). The proportions of wild species has been alluded to above and there are variable proportions of chickens at the sites with higher status Lausen showing an inferior proportion to that of Reinach although this could be due to the relatively smaller sample at the latter.

The body part analysis shows that in all cases the whole animals, or at least all the parts of the slaughtered animals were available at all sites. The main difference observed is the relative lack of cattle meat bearing bones at the Barfüsserkirche site, this is perhaps due to the horner's workshop present swamping the sample with waste from this process, rather than the lack of beef available to the inhabitants. At Altenberg the low deviations from the standard suggests that whole cattle carcasses are being slaughtered and consumed. However there are smaller proportions of trunk remains but this is likely due to taphonomic processes. Similar absences of trunk parts are observed in cattle at Reinach and Lausen, although there is more deviation from the standard with higher proportions of the major meat bearing bones, suggesting a greater emphasis on jointing of the slaughtered animals. The body part analysis for ovicaprids shows that each site is processing the carcasses in the same or similar way irrespective of age of the animals and the social status of the site.

The data presented here is that from each site individually, now if it is assumed that the animals found within the urban sites and perhaps to a lesser extent at the castle sites come from the rural sites then the differences observed may lead to an understanding of the patterns of distribution of the animals into the other sites. It must be made clear that the term rural sites here is a general term and not relating specifically to Reinach or Lausen as it is impossible to ascertain where the animals and thus the surviving bones from other sites have come from. As mentioned above this is not a watertight method as many assumptions have been made and many processes have been overlooked, but these first steps however make for an interesting view of the meat economy of the region. This of course ignores the proportions of wild animals, fowl and to a certain extent fish.

The main clear distinction observed here are the high proportions of lambs in the castle site, these may be related to the payment of rents to the landlord. Conversely there are high proportions of adult ovicaprids in the lower status urban sites and thus it maybe that these animals are cheaper and produce wool and dung which are important in the probable backyard economy in eleventh century Basel. This then leaves the rural sites with higher proportions of subadult ovicaprids, these maybe the surplus animals that are not being sold to market or those that are being sent to the landlord as rent. Cattle show a similar situation to ovicaprids at the rural sites where there are similar proportions of different age groups. The adults are found in highest proportions in the lower status urban sites and Altenberg. The adults at the castle are quite surprising and may be those that are used as working animals on the lands of the owners of the castle. The adult cattle at Barfüsserkirche are also probably working animals used for draughting in and around eleventh century Basel. Schneidergasse however without the evidence of crafts shows a higher proportion of prime meat animals, those around three years of age. In terms of pigs a similar pattern is observed through all sites with prime meat and year old individuals dominating, this is due to the fact that there are no secondary products with pigs which are reared for meat. The castle at Altenberg has the highest proportion of year olds and again as with ovicaprid the consumption of these young animals is a sign of the high status of the site. At the rural sites there are higher proportions of the younger animals than at the lower status urban sites, thus this may signify a slightly higher status especially in terms of Lausen. However, this could equally be due to the consumption of the excess animals that are not being sold to market or those being moved on through other means. It would be interesting to be able to observe the higher status urban sites here. Unfortunately the data for the eleventh Century is not comparable. This then shows the envisioned movements of the three main domestic animals found in the sites here.

8.3. Future research directions

In this final section before concluding this work, the future research and interesting themes derived from this work will be discussed. This section will be used as a point of introduction for topics that are perhaps secondary to the analysis above, whilst highlighting areas of the work that need further research or produce pitfalls of which future researchers should be wary.

8.3.1. Increasing the breadth of information from the Early medieval

The work here is just the beginning of the study into the faunal remains of the early medieval settlements in the region. This work hopes to set a base line with which others can work from and further the knowledge of the economic and husbandry practices of the period in relation to the rural sites especially. This of course requires the excavation and analysis of more sites, something that will be an on-going process as more information is collected. It would be interesting not only to get a broader base of information on rural, urban and castle sites but also information for religious sites, such as monasteries. Which are available in other parts of the country for example, Müstair in Canton Graubünden (Kaufmann, 2007) although the ongoing excavation at Oberdorf (canton Basellandschaft) could reveal more information on this area, if faunal remains are available. It would be interesting to relate these types of sites to the secular sites and how they differ, if at all, especially at this time when Christianity is becoming evermore popular and as further evidence there is far more written sources from religious sites than secular sites. This could also allude to the dietary habits with relation to fasting and feasting and also to foods that are prohibited to the inhabitants of such an institution. This would also give an insight into the veracity of the literary sources on the subject. It would also be an interesting insight in to the management of the manorial system as in many countries, the catholic church held great areas of land in demesne in which rents were payable to the church. This could be used as a comparison to the results seen at other landlord sites, such as Lausen and Altenberg in the early medieval period.

8.3.2. Investigation into sample sizes

The study also proved to be an interesting analysis of the affects of sample size not only in the terms of the quantity that constitutes a statistically robust sample, even though this question has been raised frequently here. The work has also raised the topic of the comparability of large samples with small samples. This latter case can be seen in the comparison of the species representation from Kaiseraugst and Reinach, where the Kaiseraugst material consists of large accumulations of faunal material, the same cannot be said for Reinach where most assemblages only just reach the required number to be considered statistically feasible. The comparison begs the question as to the proportion that one fragment composes. In a small assemblage one fragment has a greater importance than a comparable fragment from a larger assemblage and this is compounded when considering analysis by weight. Whilst there is no doubt that the researcher can only work with the assemblage that is placed in front of them, it must be considered during the analysis phase the effect that sample size will have on the results and thus how the analysis can be carried out most effectively, by recording the numerous small samples or the less frequent large samples?
Whilst the latter will give more precise data on an assemblage it can also drown out the effect of other smaller assemblages when accumulated. This study has also shown that whilst the lower end of the statistically robust data may produce results that are secure for the numerous domestic species, in particular the three main domesticates this seems not to be true for the less well represented species such as the wild animals and minor domesticates. These small samples do not allow the further analysis of these poorly represented individuals, and thus data like age, sex, palaeopathology and biometrical analysis are all but ignored for the majority of these species.

8.3.3. Biometrical analysis and a better understanding of size development

It would also be interesting to further the research on the size development of the domestic species in this period. Firstly a wider exploration of the change in stature of cattle would be of note. The wealth of data presented here has only led to more questions on this topic, as it appears from the results that the size-decrease in cattle is more than a local phenomenon but spreads further. Work from France (Audoin-Rouzeau, 1991) and England (Albarella *et al.*, 2008) show that different ways are used to cope with the departure of the Roman administration. In England, there is little seen in the way of decrease in size after the fall of the Roman occupation (Albarella *et al.*, 2008). In France too, there is no indication of the decrease in size of cattle (Audoin-Rouzeau, 1991). However, the occupation of Gaul continued longer than North-western Switzerland and thus may be an influencing factor. It would be interesting to observe if the differing methods were based on cultural preferences or perhaps as have been observed by others (Peters, 1998 fig. 14; Stopp and Marti 1997), geographical influences. However this type of undertaking would require more assemblages from the late Roman and Early medieval periods with well preserved remains and so hopefully a wealth of biometrical data. Further methodological refinements could also be applied to the work such as observing the changes in the tooth biometrical data using the log ratio technique. The reasoning behind this is that molar tooth morphology is less sexually dimorphic and responds slowly to pressures of selection and nutrition thus changes observed in tooth length illustrates an introduction of new genotypes in to the existing genetic material (Degebøl and Fredskild, 1970). Unfortunately, the material from Kaiseraugst, Lausen and Reinach could not be studied here due to relatively small data sets to push and the lack of a standard or reference material with which the data obtained could be compared. The results would perhaps reveal, in a relatively simple step, whether or not there was an influx of new genetic material into a population of animals.

Further work is also needed to better understand the changes in stature of the other domestic species especially ovicaprids, fowl and equids. These species have little in the way of biometric data that can be used here to gain a good understanding of the size development of the species after the Roman period and the work by Breuer *et al.* (2001). The results here suggest that ovicaprids at least play an important role at rural and lower status urban sites and thus it would be interesting to gain valuable insight in to the use of these animals from a biometrical perspective.

9. Conclusions

At the start of the study the aims of the project were laid out; to observe variation in the faunal material, to identify socio-economic, cultural, craft and environmental changes. This work is important, as there is little archaeozoological data from the region of northwest Switzerland on this early medieval period. In the previous chapters the results presented here have shown, that all these causes of change could be observed to varying degrees within the assemblages with the exception of environmental. Most differences could be shown to derive from changes in social status or differences in status between the sites.

In the middle Ages, pork and chicken were preferred by the socially elevated. This is reflected in the increasing proportions of pork in the site at Lausen with the investment in the site (i.e. construction of stone buildings). Wild animals were also more regularly eaten in the higher status sites either through rights of hunting in the later periods or through greater wealth and thus a greater purchasing power for more luxury foodstuffs. Yet there is no increase in the wild animal proportions at Lausen even at the height of the settlement. There is a wider range of species identified but on the whole there is no increase in their proportions. Equids also play a role in the conveyance of status, although in the study here it has been shown that the higher proportions of equids tend to be observed in the rural sites. ‘Grubenhaus 54’ at Lausen is a case in point with at least four female pelves recorded in this structure again points to the prosperity of Lausen at this time.

In contrast the second rural site studied here, Reinach, shows little in the way of the rising status that is observed at Lausen. Unlike Lausen, Reinach was not continuously settled throughout the fifth Century, periods of intermittent inhabitation are recorded and in the later sixth Century a new group of people set up in Reinach, the evidence points to these people being of Germanic origin. This resettlement of the site brings with it a different set of species proportions than those observed in the contemporary material at Lausen, which had remained continuously settled. There are much higher proportions of pig in the diet. This alongside the ageing data, which suggests that there are higher proportions of adult pigs, perhaps elucidates the hardships of setting up residence in a new area. Pig have a relatively high reproduction rate and thus allows a stable herd to be established quickly whereas the other species tend to take much longer due to single lambing/calving episodes each year. Once the site is permanently settled there is a change in the proportion of species, in that it becomes similar to the early, relatively lower status period at Lausen, where beef is the predominant meat source of the inhabitants. As with Lausen there are almost no wild animals in the assemblages and those other than large mammals are likely incursions from the surrounding environment. In the latter time periods here, higher proportions of younger animals are present at the site, although there is no increase in status according to the archaeological finds. This then suggests that there is a greater demand for meat or perhaps prime meat with the killing of younger animals. This is a trend that is seen in all three domestic species although sample sizes tend to be relatively small.

The third site, at Kaiseraugst shows changes that are perhaps due to cultural differences rather than status. However, it could be argued that the cultural changes lead to a change in the social status of the inhabitants of the urban centre. The removal of the Roman administration at the site appears to lead to a change in the proportions of domestic animals; there are higher proportions of pig, which are replacing the high proportions of cattle observed in the previous roman period. This may suggest a change to a more backyard type of economy where inhabitants are becoming more self sufficient rather than relying on the local governmental provisioning of the city. It could be argue that with the site being the bishopric seat of the region that there should be a higher status of the site perhaps comparable to that seen at Lausen in the ninth Century. However as is with all urban centres there will be horizontal variation within the settlement, some areas wealthier, some not so. Previous work by Schibler and Furger (1998) and Lehman and Breuer (1997; 2002) has shown that parts of the *Castrum* and the former city of Augusta Raurica exhibit areas of different social status and thus a variation in the preference of meat contained within the diet. There is also a small proportion of antler debris in the ‘Jakobli-Haus’ area of the site. This minor accumulation hints at the possibility of crafts at the site, which would fit well with the other crafts observed in the ‘Gasthof Adler’ area (c.f. Marti 1996; Fünfschilling 1996).

At all three sites, there is a general trend that shows a decrease in the body size of cattle, and to a lesser degree pig, through time. The first change is thought to be due to the changing regime; from Roman administration and a breakdown of the large villa farmstead provisioning of the towns to a more self-sufficient system alluded to above. A second change is observed around the ninth Century and could be due to the advancement of the manorial system and perhaps a change from a two-field system of agriculture to a three-field system although this cannot be proven here.

Finally the incorporation of the sites studied here into a wider perspective shows that there are patterns to be observed in the proportions of the main three domestic species, cattle, pig and ovicaprids. In the Roman period and roman influenced sites there are high proportions of cattle. In the early medieval and medieval urban centres there is a pattern that suggests two groups of relatively stable proportions of pig with the changes occurring due to fluctuations in the proportions of cattle and ovicaprids, these perhaps occurring due to status. The lower status areas, of craftsmen and poor show that there are higher proportions of ovicaprids in the assemblages, whilst the higher status sites have a higher proportion of pig and young ovicaprids. The castle sites also show this trend to high proportions of pig and young ovicaprids. Surprisingly chicken remains tend not to be associated with site type and thus status although goose appears to be related to status. However, the low proportions make this difficult to elucidate. However if castle sites are split into those of higher and lower status then a difference in the proportions of chicken assemblages can also be observed, with higher status sites having higher proportions. The rural sites tend to show a consistency of results with respect to ovicaprids, with cattle and pigs making up the variables in these sites. It is difficult to understand these changes perhaps it is due to the secondary products. Dung, dairy and wool products would all have been useful in the early middle age rural settlement.

This work then clearly shows that there are differences both between and within the different site types and archaeozoology can clearly help in the understanding of settlement dynamics in complex societies, even with the absence of written sources within many of the periods and places studied in this work. This can occur through the study of husbandry and agricultural practices but also the social history of a site, region or farther a field can also be clarified by study of the faunal remains.

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Oct. 1994 – Jul. 1995	**City College Norwich** – A Level Chemistry
Oct. 1992 – Jul. 1994	**West Norwich 6th Form Centre** – A Level Biology and Maths
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PUBLICATION LIST

Publications

2011

Archaeozoological studies of the medieval food supply in north-western Switzerland, In (Klápště J and Sommer P) Processing, Storage, Distribution of Food; Food in a Medieval Rural Environment **Ruralia VIII** 255-270 (co-authored with Marti-Grädel E)

2010

New Beginnings: Animal Exploitation and Changing Cultural Identity at Settlements in North West Switzerland from the 4th – 8th Centuries; **Via Vias,** 3, 15-22.

A general study of the faunal assemblages (in El Kowm) with an emphasis on the taphonomic processes that are creating them. In: **Le Paléolithique d'El Kowm (Syrie) rapport final 2007-2010 et rapport d'activities 2009-2010**, 62-74 available online

2008

Geweihverarbeitung in drei frühmittelalterlichen Siedlungen der Nordwestschweiz. **Zeitschrift für Schweizerische Archäologie und Kunstgeschichte** Band 65, Heft 1/2, 2008, 120-122.

In press and preparation

- Filling in the gaps: Size and body shape of the domestic animals through time in NW Switzerland. (In prep.)
- Spatial distribution of faunal remains from the Hummal Site in El Kowm, Syria. (In prep.)
- Faunal remains from the Hummalian layers, El Kowm (In prep)
- Site report Reinach (canton Baselland) the archaeozoological remains (in prep)
- Site report Lausen (canton Baselland); The Early Medieval occupants (in prep)
- Site report Castrum Raurcense (canton Aargau); The animals bones of the Late Roman Early Medieval period (in prep)

Unpublished reports

- Benken-Hämmenreit (canton St. Gallen): Archeozoological Report (unpublished)
- Gals-Zihlbrücke (canton Bern): Archeozoological Report (unpublished)
- Schaan-Tonidis (Lichtenstein): Archeozoological Report (unpublished)
- Archaeozoology in the Early Medieval (PhD funding): Swiss National Foundation Research Final Report, (unpublished)

Basel University
Institute for Prehistory and Archaeological Science

Status and New Beginnings; Archaeozoological research into the Early Medieval rural settlements of Northwest Switzerland

Volume II: Tables and Figures

Richard Frosdick

Basel, 2017 (2nd edition)

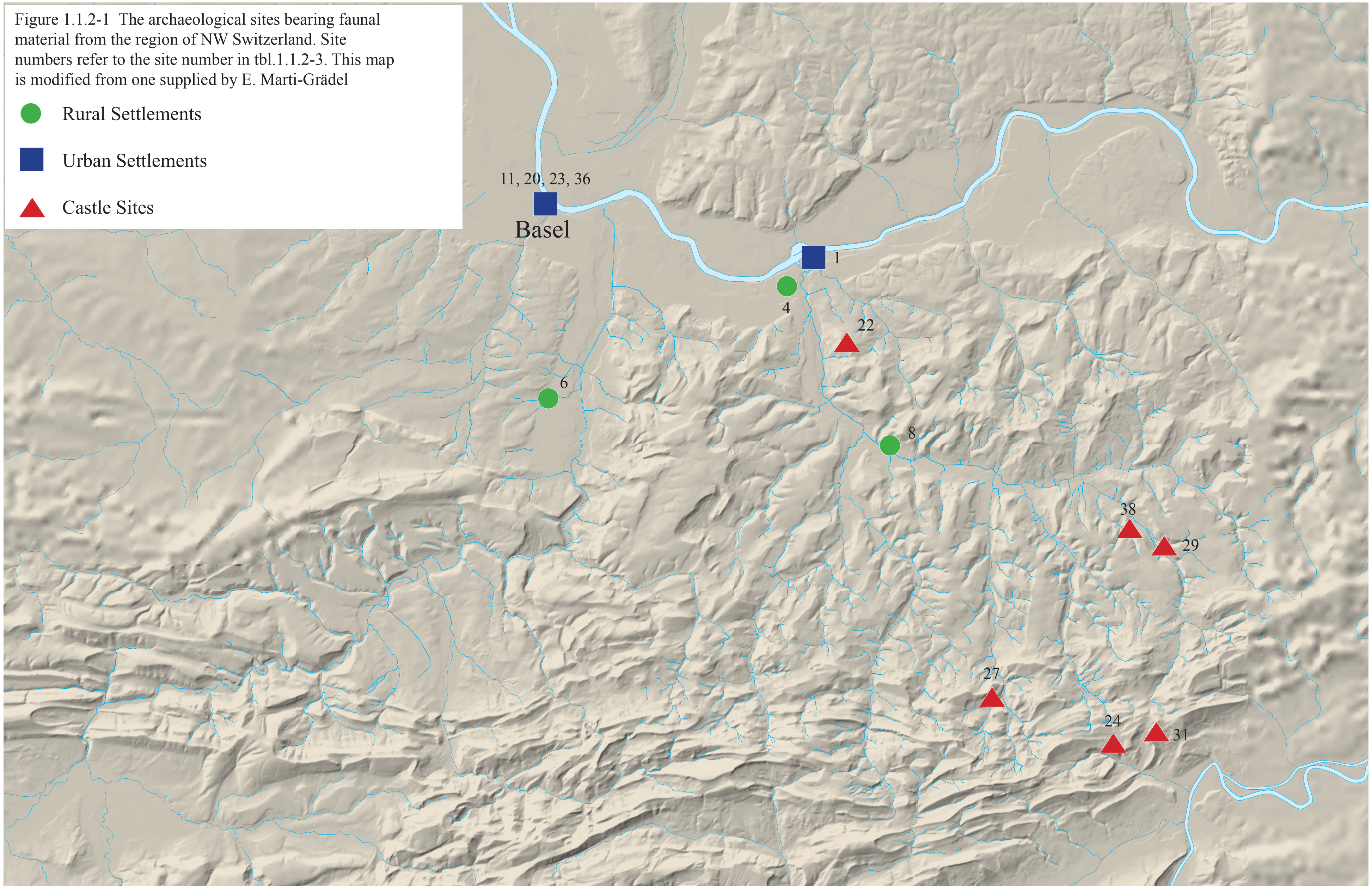

Figure 1.1.2-1 The archaeological sites bearing faunal material from the region of NW Switzerland. Site numbers refer to the site number in tbl.1.1.2-3. This map is modified from one supplied by E. Marti-Grädel

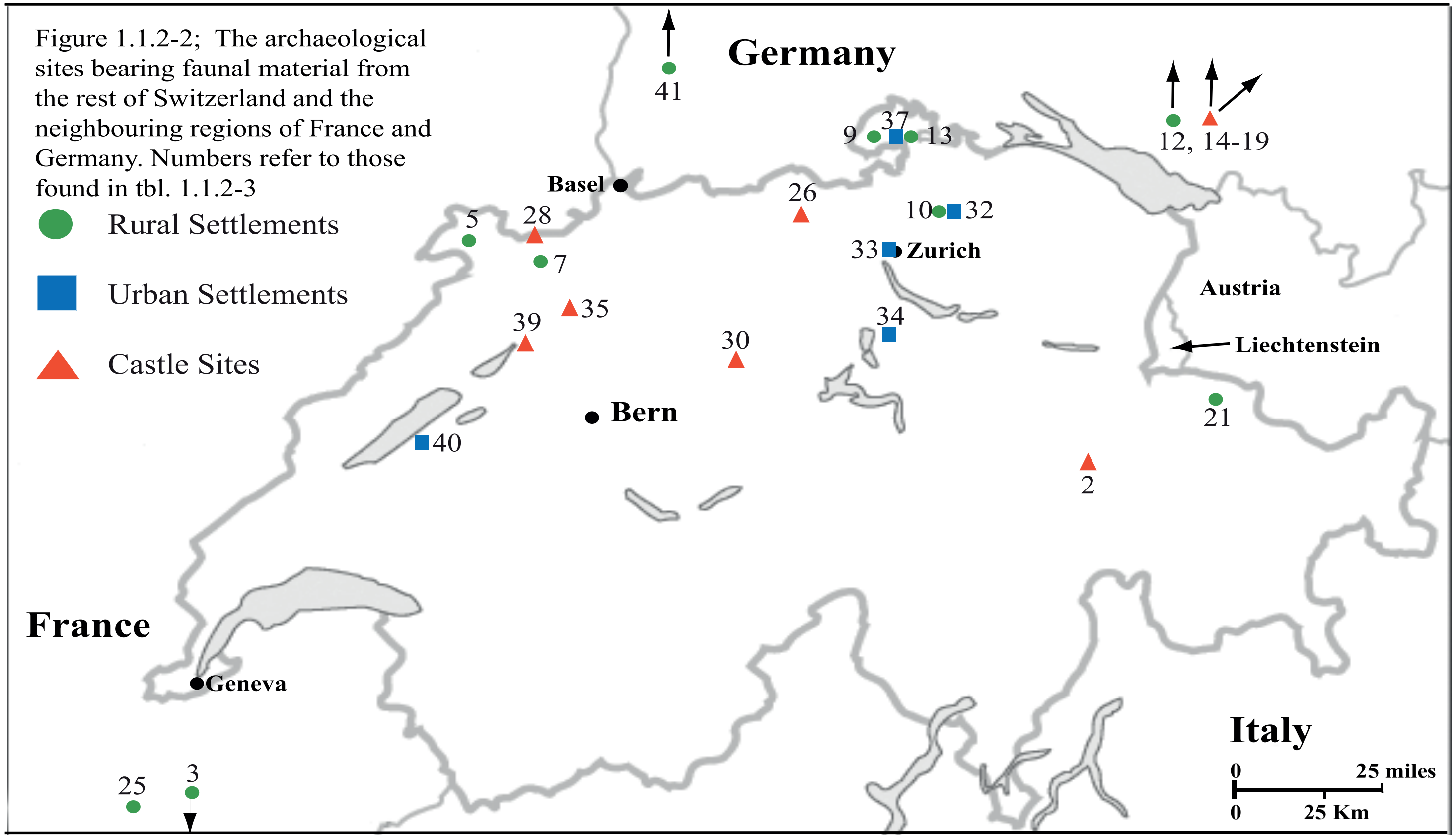

Figure 1.1.2-2; The archaeological sites bearing faunal material from the rest of Switzerland and the neighbouring regions of France and Germany. Numbers refer to those found in tbl. 1.1.2-3

Number	Site	Site shortcut	Settlement Type	Region	Archaeozoological Reference
1	Kaiseraugst-*Castrum*	KA	S	JU-NW	This volume; Lehmann and Breuer (1997; 2002); Schibler and Furger (1988)
2	Schiers	Schiers	L	SE-GR	Hartmann-Frick (1975)
3	Potiers de Portout	PdPI	L	FR -Sa	Olive (1990)
4	Pratteln Hauptstrasse	PHstr	L	JU-NW	Marti-Grädel (in prep)
5	Courtedoux-Creugenaut	CC	L	JU-NW	Putelat (2005)
6	Reinach	R	L	JU-NW	This volume
7	Develier-Courtételle	DC	L	JU-NW	Olive (2008)
8	Lausen-Bettenach	LB	L	JU-NW	This volume
9	Schleitheim-Brüel	SB	L	MI-O	Rehazek (2002)
10	Winterthur-Technikumstrasse	WTL	L	MI-O	Stopp (2010)
11	Basel-Reischacherhof	BSReis	S	JU-NW	Morel (n.d.)
12	Karlburg Talseidlung North	KTN	L	DE-Byn	Kerth, Ettel and Obst (2001)
13	Berslingen	Bers	L	MI-O	Rehazek (2000)
14	Sulzbach	Sulz	B	DE-Byn	Pasda (2004)
15	Burg Bamberg	BB	B	DE-Byn	Kerth, Ettel, Hartmann and Langraf (1999)
16	Burgkunstadt	BK	B	DE-Byn	Kerth, Ettel, Hartmann and Langraf (1999)
18	Oberammertal	OA	B	DE-Byn	Kerth, Ettel, Hartmann and Langraf (1999)
19	Rosstal	RT	B	DE-Byn	Vagedes and Peters (2001)
20	Basel Schneidergasse	BSSch	S	JU-NW	Reich (1995)
21	Burg Schiedberg	Schied	B	SE-GR	Küpper (1972); Scholz (1972); von den Driesch (1973)
22	Altenburg	Alt	B	JU-NW	Marti-Grädel (2008)
23	Basel-Barfüsserkirche	BSBf	S	JU-NW	Schibler and Stopp (1987)
24	Burg Rickenbach	BR	B	ML-O	Stampfli (1972)
25	Lac de Paladru	LdP	L	FR -Ir	Olive (1993)
26	Habsburg	Habs	B	ML-O	Veszeli and Schibler (1997)
27	Eptingen, Riedfluh	ER	B	JU-NW	Kaufmann (1988)
28	Löwenburg	Löw	B	JU-NW	Häsler (1980)
29	Ödenburg b. Weslingen	Öden	B	JU-NW	Kaufmann (1991) results taken from Marti-Gradel (2008)
30	Salbüel, LU	Sal	B	VA-O	Morel (1991)
31	Frohburg	Froh	B	JU-NW	Schibler 1991 results taken from Marti-Gradel (2008)
32	Winterthur	W	S	MI-O	Hartmann-Frick (1994)
33	Zürich Münsterhof	ZMh	S	MI-O	Csont (1982)
34	Zug Kaufhaus	ZK	S	MI-O	Rehazek (n.d.)
35	Burg Grenchen	BG	B	JU-NW	Stampfli (1962)
36	Basel- Augustinergasse	BSAug	S	JU-NW	Schibler (1996)
37	SH-Stadtkirche St. Johann	SHS	S	MI-O	Markert (1990); Markert (n.d.)
38	Gelterkinden, Scheidegg	GSch	B	JU-NW	Kaufmann (1975)
39	Nidau-Schloss	Nid	B	MI-W	Büttiker and Nussbaumer (1990)
40	Avenche Theatre	Ath	S	SW-VD	Deschler-Erb (in prep.)
41	Hildesheim	H	L	DE-NS	Hanik (2005)

Fig.1.1.2-3; Comparative sites; Settlement types: S-Urban, L-Rural, B-Castle; Location: JU-NW - Jura-Northwest Switzerland, SE-GR - Southeast Switzerland Graubunden, FR-Sa - France- Savoir, MI-O - Swiss Midlands- East, DE-Byn - Germany- Bayern, DE-NS - Germany- Niedersachsen, FR-Ir - France- Isere, MI-W - Swiss midlands west, ML-O Luxemburg-East, SW-VD - South West Switzerland-Vaud
Site number represents the site in fig. 1.1.2-1

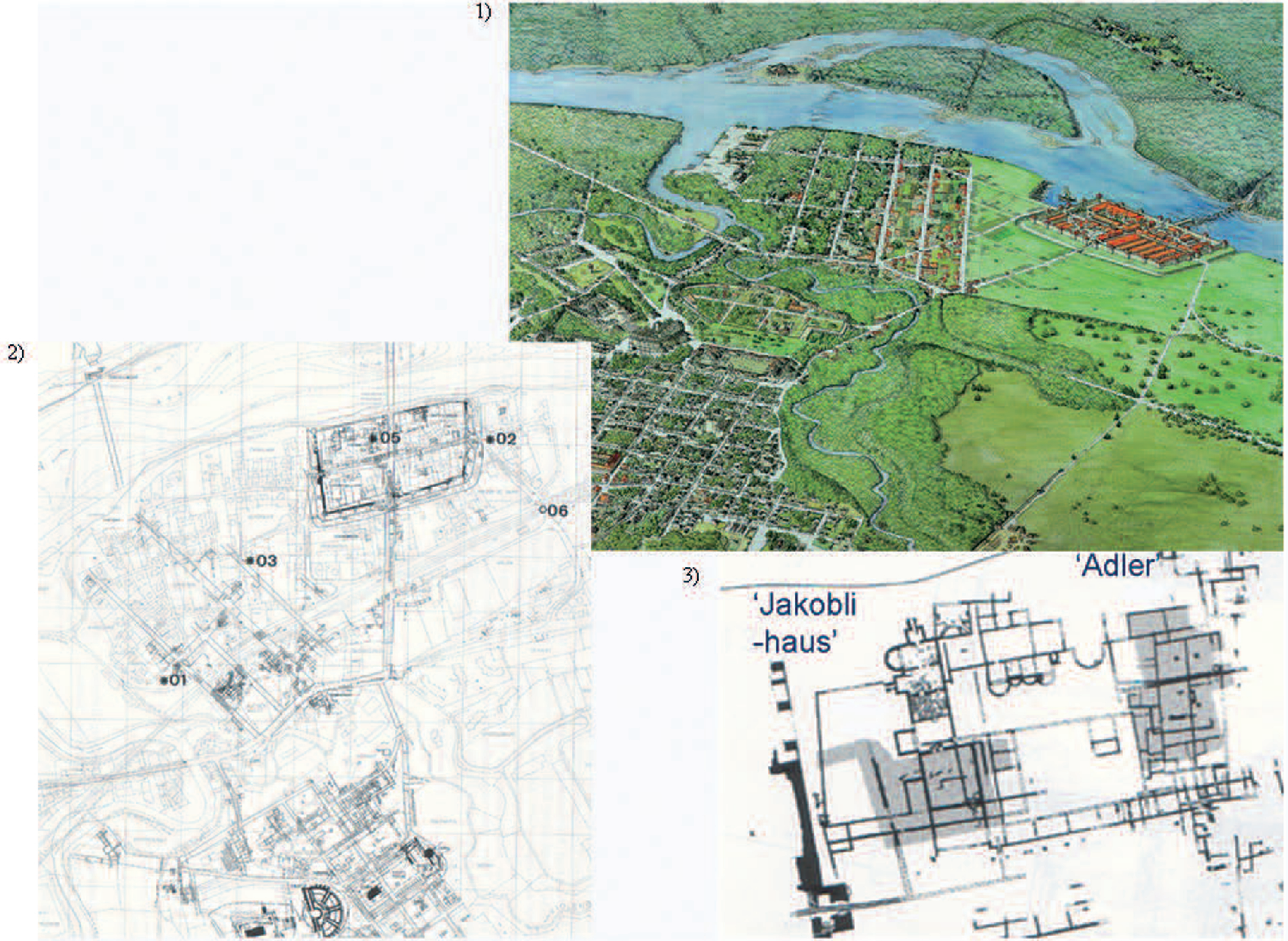

Figure 1.1.2.1-1; The site at Kaiseraugst and excavation areas. 1) An artist's representation of the city of Augusta Raurica and the Castrum Raurencense during the middle of the third Century AD (copyright, Markus Schaub). 2) A plan of the castrum and parts of the city of Augusta Raurica, the areas of Jakobli-haus and Gasthof Adler are situated at 05 and the Fabrikstrasse structures outside the castrum labelled by 02. The plan is modified from Müller 1991, fig 1. 3) A plan of the Jakobli-haus and Gasthof Adler areas (in grey) alongside the other earlier Roman structures uncovered by these and other excavations in the Castrum, modified from Müller 1991, fig. 6.

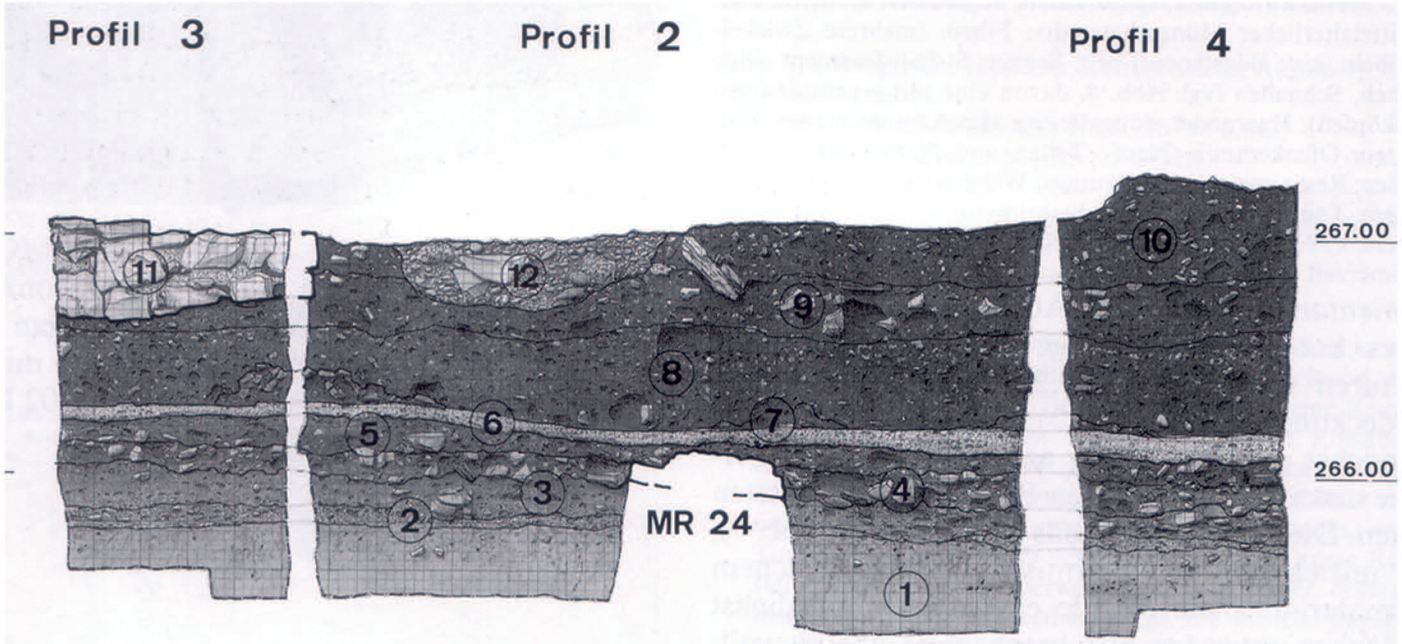

Figure 1.1.2.1-2; A selection of the profiles from the Jakobli-haus area showing the complex and numerous layers including the 'dark earth layers, taken from Müller 1995 fig.8. Scale 1:40. 1) Natural ground level, 2) Mortar lens 3) Levelling 4) Track-way 5) Horizon with dark colouration 6) Terrazzo floor 7) Brick debris 8) Dark earth layer 9) Dark earth layer 10) Dark earth layer 11) Foundation of the 'Jakobli-haus' 12) Modern down flow pipe soakaway.

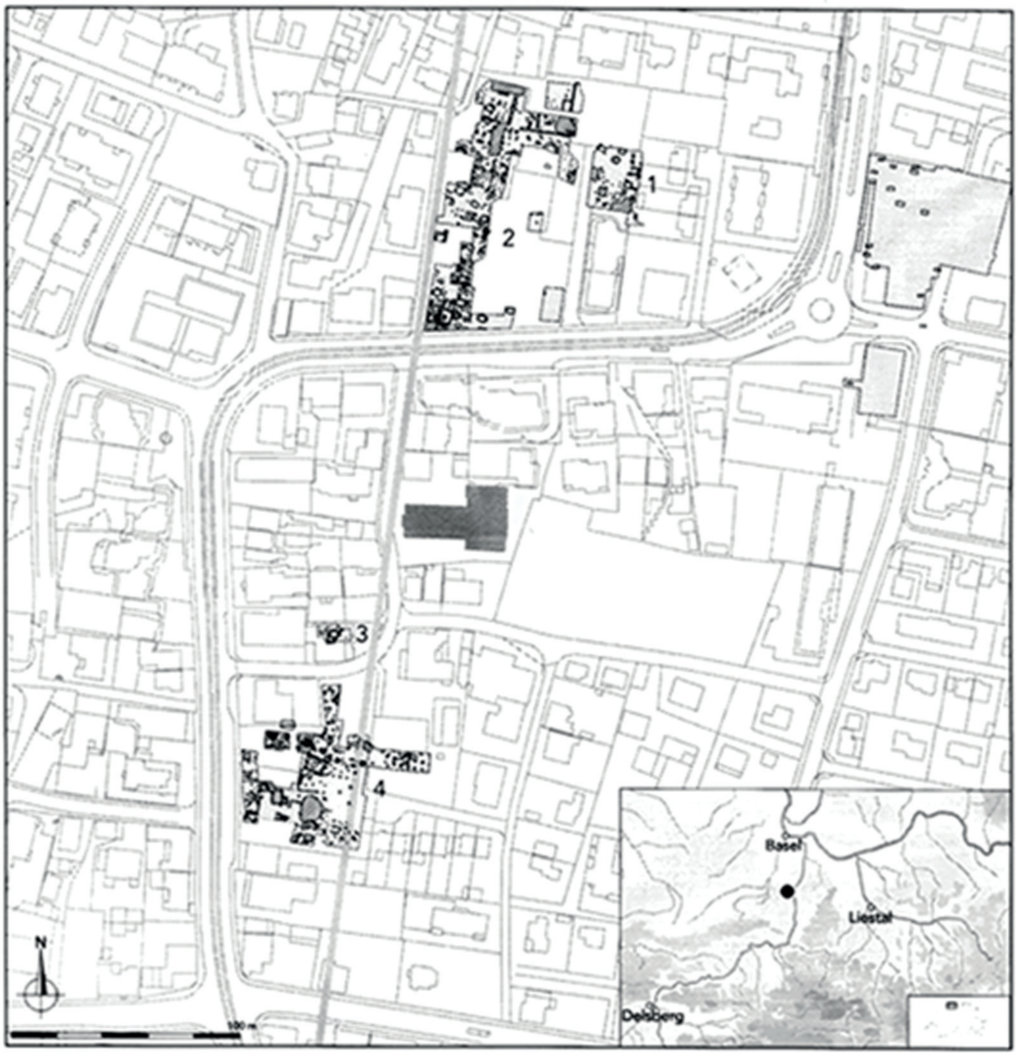

Figure 1.1.2.2-1; A plan of Reinach containing the excavation areas and their relationship to each other. 1) Altebrauerei, 2) Gemeindezentrum, 3) Kirchegasse, 4) Stadthof.. The scale equates to 100m. In the top right the early medieval cemetery ‘Rankhof’ and the modern church (centre) are also illustrated. This plan is modified from Marti 2004, fig. 3

Figure 1.1.2.3-1; The position of the Lausen excavation (shaded grey) within the modern village. Above lies the Roman building and below and to the left lies the modern church under which was discovered an 8th Century stone built church. The plan is modified from Schmaedecke and Tauber 1992, fig 8.

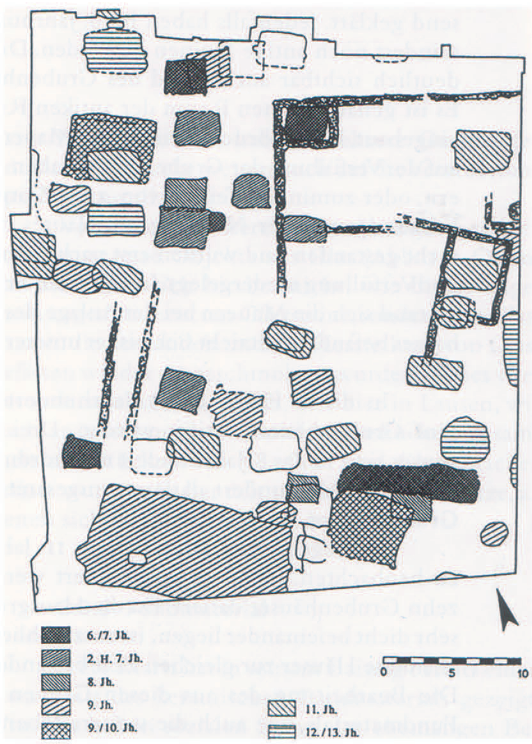

Figure 1.1.2.3-2; The position of the structures within the excavation area, the structures are shaded by date, where x.Jh. translates as xth Century. The plan is modified from Schmaedecke and Tauber 1992, fig?

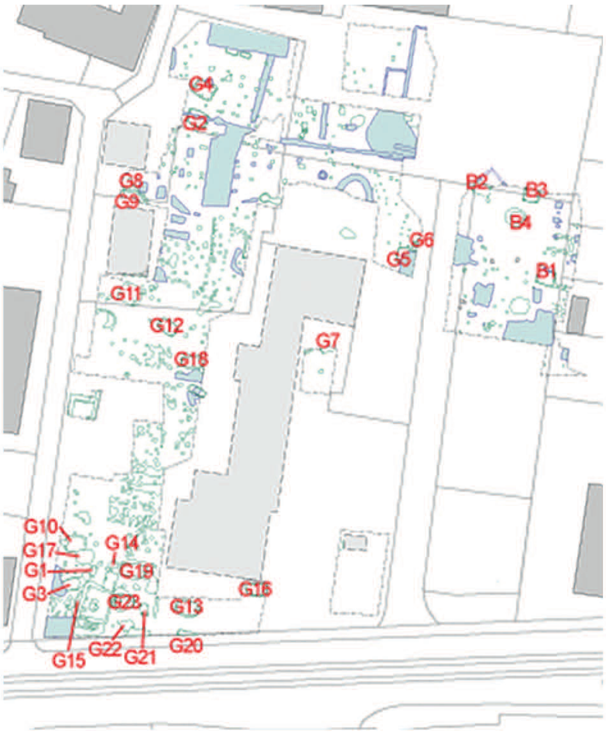

Figure 2.2.3-2; The archaeological structures (coloured blue) found within the Alte Brauerei (labelled with a 'B' prefix) and Gemeindezentrum (labelled with a 'G' prefix) areas of the Reinach site. The modern structures are represented in grey. North is in the direction of the top of the page whilst the scale equates 1cm to 24m. Thanks go to R. Marti for the production of this plan.

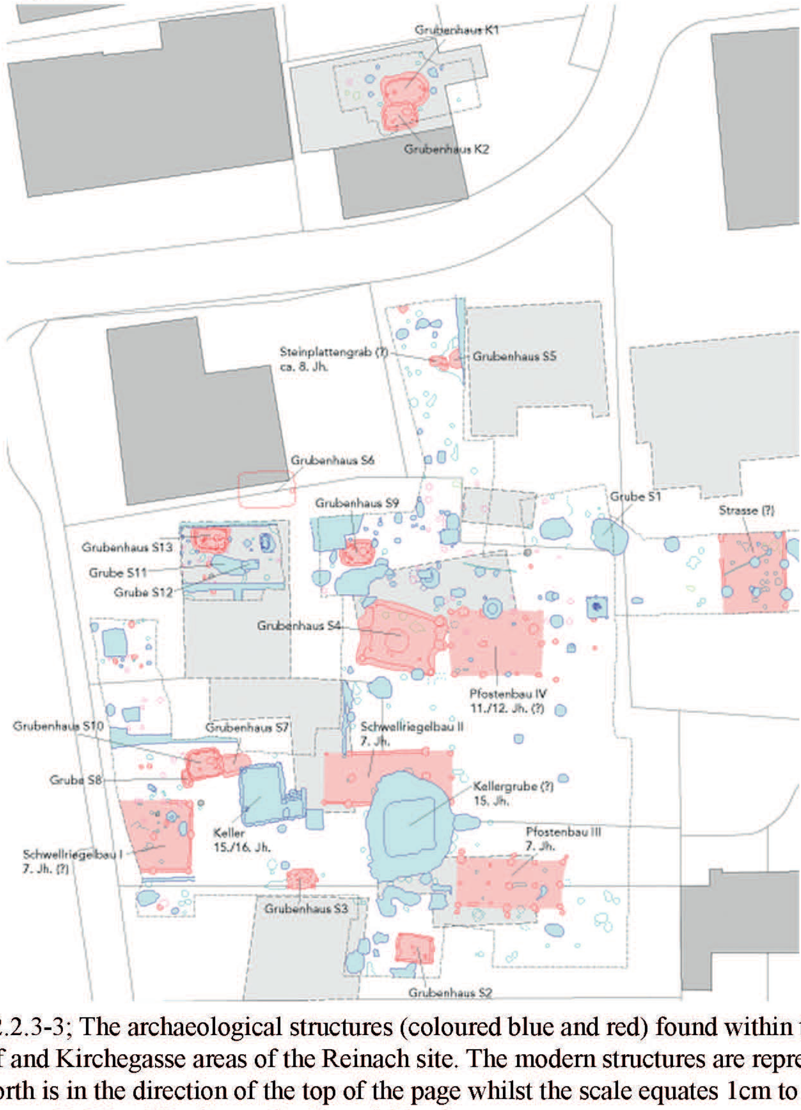

Figure 2.2.3-3; The archaeological structures (coloured blue and red) found within the Stadthof and Kirchegasse areas of the Reinach site. The modern structures are represented in grey. North is in the direction of the top of the page whilst the scale equates 1cm to 9.5m. Thanks go to R. Marti for the production of this plan.

Area	Dating	Structure	count n.	mass g.
Gasthof Adler	Mid 4thC	F2/1	32	408.9
		F2/3	386	8076.2
		F3/2	640	7695.7
		F3/3	145	3285.1
		F3/4	57	1973.9
	450-early 500	F2/2	132	2090
		F3/1	40	606.5
	mid 5 - late 6thC	F17/1	34	515.6
		F17/2	205	5717.4
		F17/2 oberer abtrag	308	6015.8
		F17/2 unterer abtrag	189	6001.9
		F2/4	602	13749.2
		F3/5	217	4079.2
	12thC	Grubenhaus 1	105	1512.3
		Grubenhaus 4	112	1937.5
Jakobli-Haus	4-6thC	Uppermost Late Roman 'Bodenniveau'	451	5287.2
		gruben	219	4955.9
	5-late 6thC	ziegelschutthorizont	980	22464.7
	6thC	lehmbodenrest	91	1009
		unterer humusbereich	1659	42978.3
	beg. 7thC	mauershutt	62	706.1
		oberer humusbereich	997	17741.8
	n.d.	andere komplex	20	135.3
		gruben	45	467
Fabrikstr	12thC	Grubenhaus 4	77	632.7
		Grubenhaus 5	28	117.8
		Total	7833	160161

Table 2.2.1-1; A list of structures at Kaiseraugst by area and the number and weight of bone material, n.d.- not dated, Fabrikstr- Fabrikstrasse, n.- number, g.- grammes

Excavation	Dating	Structure	count n.	mass g.
Lausen Bettenach	Late 6-late 7thC	grube 1	109	1898.8
		grube 50	327	3936.4
		grube 56	322	3920.6
	Late 7-late 8thC	grube 61	20	49.6
		grube 65	269	1715.3
	c. 8/9th C	grube 8	159	845.3
	c. 9thC	grube 28	3707	235589.1
		grube 34	1	2.2
		grube 9	984	3426
	c. 10thC	grube 13/14	8	14
		grube 17	568	1361.6
		grube 54	2022	15393.5
	c. 11thC	grube 10	1198	5506.7
		grube 20	442	1892
		grube 36	492	2123.3
		grube 45	803	5663.3
		grube 57	318	2006.3
		grube 7	68	600.2
		grube19/52	945	2619.5
	early 11thC	grube 11	797	2746.9
		grube 15	12	26.8
	Late 11-12thC	grube 4	417	1611.9
	mid 12th C	grube 38	340	3085.8
		Total	14328	296035.1

Table 2.2.2-1; A list of structures at Lausen by area and the number and weight of bone material, n.- number, g.- grammes

Area	Dating	Structure	count n.	mass g.
AB	Late 6-late 7thC	B1	1119	3676.3
	Late7-late 8thC	B3	92	241.1
		B4	203	1480.3
	Early 8thC	B2	25	340.4
		A502	42	58.1
	n.d.	-	16	90.9
		-	6	129.6
		569	4	246.5
Gemeindezentrum	6thC	Grubenhaus G2*	4033	4488.7
		Grubenhaus G3	51	399.4
		Pfostengrube	1	12.4
	7thC	Grubenhaus G4	167	1831.2
		Grubenhaus G5	114	1495
	8thC	Grubenhaus G6	61	465.2
		Grubenhaus G7	114	725.7
		Grubenhaus G9	129	1414.6
		Kleine Werkgrube	8	73.9
		Pfostengrube	19	111.1
		Töpferofen I	9	41.1
	9thC	Grubenhaus G10	65	661.3
		Grubenhaus G11	226	2152.5
		Grubenhaus G12	264	1466.3
		Grubenhaus G13	372	1904.4
		Pfostengrube	7	21.7
		Töpferofen II	16	99.4
	10thC	Grube G14	8	561.7
		Grube G17	36	336.2
		Grubenhaus G15	31	526.8
		Grubenhaus G16	113	684.3
		Grubenhaus G18	142	1062.7
	11thC	Grubenhaus G19	74	801.8
		Grubenhaus G20	103	282.6
	12thC	Grubenhaus G21	57	132.6
		Grube G23	131	1103.8
	n.d.	-	1	1.2
Stadthof	Early 7thC	Grube in Pfostenbau IV	11	48.8
		Grubenhaus S2	133	1063.2
		Pfostengrube	6	30.0
		Schwellriegelbau I	15	116.5
	Late 7thC	Grubenhaus S3	96	1239.0
		Grubenhaus S4	278	4063.3
		Pfostenbau III	3	82.9
		Pfostengrube	1	3.9
		Schwellriegelbau II	8	43.0
	9thC	Grubenhaus S5	172	2682.5
	10thC	Pfostengrube	1	0.1
	11thC	Grubenhaus S6 **	104	3721.5
		Grubenhaus S7	68	864.1
		Grubenhaus K1	241	2624.1
		Pfostengrube	2	4.4
	12thC	Grubenhaus S10	26	175.5
		Grubenhaus S13	242	3547.5
		Grubenhaus S9	103	1431.6
		Grubenhaus K2	167	2638.9
		Grube S8	3	31.9
		Grube S11	18	57.0
	n.d.	-	4	32.2
		Total	9561	53622.7

Table 2.2.3-1; A list of structuresfrom Reinach by area and the number and weight of bone material; *- includes seived material, **- includes a partial cattle skeleton, n.d.- not dated, AB- Altebrauerei, n.- number, g.- grammes

Element	n.	n.%	mass	mass%
Skull	3	3.57%	94.5	2.94%
Teeth	2	2.38%	8.8	0.27%
Mandible	2	2.38%	37.4	1.16%
Scapula	0	0.00%	0	0.00%
Humerus	2	2.38%	16.6	0.52%
Radius	0	0.00%	0	0.00%
Ulna	0	0.00%	0	0.00%
Metacarpals	0	0.00%	0	0.00%
Carpals	0	0.00%	0	0.00%
Ant Phalanges	1	1.19%	15	0.47%
Vertebra	21	25.00%	1749.4	54.34%
Ribs	49	58.33%	826.2	25.66%
Pelvis	3	3.57%	458.4	14.24%
Femur	0	0.00%	0	0.00%
Tibia	0	0.00%	0	0.00%
Astragalus	0	0.00%	0	0.00%
Calcaneus	0	0.00%	0	0.00%
Metatarsals	0	0.00%	0	0.00%
Tarsals other	0	0.00%	0	0.00%
Phalanges Post	1	1.19%	13.1	0.41%
Total	84		3219.4	

Table 2.2.3-4; Cattle partial skeleton found in 'Grubenhaus S6' dated to 1000AD from the Stadthof excavation, n.- number of fragments, mass measured in grams

Chapter 3: Taphonomy

	KA		R		L		All	
	Total	Total %	Total	Total %	Total	Total %	Total	Total %
Good	6127	78.87%	4595	78.15%	11783	89.90%	22505	84.12%
Eroded	11	0.14%	16	0.27%	2	0.03%	29	0.11%
Weathered	1521	19.58%	1165	19.81%	1203	15.49%	3889	14.54%
Heavy Weathering	109	1.40%	104	1.77%	119	1.53%	332	1.24%
	7768		5880		13107		26755	

Table 3.1-1; General preservation at all three sites studied here, KA- Kaiseraugst, R-Reinach, L-Lausen

Area	Jak		Adl		Adl		Jak		Jak		Jak		Adl		Fab	
Date	4-6th	4-6th%	Mid 4th	Mid 4th%	mid 5 - late 6th	mid 5 - late 6th%	mid 5 - late 6th	mid 5 - late 6th%	6th	6th%	beg. 7th	beg. 7th%	12th	12th%	12th	12th%
Good	635	94.78%	955	75.79%	1219	70.58%	848	86.53%	1433	81.89%	853	80.55%	133	61.29%	51	48.57%
Eroded	0	0.00%	8	0.63%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	3	2.86%
Weathered	35	5.22%	271	21.51%	482	27.91%	121	12.35%	297	16.97%	191	18.04%	78	35.94%	46	43.81%
Heavy Weathering	0	0.00%	26	2.06%	26	1.51%	11	1.12%	20	1.14%	15	1.42%	6	2.76%	5	4.76%
	670		1260		1727		980		1750		1059		217		105	

Table 3.1.1-1; Preservation states at Kaiseraugst by date and excavation area, Adl- Gasthof Adler, Jak- Jakoblihaus, Fab- Fabrikstrasse

Date	6th	6th%	7th	7th%	8th/9th	8/9th%	9th	9th%	10th	10th%	Early 11th	11th%	11th	11th%	Late 11th	11th%	12th	12th%
Good	670	88.39%	272	94.12%	139	87.42%	3210	92.48%	2357	90.72%	742	91.72%	3721	87.22%	388	93.05%	284	83.53%
Eroded	0	0.00%	0	0.00%	0	0.00%	1	0.03%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%
Weathered	74	9.76%	15	5.19%	15	9.43%	252	7.26%	232	8.93%	57	7.05%	488	11.44%	23	5.52%	47	13.82%
Heavy Weathering	14	1.85%	2	0.69%	5	3.14%	8	0.23%	9	0.35%	10	1.24%	56	1.31%	6	1.44%	9	2.65%
	758		289		159		3471		2598		809		4266		417		340	

Table 3.1.2-1 Preservation states at Lausen by date

Area	GMZ		STH		AB		GMZ		STH		AB		GMZ		GMZ		STH	
			Early						Late									
Date	6th	6th%	7th	Early 7th%	7th	7th%	7th	7th%	7th	Late 7th%	8th	8th%	8th	8th%	9th	9th%	9th	9th%
Good	520	88.89%	123	74.55%	801	71.58%	201	71.53%	286	74.09%	258	80.63%	244	72.19%	828	87.16%	125	72.25%
Eroded	0	0.00%	0	0.00%	0	0.00%	1	0.36%	0	0.00%	0	0.00%	1	0.30%	0	0.00%	1	0.58%
Weathered	59	10.09%	38	23.03%	296	26.45%	76	27.05%	84	21.76%	57	17.81%	89	26.33%	117	12.32%	44	25.43%
Heavy Weathering	6	1.03%	4	2.42%	22	1.97%	3	1.07%	16	4.15%	5	1.56%	4	1.18%	5	0.53%	3	1.73%
	585		165		1119		281		386		320		338		950		173	

Area	GMZ		STH		GMZ		STH		GMZ		STH	
Date	10th	10th%	10th	10th%	11th	11th%	11th	11th%	12th	12th%	12th	12th%
Good	257	77.88%	1	100.00%	113	63.84%	262	83.97%	135	71.81%	441	79.46%
Eroded	0	0.00%	0	0.00%	2	1.13%	2	0.64%	2	1.06%	7	1.26%
Weathered	63	19.09%	0	0.00%	59	33.33%	44	14.10%	49	26.06%	90	16.22%
Heavy Weathering	10	3.03%	0	0.00%	3	1.69%	4	1.28%	2	1.06%	17	3.06%
	330		1		177		312		188		555	

Table 3.1.3-1; Preservation states at Reinach by date and excavation area, GMZ- Gemeindezentrum, STH- Stadthof, AB- Altebrauerei

	Kaiseraugst	%	Lausen	%	Reinach	%	Total	%
P	241	9.91%	205	7.99%	143	11.61%	589	9.45%
P1/2	120	4.93%	77	3.00%	48	3.90%	245	3.93%
P3/4	102	4.19%	68	2.65%	44	3.57%	214	3.43%
S	1093	44.92%	1671	65.12%	643	52.19%	3407	54.68%
D	334	13.73%	235	9.16%	134	10.88%	703	11.28%
D1/2	77	3.16%	40	1.56%	24	1.95%	141	2.26%
D3/4	64	2.63%	52	2.03%	19	1.54%	135	2.17%
W	400	16.44%	216	8.42%	174	14.12%	790	12.68%
A	2	0.08%	2	0.08%	3	0.24%	7	0.11%
	2433		2566		1232		6231	

Table 3.2-1; General fragmentation of long bones from the three sites,

P- proximal articulation, P1/2- Proximal articulation inc up to half of the diaphysis, P3/4- Proximal articulation inc up to three quarters of the diaphysis, S- shaft fragments, D- Distal articulation, D1/2 and D3/4 are the same as for the proximal portion, W- whole bone, A- unidentified articulation.

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	3	5	6	0	14	2.36%	3.94%	4.72%	0.00%	11.02%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	27	29	4	12	72	21.26%	22.83%	3.15%	9.45%	56.69%
	D	9	10	7	8	34	7.09%	7.87%	5.51%	6.30%	26.77%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	0.79%	0.79%
	D3/4	0	0	0	4	4	0.00%	0.00%	0.00%	3.15%	3.15%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	1.57%	1.57%
	Total Hm	39	44	17	27	127	30.71%	34.65%	13.39%	21.26%	1
Radius	P	2	3	6	7	18	3.08%	4.62%	9.23%	10.77%	27.69%
	P1/2	0	2	2	1	5	0.00%	3.08%	3.08%	1.54%	7.69%
	P3/4	0	0	1	1	2	0.00%	0.00%	1.54%	1.54%	3.08%
	S	5	8	6	3	22	7.69%	12.31%	9.23%	4.62%	33.85%
	D	5	1	1	7	14	7.69%	1.54%	1.54%	10.77%	21.54%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.54%	1.54%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	1	2	3	0.00%	0.00%	1.54%	3.08%	4.62%
	Total Rd	12	14	17	22	65	18.46%	21.54%	26.15%	33.85%	
Metacarpal 3+4	P	0	6	1	4	11	0.00%	8.57%	1.43%	5.71%	15.71%
	P1/2	0	1	1	5	7	0.00%	1.43%	1.43%	7.14%	10.00%
	P3/4	0	2	3	3	8	0.00%	2.86%	4.29%	4.29%	11.43%
	S	2	4	2	2	10	2.86%	5.71%	2.86%	2.86%	14.29%
	D	1	9	3	6	19	1.43%	12.86%	4.29%	8.57%	27.14%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.43%	1.43%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.43%	1.43%
	W	0	0	4	9	13	0.00%	0.00%	5.71%	12.86%	18.57%
	Total Mc	3	22	14	31	70	4.29%	31.43%	20.00%	44.29%	
Femur	P	5	10	7	1	23	3.55%	7.09%	4.96%	0.71%	16.31%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	0.71%	0.71%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	36	31	14	10	91	25.53%	21.99%	9.93%	7.09%	64.54%
	D	10	7	3	4	24	7.09%	4.96%	2.13%	2.84%	17.02%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	0.71%	0.71%
	D3/4	0	0	1	0	1	0.00%	0.00%	0.71%	0.00%	0.71%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Fm	51	48	25	17	141	36.17%	34.04%	17.73%	12.06%	
Tibia	P	3	4	4	0	11	3.41%	4.55%	4.55%	0.00%	12.50%
	P1/2	1	1	1	0	3	1.14%	1.14%	1.14%	0.00%	3.41%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	20	15	6	6	47	22.73%	17.05%	6.82%	6.82%	53.41%
	D	2	6	4	9	21	2.27%	6.82%	4.55%	10.23%	23.86%
	D1/2	0	2	0	0	2	0.00%	2.27%	0.00%	0.00%	2.27%
	D3/4	0	0	1	1	2	0.00%	0.00%	1.14%	1.14%	2.27%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	2.27%	2.27%
	Total Tb	26	28	16	18	88	29.55%	31.82%	18.18%	20.45%	
Metatarsal 3+4	P	2	7	1	4	14	2.20%	7.69%	1.10%	4.40%	15.38%
	P1/2	0	2	1	2	5	0.00%	2.20%	1.10%	2.20%	5.49%
	P3/4	1	0	5	2	8	1.10%	0.00%	5.49%	2.20%	8.79%
	S	9	8	5	4	26	9.89%	8.79%	5.49%	4.40%	28.57%
	D	1	5	6	11	23	1.10%	5.49%	6.59%	12.09%	25.27%
	D1/2	0	0	0	2	2	0.00%	0.00%	0.00%	2.20%	2.20%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.10%	1.10%
	W	0	1	4	8	12	0.00%	1.10%	4.40%	8.79%	13.19%
	Total Mt	13	23	22	34	91	14.29%	25.27%	24.18%	37.36%	

Table 3.2.1-1; Fragmentation of cattle long bones from Kaiseraugst, <Q- less than a quarter circumference Q-H- quarter to half of the circumference, H-W- half to whole circumference, W- whole circumference, for other abreviations see table 3.2-1.

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	1	3	2	1	7	1.75%	5.26%	3.51%	1.75%	12.28%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	14	13	3	4	34	24.56%	22.81%	5.26%	7.02%	59.65%
	D	4	6	3	3	16	7.02%	10.53%	5.26%	5.26%	28.07%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Hm	19	22	8	8	57	33.33%	38.60%	14.04%	14.04%	
Radius	P	0	1	3	4	8	0.00%	3.85%	11.54%	15.38%	30.77%
	P1/2	0	2	1	0	3	0.00%	7.69%	3.85%	0.00%	11.54%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	4	4	0	1	9	15.38%	15.38%	0.00%	3.85%	34.62%
	D	3	2	1	0	6	11.54%	7.69%	3.85%	0.00%	23.08%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Rd	7	9	5	5	26	26.92%	34.62%	19.23%	19.23%	
Metacarpal 3+4	P	3	4	1	2	10	11.54%	15.38%	3.85%	7.69%	38.46%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	1	3	4	0.00%	0.00%	3.85%	11.54%	15.38%
	S	2	4	0	2	8	7.69%	15.38%	0.00%	7.69%	30.77%
	D	1	0	0	1	2	3.85%	0.00%	0.00%	3.85%	7.69%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	7.69%	7.69%
	Total Mc	6	8	2	10	26	23.08%	30.77%	7.69%	38.46%	
Femur	P	2	1	2	5	10	5.00%	2.50%	5.00%	12.50%	25.00%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	10	10	1	2	23	25.00%	25.00%	2.50%	5.00%	57.50%
	D	2	1	0	3	6	5.00%	2.50%	0.00%	7.50%	15.00%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	2.50%	2.50%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Fm	14	12	3	11	40	35.00%	30.00%	7.50%	27.50%	
Tibia	P	3	5	2	1	11	6.38%	10.64%	4.26%	2.13%	23.40%
	P1/2	0	0	1	0	1	0.00%	0.00%	2.13%	0.00%	2.13%
	P3/4	0	1	1	0	2	0.00%	2.13%	2.13%	0.00%	4.26%
	S	8	3	1	4	16	17.02%	6.38%	2.13%	8.51%	34.04%
	D	3	4	1	5	13	6.38%	8.51%	2.13%	10.64%	27.66%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	2.13%	2.13%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	2.13%	2.13%
	W	1	0	1	0	2	2.13%	0.00%	2.13%	0.00%	4.26%
	Total Tb	15	13	7	12	47	31.91%	27.66%	14.89%	25.53%	
Metatarsal 3+4	P	2	0	2	4	8	6.67%	0.00%	6.67%	13.33%	26.67%
	P1/2	0	0	2	1	3	0.00%	0.00%	6.67%	3.33%	10.00%
	P3/4	0	0	1	1	2	0.00%	0.00%	3.33%	3.33%	6.67%
	S	6	1	0	0	7	20.00%	3.33%	0.00%	0.00%	23.33%
	D	2	1	1	0	4	6.67%	3.33%	3.33%	0.00%	13.33%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	3.33%	3.33%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	3.33%	3.33%
	W	0	0	0	4	4	0.00%	0.00%	0.00%	13.33%	13.33%
	Total Mt	10	2	6	12	30	33.33%	6.67%	20.00%	40.00%	

Table 3.2.1-2; Fragmentation of cattle long bones from Reinach, see table 3.2-1and 3.2.1-1 for abbreviations

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	0	0	2	0	2	0.00%	0.00%	2.63%	0.00%	2.63%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	19	24	7	5	55	25.00%	31.58%	9.21%	6.58%	72.37%
	D	8	3	2	3	16	10.53%	3.95%	2.63%	3.95%	21.05%
	D1/2	0	0		0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	1	0	2	3	0.00%	1.32%	0.00%	2.63%	3.95%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Hm	27	28	11	10	76	35.53%	36.84%	14.47%	13.16%	
Radius	P	1	4	4	1	10	2.63%	10.53%	10.53%	2.63%	26.32%
	P1/2	0	0	1	0	1	0.00%	0.00%	2.63%	0.00%	2.63%
	P3/4	0	0	1	1	2	0.00%	0.00%	2.63%	2.63%	5.26%
	S	7	6	3	5	21	18.42%	15.79%	7.89%	13.16%	55.26%
	D	0	1	1	1	3	0.00%	2.63%	2.63%	2.63%	7.89%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	1	0	1	0.00%	0.00%	2.63%	0.00%	2.63%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Rd	8	11	11	8	38	21.05%	28.95%	28.95%	21.05%	
Metacarpal 3+4	P	3	3	0	0	6	6.25%	6.25%	0.00%	0.00%	12.50%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	2	6	4	12	0.00%	4.17%	12.50%	8.33%	25.00%
	S	7	6	3	5	21	14.58%	12.50%	6.25%	10.42%	43.75%
	D	3	0	1	2	6	6.25%	0.00%	2.08%	4.17%	12.50%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	2	1	3	0.00%	0.00%	4.17%	2.08%	6.25%
	Total Mc	13	11	12	12	48	27.08%	22.92%	25.00%	25.00%	
Femur	P	1	1	1	0	3	1.10%	1.10%	1.10%	0.00%	3.30%
	P1/2	0	0	1	0	1	0.00%	0.00%	1.10%	0.00%	1.10%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	38	25	8	9	80	41.76%	27.47%	8.79%	9.89%	87.91%
	D	5	1	0	0	6	5.49%	1.10%	0.00%	0.00%	6.59%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	1	0	1	0.00%	0.00%	1.10%	0.00%	1.10%
	Total Fm	44	27	11	9	91	48.35%	29.67%	12.09%	9.89%	
Tibia	P	2	1	4	1	8	1.75%	0.88%	3.51%	0.88%	7.02%
	P1/2	1	0	0	0	1	0.88%	0.00%	0.00%	0.00%	0.88%
	P3/4	0	0	1	0	1	0.00%	0.00%	0.88%	0.00%	0.88%
	S	55	20	7	4	86	48.25%	17.54%	6.14%	3.51%	75.44%
	D	2	3	4	7	16	1.75%	2.63%	3.51%	6.14%	14.04%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	2	0	2	0.00%	0.00%	1.75%	0.00%	1.75%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Tb	60	24	18	12	114	52.63%	21.05%	15.79%	10.53%	
Metatarsal 3+4	P	5	2	2	2	11	10.20%	4.08%	4.08%	4.08%	22.45%
	P1/2	0	1	0	0	1	0.00%	2.04%	0.00%	0.00%	2.04%
	P3/4	0	0	6	1	7	0.00%	0.00%	12.24%	2.04%	14.29%
	S	11	6	5	3	25	22.45%	12.24%	10.20%	6.12%	51.02%
	D	0	1	2	1	4	0.00%	2.04%	4.08%	2.04%	8.16%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	2.04%	2.04%
	Total Mt	16	10	15	8	49	32.65%	20.41%	30.61%	16.33%	

Table 3.2.1-3; Fragmentation of cattle long bones from Lausen, see table 3.2-1and 3.2.1-1 for abbreviations

	Part	Kaiseraugst	n. %	Reinach	n. %	Lausen	n. %
Scapula	Glenoid/Neck	28	41.18%	15	57.69%	15	25.86%
	Margo thoracalis	7	10.29%	4	15.38%	11	18.97%
	Margo cervicalis	5	7.35%	2	7.69%	8	13.79%
	Spine	3	4.41%	3	11.54%	10	17.24%
	Proximal end	0	0.00%	0	0.00%	2	3.45%
	Large portion 1/3-3/4	23	33.82%	1	3.85%	11	18.97%
	Whole	2	2.94%	1	3.85%	1	1.72%
	Total Sc	68		26		58	
Pelvis	Acetabulum	13	14.61%	3	6.52%	9	9.00%
	Ischium	26	29.21%	9	19.57%	31	31.00%
	Pubis	15	16.85%	10	21.74%	18	18.00%
	Illium	31	34.83%	22	47.83%	42	42.00%
	large portion	4	4.49%	2	4.35%	0	0.00%
	Whole	0	0.00%	0	0.00%	0	0.00%
	Total Pv	89		46		100	

Table 3.2.1-4; Fragmentation of cattle girdle bones, scapula and pelvis, at all three sites

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	3.13%	3.13%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	2	7	2	4	15	6.25%	21.88%	6.25%	12.50%	46.88%
	D	1	1	3	6	11	3.13%	3.13%	9.38%	18.75%	34.38%
	D1/2	0	0	0	3	3	0.00%	0.00%	0.00%	9.38%	9.38%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	3.13%	3.13%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	3.13%	3.13%
	Total Hm	3	8	5	16	32	9.38%	25.00%	15.63%	50.00%	1
Radius	P	0	0	1	2	3	0.00%	0.00%	2.04%	4.08%	6.12%
	P1/2	0	0	2	3	5	0.00%	0.00%	4.08%	6.12%	10.20%
	P3/4	0	1	0	3	4	0.00%	2.04%	0.00%	6.12%	8.16%
	S	4	6	6	15	31	8.16%	12.24%	12.24%	30.61%	63.27%
	D	0	1	0	2	3	0.00%	2.04%	0.00%	4.08%	6.12%
	D1/2	0	0	0	2	2	0.00%	0.00%	0.00%	4.08%	4.08%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	2.04%	2.04%
	Total Rd	4	8	9	28	49	8.16%	16.33%	18.37%	57.14%	
Metacarpal 3+4	P	2	1	0	3	6	5.00%	2.50%	0.00%	7.50%	15.00%
	P1/2	0	1	2	2	5	0.00%	2.50%	5.00%	5.00%	12.50%
	P3/4	0	0	0	4	4	0.00%	0.00%	0.00%	10.00%	10.00%
	S	2	9	1	2	14	5.00%	22.50%	2.50%	5.00%	35.00%
	D	0	1	0	4	5	0.00%	2.50%	0.00%	10.00%	12.50%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	1	0	5	6	0.00%	2.50%	0.00%	12.50%	15.00%
	Total Mc	4	13	3	20	40	10.00%	32.50%	7.50%	50.00%	
Femur	P	0	2	1	1	4	0.00%	7.69%	3.85%	3.85%	15.38%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	3.85%	3.85%
	P3/4	0	0	1	0	1	0.00%	0.00%	3.85%	0.00%	3.85%
	S	2	10	3	3	18	7.69%	38.46%	11.54%	11.54%	69.23%
	D	0	1	1	0	2	0.00%	3.85%	3.85%	0.00%	7.69%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Fm	2	13	6	5	26	7.69%	50.00%	23.08%	19.23%	
Tibia	P	0	1	1	0	2	0.00%	1.23%	1.23%	0.00%	2.47%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	6	7	9	34	56	7.41%	8.64%	11.11%	41.98%	69.14%
	D	0	1	2	7	10	0.00%	1.23%	2.47%	8.64%	12.35%
	D1/2	0	1	0	9	10	0.00%	1.23%	0.00%	11.11%	12.35%
	D3/4	0	0	0	3	3	0.00%	0.00%	0.00%	3.70%	3.70%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Tb	6	10	12	53	81	7.41%	12.35%	14.81%	65.43%	
Metatarsal 3+4	P	1	4	1	0	6	2.86%	11.43%	2.86%	0.00%	17.14%
	P1/2	0	1	1	2	4	0.00%	2.86%	2.86%	5.71%	11.43%
	P3/4	0	1	0	3	4	0.00%	2.86%	0.00%	8.57%	11.43%
	S	4	8	0	3	15	11.43%	22.86%	0.00%	8.57%	42.86%
	D	0	0	0	1	1	0.00%	0.00%	0.00%	2.86%	2.86%
	D1/2	0	1	0	0	1	0.00%	2.86%	0.00%	0.00%	2.86%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	2.86%	2.86%
	W	0	1	0	3	3	0.00%	2.86%	0.00%	8.57%	8.57%
	Total Mt	5	16	2	13	35	14.29%	45.71%	5.71%	37.14%	

Table 3.2.2-1; Fragmentation of ovicaprid long bones from Kaiseraugst,
see table 3.2-1 and 3.2.1-1 for abbreviations

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	2	0	1	1	4	2.25%	0.00%	1.12%	1.12%	4.49%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.12%	1.12%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	16	27	10	12	65	17.98%	30.34%	11.24%	13.48%	73.03%
	D	1	2	5	5	13	1.12%	2.25%	5.62%	5.62%	14.61%
	D1/2	0	0	2	2	4	0.00%	0.00%	2.25%	2.25%	4.49%
	D3/4	0	0	0	2	2	0.00%	0.00%	0.00%	2.25%	2.25%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Hm	19	29	18	23	89	21.35%	32.58%	20.22%	25.84%	
Radius	P	0	3	4	0	7	0.00%	2.80%	3.74%	0.00%	6.54%
	P1/2	0	2	1	1	4	0.00%	1.87%	0.93%	0.93%	3.74%
	P3/4	0	1	1	4	6	0.00%	0.93%	0.93%	3.74%	5.61%
	S	17	20	32	18	87	15.89%	18.69%	29.91%	16.82%	81.31%
	D	1	0	0	1	2	0.93%	0.00%	0.00%	0.93%	1.87%
	D1/2	0	1	0	0	1	0.00%	0.93%	0.00%	0.00%	0.93%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Rd	18	27	38	24	107	16.82%	25.23%	35.51%	22.43%	
Metacarpal 3+4	P	0	0	0	2	2	0.00%	0.00%	0.00%	4.35%	4.35%
	P1/2	0	1	1	1	3	0.00%	2.17%	2.17%	2.17%	6.52%
	P3/4	0	0	4	1	5	0.00%	0.00%	8.70%	2.17%	10.87%
	S	8	15	6	2	31	17.39%	32.61%	13.04%	4.35%	67.39%
	D	1	0	0	2	3	2.17%	0.00%	0.00%	4.35%	6.52%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	4.35%	4.35%
	Total Mc	9	16	11	10	46	19.57%	34.78%	23.91%	21.74%	
Femur	P	2	1	2	5	10	2.56%	1.28%	2.56%	6.41%	12.82%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	22	32	6	4	64	28.21%	41.03%	7.69%	5.13%	82.05%
	D	1	0	0	2	3	1.28%	0.00%	0.00%	2.56%	3.85%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.28%	1.28%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Fm	25	33	8	12	78	32.05%	42.31%	10.26%	15.38%	
Tibia	P	1	0	0	0	1	0.60%	0.00%	0.00%	0.00%	0.60%
	P1/2	0	1	0	1	2	0.00%	0.60%	0.00%	0.60%	1.19%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	41	22	49	34	146	24.40%	13.10%	29.17%	20.24%	86.90%
	D	1	1	2	7	11	0.60%	0.60%	1.19%	4.17%	6.55%
	D1/2	0	1	0	1	2	0.00%	0.60%	0.00%	0.60%	1.19%
	D3/4	0	1	0	2	3	0.00%	0.60%	0.00%	1.19%	1.79%
	W	0	3	0	0	3	0.00%	1.79%	0.00%	0.00%	1.79%
	Total Tb	43	29	51	45	168	25.60%	17.26%	30.36%	26.79%	
Metatarsal 3+4	P	2	6	1	0	9	3.23%	9.68%	1.61%	0.00%	14.52%
	P1/2	0	3	3	1	7	0.00%	4.84%	4.84%	1.61%	11.29%
	P3/4	1	0	2	1	4	1.61%	0.00%	3.23%	1.61%	6.45%
	S	10	18	3	2	33	16.13%	29.03%	4.84%	3.23%	53.23%
	D	1	2	0	3	6	1.61%	3.23%	0.00%	4.84%	9.68%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	2	1	3	0.00%	0.00%	3.23%	1.61%	4.84%
	Total Mt	14	29	11	8	62	22.58%	46.77%	17.74%	12.90%	

Table 3.2.2.-2; Fragmentation of ovicaprid long bones from Lausen, see table 3.2-1 and 3.2.1-1 for abbreviations

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	0	0	1	0	1	0.00%	0.00%	3.03%	0.00%	3.03%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	11	9	4	0	24	33.33%	27.27%	12.12%	0.00%	72.73%
	D	1	1	1	3	6	3.03%	3.03%	3.03%	9.09%	18.18%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	3.03%	3.03%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	3.03%	3.03%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Hm	12	10	6	5	33	36.36%	30.30%	18.18%	15.15%	
Radius	P	0	3	0	1	4	0.00%	6.52%	0.00%	2.17%	8.70%
	P1/2	0	1	0	0	1	0.00%	2.17%	0.00%	0.00%	2.17%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	12	12	6	5	35	26.09%	26.09%	13.04%	10.87%	76.09%
	D	2	1	1	0	4	4.35%	2.17%	2.17%	0.00%	8.70%
	D1/2	1	0	0	0	1	2.17%	0.00%	0.00%	0.00%	2.17%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	2.17%	2.17%
	Total Rd	15	17	7	7	46	32.61%	36.96%	15.22%	15.22%	
Metacarpal 3+4	P	0	3	0	1	4	0.00%	6.52%	0.00%	2.17%	8.70%
	P1/2	0	1	0	0	1	0.00%	2.17%	0.00%	0.00%	2.17%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	12	12	6	5	35	26.09%	26.09%	13.04%	10.87%	76.09%
	D	2	1	1	0	4	4.35%	2.17%	2.17%	0.00%	8.70%
	D1/2	1	0	0	0	1	2.17%	0.00%	0.00%	0.00%	2.17%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	2.17%	2.17%
	Total Mc	15	17	7	7	46	32.61%	36.96%	15.22%	15.22%	
Femur	P	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	14	13	2	1	30	40.00%	37.14%	5.71%	2.86%	85.71%
	D	2	0	0	1	3	5.71%	0.00%	0.00%	2.86%	8.57%
	D1/2	1	0	0	0	1	2.86%	0.00%	0.00%	0.00%	2.86%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	1	0	0	1	0.00%	2.86%	0.00%	0.00%	2.86%
	Total Fm	17	14	2	2	35	48.57%	40.00%	5.71%	5.71%	
Tibia	P	4	2	1	0	7	5.88%	2.94%	1.47%	0.00%	10.29%
	P1/2	1	1	0	1	3	1.47%	1.47%	0.00%	1.47%	4.41%
	P3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.47%	1.47%
	S	18	11	1	21	51	26.47%	16.18%	1.47%	30.88%	75.00%
	D	0	2	0	1	3	0.00%	2.94%	0.00%	1.47%	4.41%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.47%	1.47%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.47%	1.47%
	W	0	0	0	1	1	0.00%	0.00%	0.00%	1.47%	1.47%
	Total Tb	23	16	2	27	68	33.82%	23.53%	2.94%	39.71%	
Metatarsal 3+4	P	1	1	0	1	3	3.23%	3.23%	0.00%	3.23%	9.68%
	P1/2	0	0	1	0	1	0.00%	0.00%	3.23%	0.00%	3.23%
	P3/4	0	1	0	0	1	0.00%	3.23%	0.00%	0.00%	3.23%
	S	8	9	1	5	23	25.81%	29.03%	3.23%	16.13%	74.19%
	D	0	0	0	1	1	0.00%	0.00%	0.00%	3.23%	3.23%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	1	0	0	1	2	3.23%	0.00%	0.00%	3.23%	6.45%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Mt	10	11	2	8	31	32.26%	35.48%	6.45%	25.81%	

Table 3.2.2-3; Fragmentation of ovicaprid long bones from Reinach, see table 3.2-1 and 3.2.1-1 for abbreviations

Element	Part	Kaiseraugst	n. %	Reinach	n. %	Lausen	n. %
Scapula	Glenoid/Neck	12	38.71%	13	25.49%	26	36.11%
	Margo thoracalis	6	19.35%	15	29.41%	15	20.83%
	Margo cervicalis	3	9.68%	3	5.88%	0	0.00%
	Spine	2	6.45%	2	3.92%	0	0.00%
	Proximal end	0	0.00%	1	1.96%	5	6.94%
	Large portion 1/3-3/4	8	25.81%	17	33.33%	24	33.33%
	Whole	0	0.00%	0	0.00%	2	2.78%
	Total Sc	31		51		72	
Pelvis	Acetabulum	2	11.76%	3	5.66%	3	6.00%
	Ischium	6	35.29%	22	41.51%	22	44.00%
	Pubis	0	0.00%	12	22.64%	12	24.00%
	Illium	8	47.06%	13	24.53%	12	24.00%
	large portion	1	5.88%	3	5.66%	1	2.00%
	Whole	0	0.00%	0	0.00%	0	0.00%
	Total Pv	17		53		50	

Table 3.2.2-4; Fragmentation of ovicaprid girdle bones, scapula and pelvis at all three sites

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	0	1	0	5	6	0.00%	1.00%	0.00%	5.00%	6.00%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.00%	1.00%
	P3/4	0	0	1	0	1	0.00%	0.00%	1.00%	0.00%	1.00%
	S	6	19	8	23	56	6.00%	19.00%	8.00%	23.00%	56.00%
	D	3	4	6	9	22	3.00%	4.00%	6.00%	9.00%	22.00%
	D1/2	0	0	2	3	5	0.00%	0.00%	2.00%	3.00%	5.00%
	D3/4	0	0	2	5	7	0.00%	0.00%	2.00%	5.00%	7.00%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	2.00%	2.00%
	Total Hm	9	24	19	48	100	9.00%	24.00%	19.00%	48.00%	
Radius	P	0	0	3	6	9	0.00%	0.00%	6.00%	12.00%	18.00%
	P1/2	0	0	5	4	9	0.00%	0.00%	10.00%	8.00%	18.00%
	P3/4	0	0	2	5	7	0.00%	0.00%	4.00%	10.00%	14.00%
	S	1	4	2	6	13	2.00%	8.00%	4.00%	12.00%	26.00%
	D	0	0	3	4	7	0.00%	0.00%	6.00%	8.00%	14.00%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	2.00%	2.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	1	3	4	0.00%	0.00%	2.00%	6.00%	8.00%
	Total Rd	1	4	16	29	50	2.00%	8.00%	32.00%	58.00%	
Metacarpal	P	2	1	2	5	10	6.25%	3.13%	6.25%	15.63%	31.25%
	P1/2	3	0	0	3	6	9.38%	0.00%	0.00%	9.38%	18.75%
	P3/4	0	0	1	0	1	0.00%	0.00%	3.13%	0.00%	3.13%
	S	1	0	0	1	2	3.13%	0.00%	0.00%	3.13%	6.25%
	D	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	3.13%	3.13%
	W	0	6	0	6	12	0.00%	18.75%	0.00%	18.75%	37.50%
	Total Mc	6	7	3	16	32	18.75%	21.88%	9.38%	50.00%	
Femur	P	3	7	6	4	20	2.42%	5.65%	4.84%	3.23%	16.13%
	P1/2	0	0	1	1	2	0.00%	0.00%	0.81%	0.81%	1.61%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	18	33	12	18	81	14.52%	26.61%	9.68%	14.52%	65.32%
	D	2	3	3	7	15	1.61%	2.42%	2.42%	5.65%	12.10%
	D1/2	0	0	0	2	2	0.00%	0.00%	0.00%	1.61%	1.61%
	D3/4	0	0	1	1	2	0.00%	0.00%	0.81%	0.81%	1.61%
	W	0	0	1	1	2	0.00%	0.00%	0.81%	0.81%	1.61%
	Total Fm	23	43	24	34	124	18.55%	34.68%	19.35%	27.42%	
Tibia	P	0	3	3	3	9	0.00%	2.73%	2.73%	2.73%	8.18%
	P1/2	1	0	0	0	1	0.91%	0.00%	0.00%	0.00%	0.91%
	P3/4	0	0	1	0	1	0.00%	0.00%	0.91%	0.00%	0.91%
	S	20	21	13	16	70	18.18%	19.09%	11.82%	14.55%	63.64%
	D	2	0	2	9	13	1.82%	0.00%	1.82%	8.18%	11.82%
	D1/2	2	1	2	2	7	1.82%	0.91%	1.82%	1.82%	6.36%
	D3/4	0	1	1	4	6	0.00%	0.91%	0.91%	3.64%	5.45%
	W	0	0	1	2	3	0.00%	0.00%	0.91%	1.82%	2.73%
	Total Tb	25	26	23	36	110	22.73%	23.64%	20.91%	32.73%	
Metatarsal	P	1	3	0	2	6	3.23%	9.68%	0.00%	6.45%	19.35%
	P1/2	0	0	3	0	3	0.00%	0.00%	9.68%	0.00%	9.68%
	P3/4	0	1	2	3	6	0.00%	3.23%	6.45%	9.68%	19.35%
	S	1	2	0	2	5	3.23%	6.45%	0.00%	6.45%	16.13%
	D	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	3.23%	3.23%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	3.23%	3.23%
	W	0	0	1	8	9	0.00%	0.00%	3.23%	25.81%	29.03%
	Total Mt	2	6	6	17	31	6.45%	19.35%	19.35%	54.84%	

Table 3.2.3-1; Fragmentation of pig long bones from Kaiseraugst,see table 3.2-1 and 3.2.1-1 for abbreviations

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	1	0	1	0	2	2.17%	0.00%	2.17%	0.00%	4.35%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	9	7	6	6	28	19.57%	15.22%	13.04%	13.04%	60.87%
	D	5	1	1	4	11	10.87%	2.17%	2.17%	8.70%	23.91%
	D1/2	0	0	1	2	3	0.00%	0.00%	2.17%	4.35%	6.52%
	D3/4	0	0	0	2	2	0.00%	0.00%	0.00%	4.35%	4.35%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Hm	15	8	9	14	46	32.61%	17.39%	19.57%	30.43%	
Radius	P	0	1	0	1	2	0.00%	4.17%	0.00%	4.17%	8.33%
	P1/2	0	0	1	2	3	0.00%	0.00%	4.17%	8.33%	12.50%
	P3/4	0	0	0	1	1	0.00%	0.00%	0.00%	4.17%	4.17%
	S	5	4	2	3	14	20.83%	16.67%	8.33%	12.50%	58.33%
	D	1	0	0	0	1	4.17%	0.00%	0.00%	0.00%	4.17%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	3	3	0.00%	0.00%	0.00%	12.50%	12.50%
	Total Rd	6	5	3	10	24	25.00%	20.83%	12.50%	41.67%	
Metacarpal	P	1	1	0	3	5	5.88%	5.88%	0.00%	17.65%	29.41%
	P1/2	0	2	0	1	3	0.00%	11.76%	0.00%	5.88%	17.65%
	P3/4	0	0	0	1	1	0.00%	0.00%	0.00%	5.88%	5.88%
	S	2	1	1	0	4	11.76%	5.88%	5.88%	0.00%	23.53%
	D	0	1	0	0	1	0.00%	5.88%	0.00%	0.00%	5.88%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	1	2	3	0.00%	0.00%	5.88%	11.76%	17.65%
	Total Mc	3	5	2	7	17	17.65%	29.41%	11.76%	41.18%	
Femur	P	0	0	0	3	3	0.00%	0.00%	0.00%	7.32%	7.32%
	P1/2	0	0	1	0	1	0.00%	0.00%	2.44%	0.00%	2.44%
	P3/4	0	1	0	0	1	0.00%	2.44%	0.00%	0.00%	2.44%
	S	11	9	5	3	28	26.83%	21.95%	12.20%	7.32%	68.29%
	D	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D1/2	0	2	2	2	6	0.00%	4.88%	4.88%	4.88%	14.63%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	4.88%	4.88%
	Total Fm	11	12	8	10	41	26.83%	29.27%	19.51%	24.39%	
Tibia	P	3	0	3	0	6	5.66%	0.00%	5.66%	0.00%	11.32%
	P1/2	3	0	0	1	4	5.66%	0.00%	0.00%	1.89%	7.55%
	P3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.89%	1.89%
	S	17	0	7	5	29	32.08%	0.00%	13.21%	9.43%	54.72%
	D	0	0	0	11	11	0.00%	0.00%	0.00%	20.75%	20.75%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	1.89%	1.89%
	D3/4	0	0	0	1	1	0.00%	0.00%	0.00%	1.89%	1.89%
	W	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	Total Tb	23	0	10	20	53	43.40%	0.00%	18.87%	37.74%	
Metatarsal	P	2	1	2	1	6	10.00%	5.00%	10.00%	5.00%	30.00%
	P1/2	0	0	0	1	1	0.00%	0.00%	0.00%	5.00%	5.00%
	P3/4	1	2	0	0	3	5.00%	10.00%	0.00%	0.00%	15.00%
	S	0	0	1	0	1	0.00%	0.00%	5.00%	0.00%	5.00%
	D	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	9	9	0.00%	0.00%	0.00%	45.00%	45.00%
	Total Mt	3	3	3	11	20	15.00%	15.00%	15.00%	55.00%	

Table 3.2.3-2; Fragmentation of pig long bones from Reinach,see table 3.2-1 and 3.2.1-1 for abbreviations

		<Q	Q-H	H-W	W	Total	<Q%	Q-H%	H-W%	W%	Total
Humerus	P	3	0	1	0	4	1.72%	0.00%	0.57%	0.00%	2.30%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	35	35	29	26	125	20.11%	20.11%	16.67%	14.94%	71.84%
	D	10	5	6	7	28	5.75%	2.87%	3.45%	4.02%	16.09%
	D1/2	0	0	1	3	4	0.00%	0.00%	0.57%	1.72%	2.30%
	D3/4	0	0	6	5	11	0.00%	0.00%	3.45%	2.87%	6.32%
	W	0	0	0	2	2	0.00%	0.00%	0.00%	1.15%	1.15%
	Total Hm	48	40	43	43	174	27.59%	22.99%	24.71%	24.71%	
Radius	P	2	0	4	6	12	3.23%	0.00%	6.45%	9.68%	19.35%
	P1/2	0	0	4	1	5	0.00%	0.00%	6.45%	1.61%	8.06%
	P3/4	0	0	2	4	6	0.00%	0.00%	3.23%	6.45%	9.68%
	S	7	16	4	4	31	11.29%	25.81%	6.45%	6.45%	50.00%
	D	2	1	1	2	6	3.23%	1.61%	1.61%	3.23%	9.68%
	D1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	1	1	2	0.00%	0.00%	1.61%	1.61%	3.23%
	Total Rd	11	17	16	18	62	17.74%	27.42%	25.81%	29.03%	
Metacarpal	P	1	6	1	1	9	4.35%	26.09%	4.35%	4.35%	39.13%
	P1/2	0	0	2	1	3	0.00%	0.00%	8.70%	4.35%	13.04%
	P3/4	0	0	1	0	1	0.00%	0.00%	4.35%	0.00%	4.35%
	S	1	2	0	0	3	4.35%	8.70%	0.00%	0.00%	13.04%
	D	0	0	0	1	1	0.00%	0.00%	0.00%	4.35%	4.35%
	D1/2	0	0	0	1	1	0.00%	0.00%	0.00%	4.35%	4.35%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	0	0	5	5	0.00%	0.00%	0.00%	21.74%	21.74%
	Total Mc	2	8	4	9	23	8.70%	34.78%	17.39%	39.13%	
Femur	P	3	1	2	4	10	1.31%	0.44%	0.87%	1.75%	4.37%
	P1/2	0	0	1	0	1	0.00%	0.00%	0.44%	0.00%	0.44%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	82	75	29	17	203	35.81%	32.75%	12.66%	7.42%	88.65%
	D	2	1	3	2	8	0.87%	0.44%	1.31%	0.87%	3.49%
	D1/2	0	0	1	0	1	0.00%	0.00%	0.44%	0.00%	0.44%
	D3/4	1	1	0	0	2	0.44%	0.44%	0.00%	0.00%	0.87%
	W	0	0	1	3	4	0.00%	0.00%	0.44%	1.31%	1.75%
	Total Fm	88	78	37	26	229	38.43%	34.06%	16.16%	11.35%	
Tibia	P	3	4	0	0	7	1.88%	2.50%	0.00%	0.00%	4.38%
	P1/2	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	P3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	S	56	37	13	17	123	35.00%	23.13%	8.13%	10.63%	76.88%
	D	4	3	1	7	15	2.50%	1.88%	0.63%	4.38%	9.38%
	D1/2	0	0	1	6	7	0.00%	0.00%	0.63%	3.75%	4.38%
	D3/4	0	0	2	3	5	0.00%	0.00%	1.25%	1.88%	3.13%
	W	0	1	2	0	3	0.00%	0.63%	1.25%	0.00%	1.88%
	Total Tb	63	45	19	33	160	39.38%	28.13%	11.88%	20.63%	
Metatarsal	P	0	0	1	0	1	0.00%	0.00%	5.88%	0.00%	5.88%
	P1/2	2	2	4	0	8	11.76%	11.76%	23.53%	0.00%	47.06%
	P3/4	0	0	3	1	4	0.00%	0.00%	17.65%	5.88%	23.53%
	S	0	1	1	0	2	0.00%	5.88%	5.88%	0.00%	11.76%
	D	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	D1/2	0	0	1	1	2	0.00%	0.00%	5.88%	5.88%	11.76%
	D3/4	0	0	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%
	W	0	3	0	0	0	0.00%	17.65%	0.00%	0.00%	0.00%
	Total Mt	2	6	10	2	17	11.76%	35.29%	58.82%	11.76%	

Table 3.2.2-3; Fragmentation of pig long bones from Lausen,see table 3.2-1 and 3.2.1-1 for abbreviations

Element	Part	Kaiseraugst	n. %	Reinach	n. %	Lausen	n. %
Scapula	Glenoid/Neck	24	36.92%	13	34.21%	36	22.93%
	Margo thoracalis	6	9.23%	3	7.89%	30	19.11%
	Margo cervicalis	5	7.69%	2	5.26%	2	1.27%
	Spine	7	10.77%	3	7.89%	16	10.19%
	Proximal end	2	3.08%	2	5.26%	2	1.27%
	Large portion 1/3-3/4	19	29.23%	15	39.47%	71	45.22%
	Whole	2	3.08%	0	0.00%	0	0.00%
	Total Sc	65		38		157	
Pelvis	Acetabulum	10	20.41%	6	17.65%	2	2.53%
	Ischium	15	30.61%	5	14.71%	30	37.97%
	Pubis	3	6.12%	3	8.82%	2	2.53%
	Illium	14	28.57%	18	52.94%	39	49.37%
	large portion	7	14.29%	2	5.88%	6	7.59%
	Whole	0	0.00%	0	0.00%	0	0.00%
	Total Pv	49		34		79	

Table 3.2.3-4; Fragmentation of pig girdle bones, scapula and pelvis at all three sites

Site Period	KA 4th		KA 5/6th		KA 6th		KA 4-6th		Lausen 6/7th		KA 7th		Reinach 6/7th		Lausen 8/9th		Reinach 8/9th	
Proximal	48	16.90%	170	18.93%	121	21.19%	48	21.43%	35	15.77%	57	16.91%	86	17.17%	125	12.78%	68	20.54%
Shaft	157	55.28%	374	41.65%	252	44.13%	67	29.91%	137	61.71%	197	58.46%	275	54.89%	638	65.24%	163	49.24%
Distal	48	16.90%	190	21.16%	114	19.96%	37	16.52%	33	14.86%	50	14.84%	79	15.77%	131	13.39%	44	13.29%
Whole	30	10.56%	164	18.26%	84	14.71%	72	32.14%	17	7.66%	33	9.79%	60	11.98%	82	8.38%	54	16.31%
Art	1	0.35%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.20%	2	0.20%	2	0.60%
Total	284		898		571		224		222		337		501		978		331	

Site Period	Lausen 10th		Reinach 10th*		KA 12th*		Lausen 11/12th		Reinach 11/12th	
Proximal	51	11.92%	12	23.08%	18	17.65%	139	14.82%	69	20.18%
Shaft	281	65.65%	28	53.85%	38	37.25%	615	65.57%	172	50.29%
Distal	58	13.55%	5	9.62%	32	31.37%	105	11.19%	48	14.04%
Whole	38	8.88%	7	13.46%	13	12.75%	79	8.42%	53	15.50%
Art	0	0.00%	0	0.00%	1	0.98%	0	0.00%	0	0.00%
Total	428		52		102		938		342	

Table 3.2.3-5; Fragmentation of unidentified long bone fragments by date for each of the three sites analysed, * denotes statistically small samples, art-articulation

Date	Area	n.	Identified	Unidentified
4-6thC	Jakoblihaus	670	66.12%	33.88%
5th/6thC	Jakoblihaus	980	69.97%	30.03%
6thC	Jakoblihaus	1732	69.40%	30.60%
beg. 7thC	Jakoblihaus	824	64.93%	35.07%
mid 4thC	Adler	1259	50.44%	49.56%
5th/6thC	Adler	1690	67.16%	32.84%
12thC*	Adler	112	76.79%	23.21%
12thC*	Fabrikstrasse	105	62.86%	37.14%

Table 3.2.4-1: the proportion of indentified and unidentified bone fragments at Kaiseraugst with regards to area and date, * denotes statistically small samples

Date	Area-Structure	n.	Identified	Unidentified
4-6thC	Jak-Bodennivaeu	363	61.16%	38.84%
4-6thC	Jak-gruben	264	75.00%	25.00%
Mid 4thC	Adl-F2/3	243	70.47%	29.53%
Mid 4thC	Adl-F3/2	640	32.66%	67.34%
Mid 4thC	Adl-F3/3*	145	62.76%	37.24%
450-early 500	Adl-F2/2*	132	48.48%	51.52%
mid 5-late 6thC	Adl-F2/4	600	70.83%	29.17%
mid 5-late 6thC	Adl-F3/5	217	69.12%	30.88%
mid 5-late 6thC	Adl-F17/2 all	701	69.47%	30.53%
mid 5-late 6thC	Adl-F17/2	204	68.63%	31.37%
mid 5-late 6thC	Adl-F17/2 above	308	66.23%	33.77%
mid 5-late 6thC	Adl-F17/2 below*	179	75.66%	24.34%
5th/6thC	Jak-Ziegelschutthorizont	980	70.00%	30.00%
6thC	Jak-Lehmbodenrest*	88	71.59%	21.59%
6thC	Jak-Mauerschutt*	62	58.06%	41.94%
6thC	Jak-Unterer Humusbereich	1647	69.28%	30.72%
beg. 7thC	Jak-Oberer Humusbereich	765	65.62%	34.38%
12thC	Fab-Grubenhaus I*	105	54.29%	45.71%
12thC	Adl-Grubenhaus IV*	112	76.79%	23.21%

Table 3.2.4-2: the proportion of indentified and unidentified bone fragments at Kaiseraugst with regards to structure and date, * denotes statistically small samples

Date	Area	n.	Identified	Unidentified
Early 7thC*	Stadthof	165	56.97%	43.03%
Late 7thC	Stadthof	380	78.68%	21.32%
9thC*	Stadthof	172	77.91%	22.09%
11thC	Stadthof	476	60.77%	39.23%
12thC	Stadthof	559	67.26%	32.74%
6thC	GMZ	580	36.90%	63.10%
7thC	GMZ	281	50.89%	49.11%
8thC	GMZ	340	54.41%	45.59%
9thC	GMZ	950	38.84%	61.16%
10thC	GMZ	330	35.76%	64.24%
11thC*	GMZ	177	49.72%	50.28%
12thC*	GMZ	188	57.45%	42.55%
7thC	AB	1119	27.08%	72.92%
8thC	AB	320	42.50%	57.50%

Table 3.2.4-3; the proportion of indentified and unidentified bone fragments at Reinach with regards to area and date, * denotes statistically small samples

Date	Area-Structure	n.	Identified	Unidentified
6thC	GMZ-G2	531	34.27%	65.73%
6thC	GMZ-G3*	51	64.71%	35.29%
7thC	AB-B1	1101	26.79%	73.21%
7thC	GMZ-G4*	167	54.49%	45.51%
7thC	GMZ-G5*	114	45.61%	54.39%
7thC	Sth-S2*	129	58.91%	41.09%
Mid 7thC	Sth-S4	278	82.73%	17.27%
Late 7thC	Sth-S3*	96	66.67%	33.33%
8thC	AB-A521	202	43.56%	56.44%
8thC	AB-B3*	89	38.20%	61.80%
8thC	GMZ-G6*	61	63.93%	36.07%
8thC	GMZ-G7*	114	45.61%	54.39%
8thC	GMZ-G9*	128	57.03%	42.97%
9thC	GMZ-G10*	65	41.54%	58.46%
9thC	GMZ-G11	226	43.81%	56.19%
9thC	GMZ-G12	264	46.59%	53.41%
9thC	GMZ-G13	372	28.23%	71.77%
9thC	Sth-S5*	172	77.91%	22.09%
10thC	GMZ-G15*	31	67.74%	32.26%
10thC	GMZ-G16*	113	23.01%	76.99%
10thC	GMZ-G17*	36	44.44%	55.56%
10thC	GMZ-G18*	142	33.80%	66.20%
11thC	GMZ-G19*	74	62.16%	37.84%
11thC	Sth-K1	241	62.66%	37.34%
11thC	Sth-K2*	167	62.87%	37.13%
11thC	Sth-S7*	68	61.76%	38.24%
12thC	GMZ-G21*	57	40.35%	59.65%
12thC	GMZ-G23*	102	60.78%	39.22%
12thC	Sth-S9*	103	84.47%	15.53%
12thC	Sth-S10*	26	42.31%	57.69%
12thC	Sth-S13	214	71.50%	28.50%

Table 3.2.4-4; the proportion of indentified and unidentified bone fragments at Reinach with regards to structure and date, * denotes statistically small samples

Lausen	n.	Identified	Unidentified
late 6th/7thC	758	52.24%	47.76%
late 7th/8thC	289	30.45%	69.55%
8th/9thC	159	43.40%	56.60%
9thC	4652	43.83%	56.17%
10thC	2598	39.34%	60.66%
11thC	4187	40.86%	59.14%
Early 11thC	808	34.65%	65.35%
Late 11th/12thC	276	53.99%	46.01%
mid 12thC	340	45.00%	55.00%

table 3.2.4-5; the proportion of indentified and unidentified bone fragments at Lausen with regards to area and date, * denotes statistically small samples

Date	Structures	n.	Identified	Unidentified
late 6th-late7thC	G1*	109	49.54%	50.46%
late 6th-late7thC	G2*	172	57.56%	42.44%
late 6th-late7thC	G22	219	51.60%	48.40%
late 6th-late7thC	G50	327	55.66%	44.34%
late 6th-late7thC	G56	322	49.69%	50.31%
11thC	G7*	68	63.24%	36.76%
11thC	G10	1129	39.50%	60.50%
11thC	G19/52	945	31.64%	68.36%
11thC	G20	442	41.40%	58.60%
11thC	G36	492	46.75%	53.25%
11thC	G45	793	46.03%	53.97%
11thC	G57	381	45.60%	54.40%

Table 3.2.4-6; the proportion of indentified and unidentified bone fragments at Lausen for selected structures from the sixth to seventh and eleventh Centuries,
* denotes statistically small samples

Area	All	Jak	Adl	Jak	Adl	Jak	Jak	Adl	Fab
Date	Total n.	4-6th C	Mid 4thC	5 - late 6th C	mid 5 - late 6th C	6th C	beg. 7th C	12th C	12th C
None	7478	636	1224	927	1673	1699	1024	210	85
Burnt	274	31	36	52	53	48	35	6	13
Burnt and partial calcination	12	2	0	1	1	3	0	0	5
Calcinated	4	1	0	0	0	0	0	1	2

Table 3.3.1-1: Presence of burnt fragments within the three areas of the Kaiseraugst excavation, Jak- Jakoblihaus; Adl- Gasthof Adler; Fab- Fabrikstrasse.

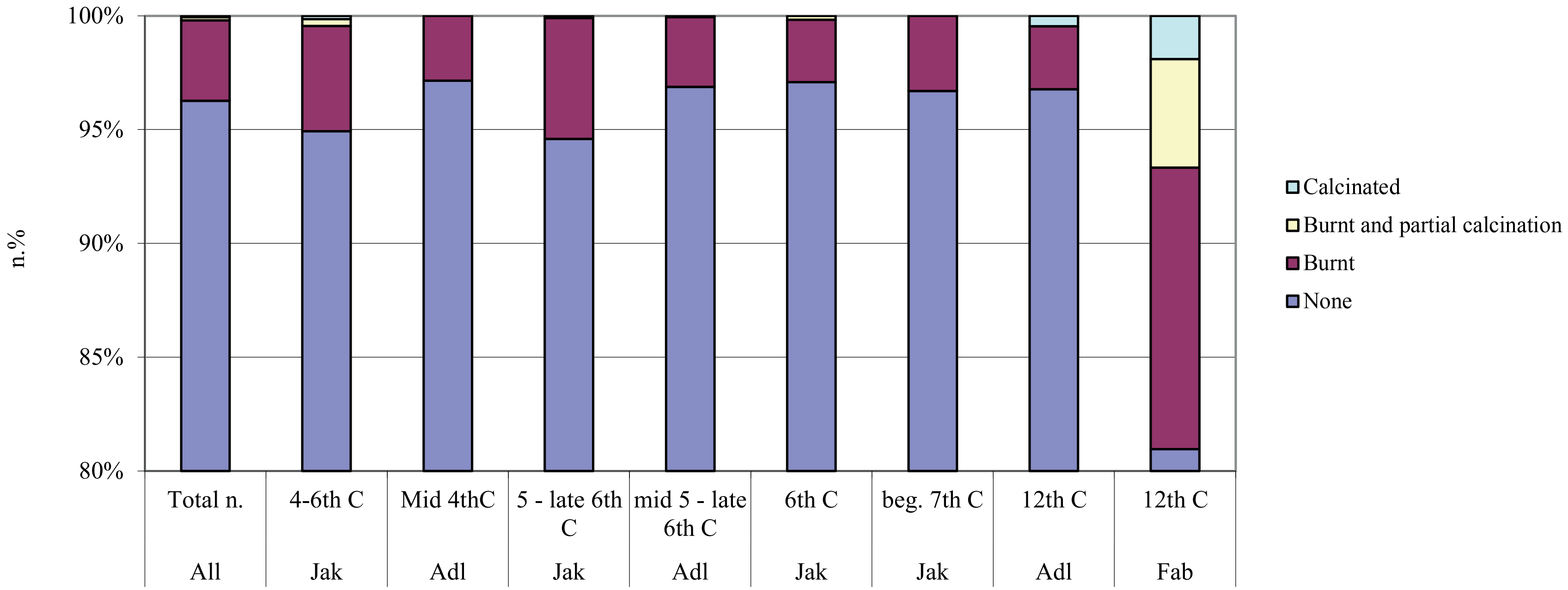

Fig. 3.3.1-2: Presence of burnt fragments within the Kaiseraugst excavation expressed as a percentage, see table 3.3.1-1 for abbreviations

	Total n.	6/7th	8/9th	10th	Early 11th	11th	Late 11th	12th
None	7086	508	2831	1093	313	1940	228	173
Burnt	112	8	35	11	13	36	6	3
Burnt and partial calcination	24	0	7	1	9	4	3	0
Calcinated	10	0	0	0	8	2	0	0

Table 3.3.2-1: Presence of burnt fragments within the Lausen excavation.

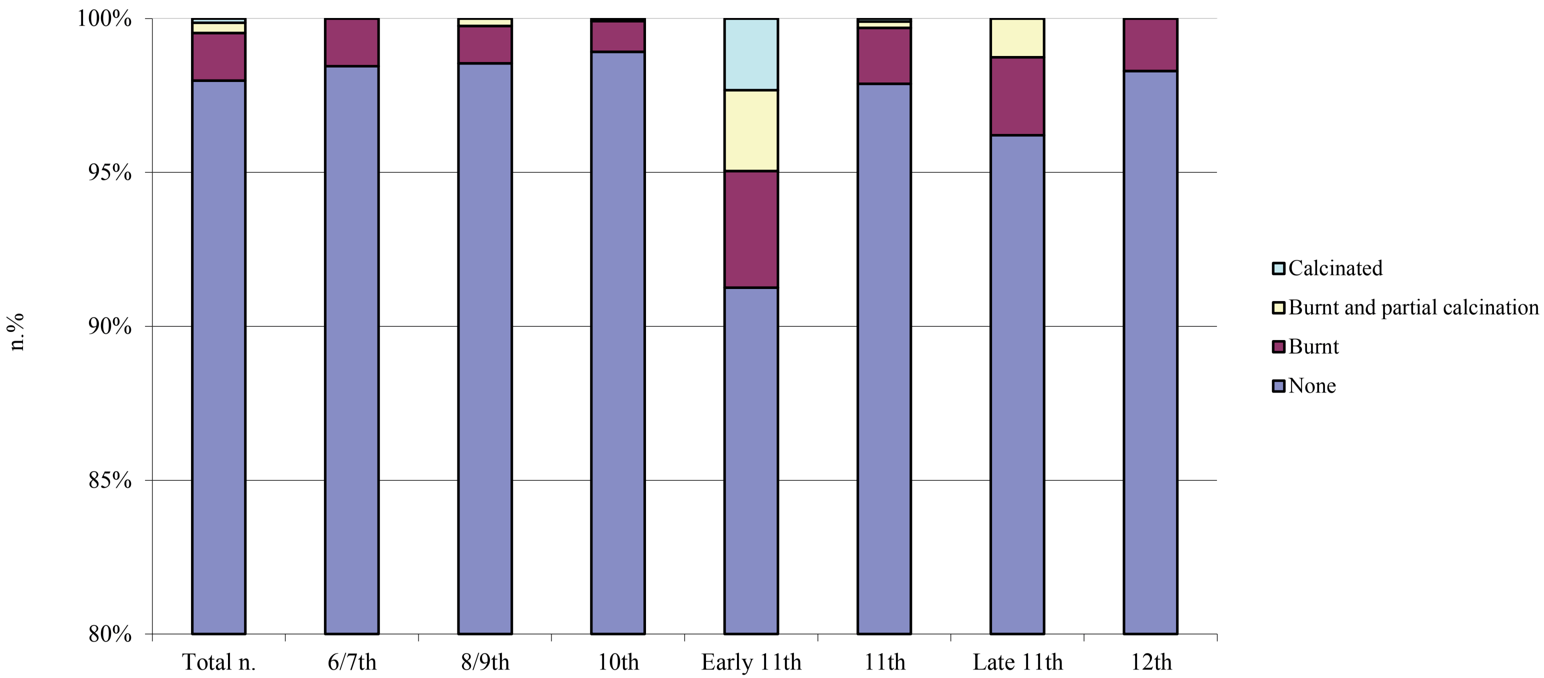

Fig. 3.3.2-2: Presence of burnt fragments within the Lausen excavation expressed as a percentage.

Area Date	All Total n.	GMZ 6th	STH Early 7th	AB 7th	GMZ 7th	STH Late 7th	AB 8th	GMZ 8th	GMZ 9th	STH 9th	GMZ 10th	STH 10th	GMZ 11th	STH 11th	GMZ 12th	STH 12th
None	4747	542	157	226	269	368	293	269	928	169	327	1	166	307	184	541
Burnt	166	39	8	9	9	16	25	3	19	3	3	0	10	4	2	16
Burnt and partial calcination	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Calcination	17	4	0	1	3	2	0	0	2	0	0	0	1	0	2	2

Table 3.3.3-1: Presence of burnt fragments within the three areas if the Reinach excavation, AB- Altebrauerei; GMZ- Gemeindezentrum; STH- Stadthof.

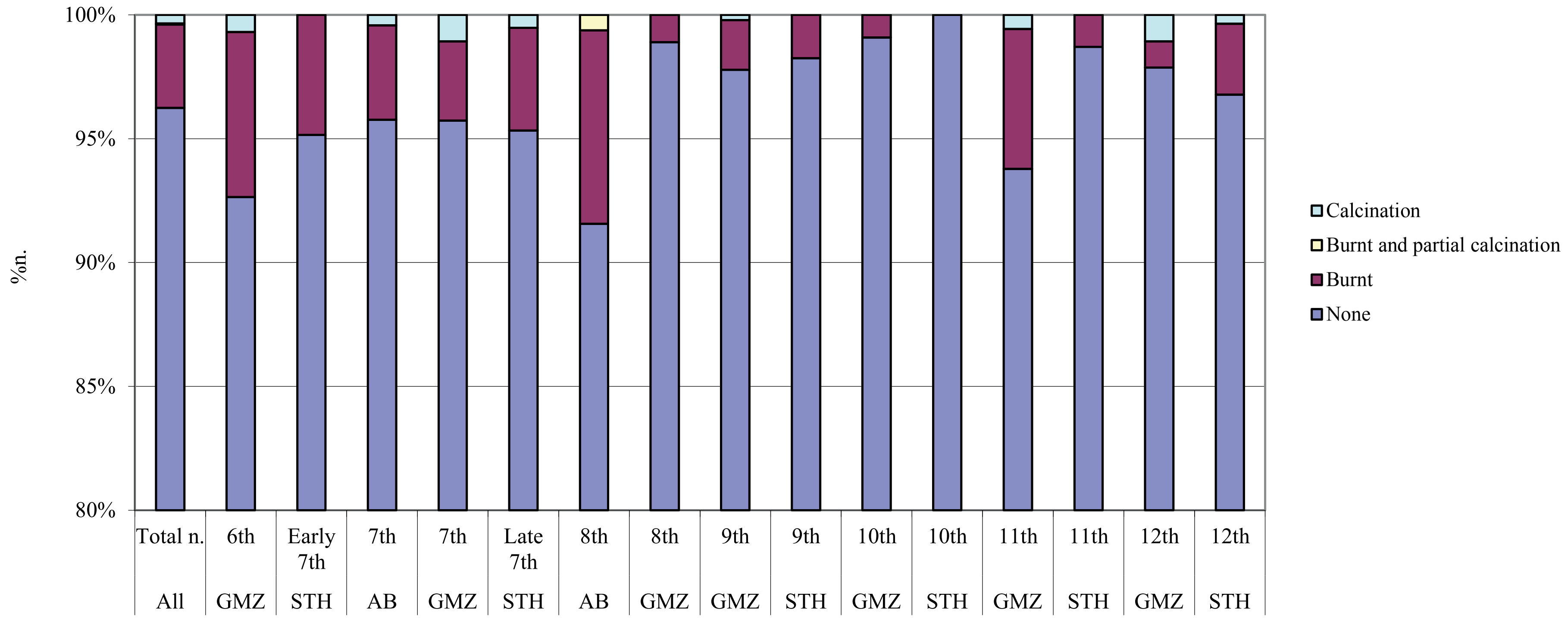

Fig. 3.3.3-2: Presence of burnt fragments within the Reinach excavation expressed as a percentage, see table 3.3.3-1 for abbreviations

Area	Date	canid gnawing	% assemblage	Rodent gnawing	% assemblage
All data	Total (n.=5871)	472	8.04%	5	0.09%
GMZ	6th	24	4.10%	1	0.17%
STH	Early 7th	20	12.12%	0	0.00%
AB	7th	32	2.86%	0	0.00%
GMZ	7th	20	7.12%	0	0.00%
STH	Late 7th	55	14.25%	0	0.00%
AB	8th	44	13.75%	0	0.00%
GMZ	8th	34	10.06%	1	0.30%
GMZ	9th	63	6.63%	0	0.00%
STH	9th	35	20.35%	2	1.16%
GMZ	10th	23	6.97%	0	0.00%
STH	10th	0	0.00%	0	0.00%
GMZ	11th	18	10.17%	0	0.00%
STH	11th	40	12.90%	0	0.00%
GMZ	12th	10	5.32%	0	0.00%
STH	12th	54	9.84%	1	0.18%

Table 3.4.1.1-2: Canid and Rodent gnawing marks present in the three areas of the Reinach excavation

Area	Date	canid gnawing	% assemblage	Rodent gnawing	% assemblage
All data	Total (n.=7768)	866	11.15%	12	0.15%
Jak	4-6th	36	5.37%	0	0.00%
Adl	Mid 4th	113	8.97%	2	0.16%
Adl	mid 5 - late 6th	198	11.46%	3	0.17%
Jak	5 - late 6th	76	7.76%	0	0.00%
Jak	6th	249	14.23%	3	0.17%
Jak	beg. 7th	147	13.88%	1	0.09%
Adl	12th	29	13.36%	3	1.38%
Fab	12th	18	17.14%	0	0.00%

Table 3.4.1.2-1: Canid and Rodent gnawing marks present in the three Kaiseraugst excavation areas

Date	canid gnawing	% assemblage
All data (n=14071)	609	4.33%
6/7th	24	3.17%
7/8th	8	2.77%
8/9th	387	8.39%
10th	38	1.47%
11th	131	2.59%
12th	21	2.77%

Table 3.4.1.3-1: Canid gnawing marks present in the Lausen material

Date	4-6th		5th-late 6th		6th		beg. 7th	
algae	33	9.68%	60	9.02%	181	15.29%	30	4.64%
concretions	64	18.77%	108	16.24%	171	14.44%	80	12.36%
ivoried	16	4.69%	17	2.56%	45	3.80%	19	2.94%
eroded	9	2.64%	26	3.91%	46	3.89%	30	4.64%
greasy	1	0.29%	7	1.05%	5	0.42%	1	0.15%
chalky	3	0.88%	1	0.15%	1	0.08%	0	0.00%
root etching	1	0.29%	13	1.95%	21	1.77%	14	2.16%
dark colouration	0	0.00%	6	0.90%	4	0.34%	0	0.00%
light colouration	0	0.00%	0	0.00%	0	0.00%	2	0.31%
green Cu^{3+} stains	0	0.00%	1	0.15%	3	0.25%	1	0.15%
none	214	62.76%	426	64.06%	707	59.71%	470	72.64%
Total	341		665		1184		647	

3.5-1 Minor taphonomic factors noted at the Kaiseraugst Jakoblihaus excavtion

Date	Mid 4th		mid 5 - late 6th		12th	
algae	10	3.03%	7	1.13%	0	0.00%
concretions	12	3.64%	23	3.70%	6	6.19%
ivoried	5	1.52%	8	1.29%	5	5.15%
eroded	10	3.03%	25	4.03%	1	1.03%
greasy	0	0.00%	0	0.00%	0	0.00%
chalky	2	0.61%	37	5.96%	2	2.06%
root etching	9	2.73%	8	1.29%	3	3.09%
dark colouration	0	0.00%	0	0.00%	0	0.00%
light colouration	0	0.00%	0	0.00%	0	0.00%
green cu stains	0	0.00%	0	0.00%	0	0.00%
none	282	85.45%	513	82.61%	80	82.47%
Total	330		621		97	

3.5-2 Minor taphonomic factors noted at the Kaiseraugst Gasthof Adler excavtion

Date	12th	
algae	2	1.90%
concretions	10	9.52%
ivoried	5	4.76%
eroded	2	1.90%
greasy	0	0.00%
chalky	0	0.00%
root etching	1	0.95%
dark colouration	0	0.00%
light colouration	0	0.00%
green cu stains	0	0.00%
none	85	80.95%
Total	105	

3.5-3 Minor taphonomic factors noted at the Kaiseraugst Fabrikstrasse excavtion

Date	Early 7thC		Late 7thC		9thC		10thC		11thC		12thC	
Root etching	5	3.03%	1	0.26%	6	3.49%	0	0.00%	3	0.96%	11	1.97%
Concretions	1	0.61%	1	0.26%	4	2.33%	0	0.00%	0	0.00%	17	3.04%
Greasy	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Ivoried	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Discolouration	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Algae	0	0.00%	0	0.00%	2	1.16%	0	0.00%	1	0.32%	9	1.61%
None	159	96.36%	384	99.48%	160	93.02%	1	100.00%	307	98.71%	522	93.38%
Total	165		386		172		1		311		559	

3.5-4 Minor taphonomic factors that are noted at the Reinach Stadthof excavation

Date	6thC		7thC		8thC		9thC		10thC		11thC		12thC	
Root etching	7	0.17%	15	5.34%	5	1.47%	14	1.47%	7	2.12%	5	2.82%	5	2.66%
Concretions	2	0.05%	1	0.36%	10	2.94%	59	6.21%	12	3.64%	21	11.86%	8	4.26%
Greasy	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Ivoried	14	0.34%	0	0.00%	11	3.24%	39	4.11%	13	3.94%	13	7.34%	10	5.32%
Discolouration	6	0.15%	5	1.78%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Algae	0	0.00%	4	1.42%	2	0.59%	5	0.53%	0	0.00%	4	2.26%	3	1.60%
None	4056	99.29%	256	91.10%	312	91.76%	833	87.68%	298	90.30%	134	75.71%	162	86.17%
Total	4085		281		340		950		330		177		188	

3.5-5 Minor taphonomic factors that are noted at the Reinach Gemeindezentrum excavation

Date	late 6- late7th		7th-late 8th	
Root etching	12	1.07%	2	0.63%
Concretions	0	0.00%	2	0.63%
Greasy	0	0.00%	0	0.00%
Ivoried	15	1.34%	11	3.44%
Discolouration	0	0.00%	0	0.00%
Algae	0	0.00%	0	0.00%
None	1092	97.59%	305	95.31%
Total	320		1507	

3.5-6 Minor taphonomic factors that are noted at the Reinach Altebrauerei excavation

Date	Late 6th-late		Late 7th-late		9th		10th		11th		12th	
Root etching	0	0.00%	0	0.00%	43	0.92%	0	0.00%	6	0.11%	0	0.00%
Concretions	0	0.00%	0	0.00%	37	0.80%	0	0.00%	0	0.00%	0	0.00%
Greasy	0	0.00%	1	0.35%	28	0.60%	0	0.00%	43	0.82%	0	0.00%
Ivoried	0	0.00%	0	0.00%	3	0.06%	0	0.00%	3	0.06%	0	0.00%
Discolouration	0	0.00%	0	0.00%	4	0.09%	0	0.00%	13	0.25%	0	0.00%
Algae	0	0.00%	0	0.00%	0	0.00%	0	0.00%	22	0.42%	0	0.00%
None	758	100.00%	288	99.65%	4537	97.53%	2598	100.00%	5183	98.35%	340	100.00%
Total	758		289		4652		2598		5270		340	

3.5-7 Minor taphonomic factors that are noted at the Lausen excavation

Species	Reinach G2 Late 6thC	Mass g.
Bos taurus	1	0.30
Sus domesticus	65	7.10
Ovis/Capra		
Capra hircus		
Ovis aries		
Equus Spec		
Canis familiaris		
Felis domesticus		
Gallus domesticus	13	0.70
Anser domesticus		
Columba domestica		
Total Domestic	**79**	**8.10**
Canis lupus		
Capreolus capreolus		
Cervus elaphus		
Mustela erminea/nivalis		
Oryctolagos cunic./Lepus europ.		
Sciurus vulgaris		
Sus scrofa		
Talpa europaeus		
Ursus arctos		
Vulpes vulpes		
Anas sp.		
Cicconia ciconia		
Corvus c.c./cornix		
Corvus corone		
Corvus spec.		
Garrulus glandarius		
Strix aluco		
Buteo Buteo		
Perdix perdix		
*Pisces**	250	24.00
*Rodentia**	69	6.50
Homo sapiens		
Total Wild	**0**	**0**
Total Id	**79**	**8.10**
Large ruminents		
Small ruminents		
Canis lupus/Canis familiaris		
Vulpes v./Canis f.		
Small carnivore		
Total Domestic/Wild	**0**	**0.00**
Indet.	3546	272.30
< Lepus		
Bos/Cervus sized		
Ovis sized	42	3.50
Aves	6	0.30
Total Unidentified	**3594**	**276.10**
% Identified	**2.15%**	**2.85%**
% Unidentified	**97.85%**	**97.15%**

Table 3.6-1; Faunal remains from the seived material at Reinach

Species	Element	B3263s (n.)
Bos taurus	lower tooth	1
Sus domesticus	axis	1
Sus domesticus	cevical vert.	3
Sus domesticus	fibula	4
Sus domesticus	lateral metapodial	1
Sus domesticus	lower tooth	17
Sus domesticus	lumbar vert.	3
Sus domesticus	phalanx 1 ant/post	1
Sus domesticus	phalanx 2 ant/post	2
Sus domesticus	rib	2
Sus domesticus	sacral vert.	1
Sus domesticus	skull	4
Sus domesticus	sternum	1
Sus domesticus	thoracic vert.	3
Sus domesticus	upper tooth	4
Sus domesticus	upper/lower tooth	11
Sus domesticus	vertebra unid	7
Gallus domesticus	long bone	6
Gallus domesticus	fibula	2
Gallus domesticus	phalanx 1 post	1
Gallus domesticus	phalanx 2 post	2
Gallus domesticus	phalanx 3 ant	1
Gallus domesticus	phalanx 3 post	1
Total dom.		79
microtus spp.	maxilla	3
microtus avarlis	teeth	6
Apodimus sylvaticus	teeth	5
Microtus agretis	teeth	1
Apodemus flavicollis	teeth	2
Mus musculus	teeth	2
Total wild		19
Total dom. & wild		98
Aves	indet	1
Aves	fibula	1
Aves	rib	1
Aves	scapula	1
Aves	vertebra indet.	2
Rodentia indet.	long bones and skull	50
Ovis sized	caudal vert.	1
Ovis sized	lower tooth	1
Ovis sized	rib	8
Ovis sized	sacral vert.	2
Ovis sized	skull	11
Ovis sized	upper/lower tooth	14
Ovis sized	vertebra indet.	5
indet.	flat bone	40
indet.	long bone	4
indet.	unidentified	3502
Total unidentified		3644
Total		3742

table 3.6-2; The contents of the faunal remains by species and element of the sieved remains at Reinach G2, vert- vertebra, ant/post- anterior/posterior, indet.-indeterminate

Sus	n.	B3263	n.	B03263s
feotal-neonatal	6	37.50%	11	47.83%
less than sub adult	5	31.25%	7	30.43%
juvenile	1	6.25%	2	8.70%
subadult	0	0.00%	1	4.35%
not adult	3	18.75%	1	4.35%
adult	1	6.25%	0	0.00%
adult or senile	0	0.00%	1	4.35%
Total	16		23	

Table 3.6-3; The age profile from the sieved material compared to the hand-collected remains

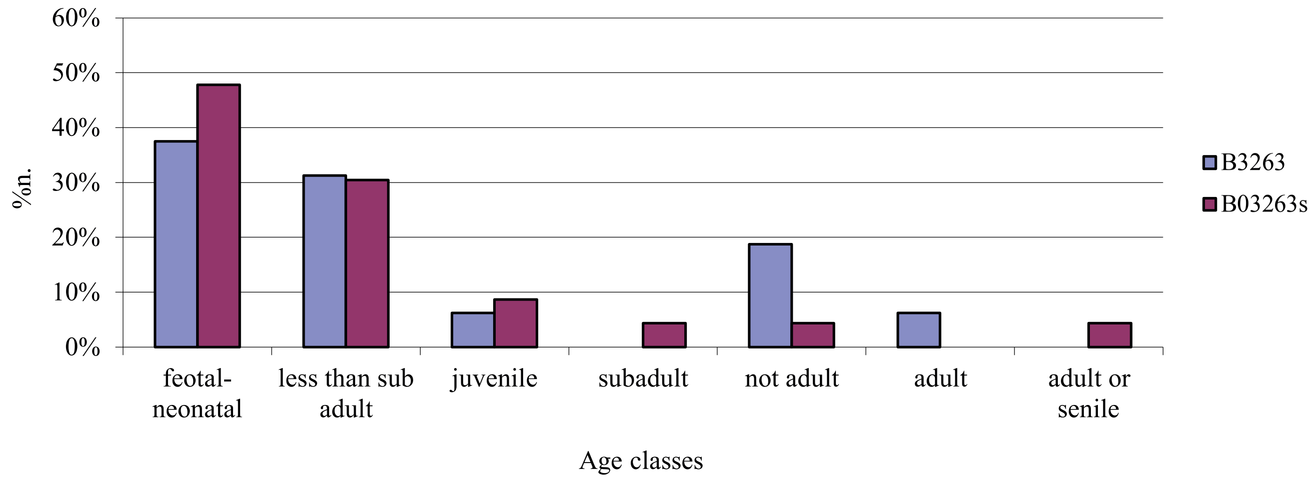

Fig. 3.6-4; The age profile from the sieved material compared to the hand-collected remains

Species	Jakobli-Haus 4-6thC n.	Mass g.	5th-6th C n.	Mass g.
Bos taurus	127	6946.40	259	15196.50
Sus domesticus	197	2133.80	315	3809.10
Ovis/Capra	20	227.80	45	553.50
Capra hircus	2	60.40	3	92.30
Ovis aries	4	79.00	3	52.40
Equus Spec			9	360.20
Canis familiaris			3	16.30
Felis domesticus				61.00
Gallus domesticus	67	90.90	34	8.20
Anser domesticus			2	2.60
Columba domestica			3	
Total Domestic	**411**	**9398.90**	**670**	**20007.40**
Canis lupus				
Capreolus capreolus				
Cervus elaphus	6	200.10	8	549.60
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.	5	4.10	3	7.30
Sciurus vulgaris				
Sus scrofa	2	71.10	2	94.00
Talpa europaeus				
Ursus arctos				
Anas sp.	1	0.90		
Corvus c.c./cornix	2	0.20	1	0.70
Corvus corone	1	0.10		
Corvus spec.	9	1.30		
Garrulus glandarius	1	0.20		
Strix aluco				
Buteo Buteo				
Perdix perdix	2	0.80	1	0.90
Amphibia [1]	1	0.20		
Pisces [2]	3	0.40	2	3.10
Rodentia [3]				
Homo sapiens				
Total Wild	**29**	**278.80**	**15**	**652.50**
Total Identified	**440**	**9677.70**	**685**	**20659.90**
Large ruminents			8	94.10
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore				
Aves Passeriformes	9	0.60		
Total Domestic/Wild	**9**	**0.60**	**8**	**94.10**
Indeterminate	44	24.00	53	34.30
< Lepus	12	2.10		
Bos/Cervus sized	55	365.80	153	1501.20
Ovis sized	99	168.20	75	169.50
Aves	9	3.90	5	5.30
Total Unidentified	**219**	**564.00**	**286**	**1710.30**
% Identified	**66.77%**	**94.49%**	**70.55%**	**92.35%**
% Unidentified	**33.23%**	**5.51%**	**29.45%**	**7.65%**

Table 4-1a; Species representation in number and weight of the faunal remains from Kaiseraugst split by area and period

[1] -see table 7.4-1; [2]- see table 7.5-1; [3]- see table 7.2-1.

Species	Jakobli-Haus 6th C n.	Mass g.	Beg. 7th C n.	Mass g.
Bos taurus	414	25576.00	282	10488.40
Sus domesticus	510	9345.80	250	3865.80
Ovis/Capra	208	2987.40	135	1772.90
Capra hircus	10	251.70	11	249.30
Ovis aries	33	1075.40	13	383.00
Equus Spec	12	1314.90	7	495.50
Canis familiaris	1	3.10	3	20.90
Felis domesticus	1	7.70		
Gallus domesticus	33	71.30	10	16.10
Anser domesticus	4	10.40		
Columba domestica	1	0.60		
Total Domestic	**1184**	**39317.20**	**687**	**16659.60**
Canis lupus				
Capreolus capreolus	1	3.40		
Cervus elaphus	15	1127.30	4	224.70
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.			1	0.50
Sciurus vulgaris				
Sus scrofa	1	27.50		
Talpa europaeus				
Ursus arctos				
Anas sp.	1	1.00		
Corvus c.c./cornix				
Corvus corone				
Corvus spec.				
Garrulus glandarius	1	0.20		
Strix aluco				
Buteo Buteo	1	1.10		
Perdix perdix				
Amphibia [1]				
Pisces [2]	1	0.60		
Rodentia [3]				
Homo sapiens				
Total Wild	**20**	**1160.50**	**5**	**225.20**
Total Identified	**1204**	**40477.70**	**692**	**16884.80**
Large ruminents			2	21.00
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore				
Aves Passeriformes				
Total Domestic/Wild	**0**	**0.00**	**2**	**21.00**
Indeterminate	180	101.60	93	63.80
< Lepus			1	0.20
Bos/Cervus sized	194	2085.30	142	980.30
Ovis sized	150	352.30	123	326.10
Aves	6	7.50	2	0.70
Total Unidentified	**530**	**2546.70**	**361**	**1371.10**
% Identified	**69.43%**	**94.08%**	**65.72%**	**92.49%**
% Unidentified	**30.57%**	**5.92%**	**34.28%**	**7.51%**

Table 4-1a contd.

Species	Gasthof Adler Mid 4th C n.	Mass g.	5th-6th C n.	Mass g.
Bos taurus	316	13201.60	451	23105.50
Sus domesticus	226	3043.00	524	7818.80
Ovis/Capra	68	854.90	126	1986.90
Capra hircus	2	34.10	8	350.70
Ovis aries	12	314.90	33	961.20
Equus Spec	9	695.30	13	576.40
Canis familiaris			4	30.50
Felis domesticus			1	3.30
Gallus domesticus	11	17.40	21	36.40
Anser domesticus	1	6.90		
Columba domestica			1	0.70
Total Domestic	**631**	**17819.10**	**1141**	**33558.50**
Canis lupus				
Capreolus capreolus	1	24.20	7	127.40
Cervus elaphus	3	173.00	13	687.30
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.				
Sciurus vulgaris				
Sus scrofa	1	32.10	1	29.30
Talpa europaeus				
Ursus arctos				
Anas sp.				
Corvus c.c./cornix				
Corvus corone				
Corvus spec.				
Garrulus glandarius				
Strix aluco				
Buteo Buteo				
Perdix perdix				
Amphibia [1]				
Pisces [2]				
Rodentia [3]				
Homo sapiens			1	3.60
Total Wild	**5**	**229.30**	**21**	**844.00**
Total Identified	**636**	**18048.40**	**1162**	**34402.50**
Large ruminents	116	1535.00	43	680.30
Small ruminents	12	39.80	5	19.90
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore				
Aves Passeriformes				
Total Domestic/Wild	**128**	**1574.80**	**48**	**700.20**
Indeterminate	208	202.20	105	108.20
< Lepus			1	0.30
Bos/Cervus sized	203	1452.20	239	2651.10
Ovis sized	85	161.70	167	469.90
Aves			1	0.50
Total Unidentified	**496**	**1816.10**	**513**	**3230.00**
% Identified	**56.18%**	**90.86%**	**69.37%**	**91.42%**
% Unidentified	**43.82%**	**9.14%**	**30.63%**	**8.58%**

Table 4-1a contd.

Species	Gasthof Adler 12thC n.	Mass g.	Fabrikstrasse 12thC n.	Mass g.
Bos taurus	44	1332.20	13	358.90
Sus domesticus	73	989.10	16	107.80
Ovis/Capra	17	226.10	34	214.60
Capra hircus	1	20.30		
Ovis aries	2	32.10	11	74.70
Equus Spec	2	324.10		
Canis familiaris	1	11.40		
Felis domesticus			1	0.10
Gallus domesticus	2	3.40	2	0.60
Anser domesticus	1	0.60		
Columba domestica	1	0.40		
Total Domestic	**141**	**2887.30**	**66**	**682.00**
Canis lupus				
Capreolus capreolus				
Cervus elaphus	1	25.60		
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.				
Sciurus vulgaris				
Sus scrofa				
Talpa europaeus				
Ursus arctos				
Anas sp.	1	0.70		
Corvus c.c./cornix				
Corvus corone				
Corvus spec.				
Garrulus glandarius				
Strix aluco				
Buteo Buteo				
Perdix perdix				
Amphibia [1]				
Pisces [2]				
Rodentia [3]				
Homo sapiens				
Total Wild	**2**	**26.30**	**0**	**0.00**
Total Identified	**143**	**2913.60**	**66**	**682.00**
Large ruminents				
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore				
Aves Passeriformes				
Total Domestic/Wild	**0**	**0.00**	**0**	**0.00**
Indeterminate	14	13.60		
< Lepus			1	0.20
Bos/Cervus sized	35	443.90	3	10.30
Ovis sized	25	77.10	33	57.40
Aves			2	0.60
Total Unidentified	**74**	**534.60**	**39**	**68.50**
% Identified	**65.90%**	**84.50%**	**62.86%**	**90.87%**
% Unidentified	**34.10%**	**15.50%**	**37.14%**	**9.13%**

Table 4-1a contd.

	Jakobli-Haus					
	4-6thC				5-late 6thC	
Species	BN n.	BN g.	Gruben n.	Gruben g.	ZSH n.	ZSH g.
Bos taurus	73	3483.70	58	3605.40	259	15196.50
Sus domesticus	111	1290.30	97	949.70	315	3809.10
Ovis/Capra	7	42.00	21	250.40	45	553.50
Capra hircus			3	74.00	3	92.30
Ovis aries	1	20.60	4	73.50	3	52.40
Equus Spec					9	360.20
Canis familiaris					3	16.30
Felis domesticus						61.00
Gallus domesticus	56	72.00	13	20.30	34	8.20
Anser domesticus					2	2.60
Columba domestica					3	
Total Domestic	**247**	**4888.00**	**189**	**4825.80**	**670**	**20007.40**
Canis lupus						
Capreolus capreolus						
Cervus elaphus			7	235.40	8	549.60
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	5	4.10			3	7.30
Sciurus vulgaris						
Sus scrofa			2	71.10	2	94.00
Talpa europaeus						
Ursus arctos						
Anas sp.	1	0.90				
Corvus c.c./cornix	2	0.20			1	0.70
Corvus corone	1	0.10				
Corvus spec.	9	1.30				
Passeriformes	7	0.40				
Picoides sp.	1	0.10				
Turdidae	1	0.10				
Garrulus glandarius	1	0.20			1	0.90
Strix aluco						
Buteo Buteo					2	3.10
Perdix perdix	2	0.80				
Amphibia [1]	1	0.20				
Pisces [2]	1	0.30			15	652.50
Rodentia [3]					685	20659.90
Homo sapiens					8	94.10
Total Wild	**30**	**8.2**	**9**	**306.5**	**17**	**655.6**
Total Id	**277**	**4896.2**	**198**	**5132.3**	**687**	**20663**
Large ruminents						
Small ruminents						
Canis lupus/Canis familiaris					8	94.10
Vulpes v./Canis f.					53	34.30
Small carnivore						
Total Domestic/Wild	**0**	**0.00**	**0**	**0.00**	**153**	**1501.20**
Indet.	35	12.40	8	11.60	75	169.50
< Lepus	12	2.10			5	5.30
Bos/Cervus sized	35	242.30	31	223.80	286	1710.30
Ovis sized	80	129.80	26	54.10	1	0.92
Aves	9	3.90	1	1.10	0	0.08
Total Unidentified	**171**	**390.50**	**66**	**290.60**	**367.00**	**1886.10**
% Identified	**61.83%**	**92.61%**	**75.00%**	**94.64%**	**65.18%**	**91.64%**
% Unidentified	**38.17%**	**7.39%**	**25.00%**	**5.36%**	**34.82%**	**8.36%**

Table 4-1b; Species representation in number and weight of the faunal remains from Kaiseraugst split by structure, BN -Bodenniveau,; UH- Untere Humusbereich; OH- Oberer humusbereich; ZSH- Ziegelschutthorizont; Ob- Oberer; Un- Unterer
1 -see table 7.4-1; 2- see table 7.5-1; 3- see table 7.2-1.

Species	Jakobli-Haus				Gasthof Adler	
	6thC		7thC		Mid 4thC	
	UH n.	UH g.	OH n.	OH g.	F2/3 n.	F2/3 g.
Bos taurus	402	25154.40	270	10100.60	103	4617.60
Sus domesticus	472	8924.10	237	3695.20	119	1801.70
Ovis/Capra	203	2869.80	126	1703.80	41	628.60
Capra hircus	4	86.30	10	244.40		
Ovis aries	31	1024.20	11	366.50	33	382.30
Equus Spec	12	1314.90	7	495.50		
Canis familiaris	1	3.10	3	20.90		
Felis domesticus	1	7.70				
Gallus domesticus	28	58.90	8	10.50	8	11.50
Anser domesticus	2	6.40			1	6.90
Columba domestica	1	0.60				
Total Domestic	**1122**	**38339.90**	**651**	**16026.50**	**272**	**7066.30**
Canis lupus						
Capreolus capreolus					1	24.20
Cervus elaphus	1	3.40	8	405.70		
Mustela erminea/nivalis	27	2159.30				
Oryctolagos cunic./Lepus europ.			1	0.50		
Sciurus vulgaris						
Sus scrofa	1	27.50				
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Passeriformes						
Picoides sp.						
Turdidae						
Garrulus glandarius						
Strix aluco						
Buteo Buteo	1	1.10				
Perdix perdix						
Amphibia [1]						
Pisces [2]	1	0.60				
Rodentia [3]						
Homo sapiens						
Total Wild	**30**	**2191.3**	**9**	**406.2**	**1**	**24.2**
Total Id	**1152**	**40531.2**	**660**	**16432.7**	**273**	**7090.5**
Large ruminents			2	21.00	7	112.90
Small ruminents					5	17.20
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0.00**	**2**	**21.00**	**12**	**130.10**
Indet.	174	96.00	87	57.10	22	22.50
< Lepus			1	0.20		
Bos/Cervus sized	185	2025.20	130	917.10	44	414.50
Ovis sized	142	319.00	115	313.00	36	59.00
Aves	5	6.30	2	0.70		
Total Unidentified	**506**	**2446.50**	**335**	**1288.10**	**102**	**496.00**
% Identified	**69.48%**	**94.31%**	**66.33%**	**92.73%**	**72.80%**	**93.46%**
% Unidentified	**30.52%**	**5.69%**	**33.67%**	**7.27%**	**27.20%**	**6.54%**

Table 4-1b; Contd

Species	Gasthof Adler					
	Mid 4thC		5-late 6thC			
	F3/2 n.	F3/2 g.	F2/4 n.	F2/4 g.	F17/2Ob n.	F17/2Ob g.
Bos taurus	121	4171.10	150	7531.50	74	3665.50
Sus domesticus	65	667.10	190	2929.70	96	1323.60
Ovis/Capra	16	120.30	55	981.40	24	213.20
Capra hircus	1	22.10	3	96.40	2	47.70
Ovis aries	2	37.00	16	580.00	4	45.50
Equus Spec	7	612.20	7	316.50	1	10.70
Canis familiaris			2	11.00		
Felis domesticus			1	3.30		
Gallus domesticus			8	18.10	6	4.70
Anser domesticus						
Columba domestica						
Total Domestic	**209**	**5570.70**	**413**	**11791.50**	**201**	**5217.70**
Canis lupus						
Capreolus capreolus			5	112.90	2	14.50
Cervus elaphus			9	701.50	1	143.60
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Passeriformes						
Picoides sp.						
Turdidae						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]						
Homo sapiens						
Total Wild	**0**	**0**	**14**	**814.4**	**3**	**158.1**
Total Id	**209**	**5570.7**	**427**	**12605.9**	**204**	**5375.8**
Large ruminents	109	1422.10	11	212.20	16.00	198.70
Small ruminents	7	22.60	3	10.80		
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**116**	**1444.70**	**14**	**223.00**	**16**	**198.70**
Indet.	179	173.40	26	17.20	26.00	30.10
< Lepus						
Bos/Cervus sized	94	424.10	68	718.80	28	315.80
Ovis sized	42	82.80	67	184.30	34	95.40
Aves						
Total Unidentified	**315**	**680.30**	**161**	**920.30**	**88**	**441.30**
% Identified	**39.89%**	**89.12%**	**72.62%**	**93.20%**	**69.86%**	**92.41%**
% Unidentified	**60.11%**	**10.88%**	**27.38%**	**6.80%**	**30.14%**	**7.59%**

Table 4-1b; Contd

Species	Gasthof Adler	
	5-late 6thC	
	F3/5 n.	F3/5 g.
Bos taurus	54	2232.50
Sus domesticus	70	1099.30
Ovis/Capra	17	162.10
Capra hircus		
Ovis aries	3	57.70
Equus Spec	3	121.90
Canis familiaris	1	1.50
Felis domesticus		
Gallus domesticus	2	4.80
Anser domesticus	1	0.70
Columba domestica		
Total Domestic	**148**	**3622.80**
Canis lupus		
Capreolus capreolus		
Cervus elaphus		
Mustela erminea/nivalis		
Oryctolagos cunic./Lepus europ.		
Sciurus vulgaris		
Sus scrofa	1	29.30
Talpa europaeus		
Ursus arctos		
Anas sp.		
Corvus c.c./cornix		
Corvus corone		
Corvus spec.		
Passeriformes		
Picoides sp.		
Turdidae		
Garrulus glandarius		
Strix aluco		
Buteo Buteo		
Perdix perdix		
Amphibia [1]		
Pisces [2]		
Rodentia [3]		
Homo sapiens	1	3.60
Total Wild	**1**	**29.3**
Total Id	**149**	**3652.1**
Large ruminents	5	79.10
Small ruminents	2	9.10
Canis lupus/Canis familiaris		
Vulpes v./Canis f.		
Small carnivore		
Total Domestic/Wild	**7**	**88.20**
Indet.		
< Lepus		
Bos/Cervus sized	35	272.20
Ovis sized	24	62.60
Aves	1	0.50
Total Unidentified	**60**	**335.30**
% Identified	**71.29%**	**91.59%**
% Unidentified	**28.71%**	**8.41%**

Table 4-1b; Contd

Species	Alte Brauerei (AB) 7thC n.	Mass g.	8thC n.	Mass g.	Gemeindezentrum Late 6thC n.**	Mass g.**
Bos taurus	44	1000.5	40	1224.7	54	1886
Sus domesticus	192	795	50	345.2	135	1119.5
Ovis/Capra	49	191.5	40	167.9	19	108.7
Capra hircus	9	91.8	2	16.3		
Ovis aries			10	66.1	5	58.7
Equus Spec	2	45.9			6	188.9
Canis familiaris	1	32				
Felis domesticus						
Gallus domesticus	4	1.8	4	1.5		
Anser domesticus	1	0.8				
Columba domestica						
Total Domestic	**293**	**2067.5**	**134**	**1739.3**	**214**	**3303.1**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	2	56.7	1	1.2		
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa	4	25				
Talpa europaeus	2	0.2				
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]	2	0.2	2	>0.1		
Pisces [2]						
Rodentia [3]						
Total Wild	**8**	**81.90**	**1**	**1.20**	**0**	**0.00**
Total Identified	**301**	**2149.4**	**135**	**1740.5**	**214**	**3303.1**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indeterminate	614	410.4	47	17.7	229	201.1
< Lepus						
Bos/Cervus sized	70	246.4	50	218.2	87	955.3
Ovis sized	130	165.4	86	85.4	50	125
Aves	4	0.4				
Total Unidentified	**818**	**822.6**	**183**	**321.3**	**366**	**1281.4**
% Identified	**26.90%**	**72.32%**	**42.45%**	**84.42%**	**36.90%**	**72.05%**
% Unidentified	**73.10%**	**27.68%**	**57.55%**	**15.58%**	**63.10%**	**27.95%**

Table 4-2a; Species representation in number and weight from Reinach, split by area and period

**- excluding sieved remains; [1] -see table 7.4-1; [2]- see table 7.5-1; [3]- see table 7.2-1.

Species	Gemeindezentrum (GMZ) contd. Late 7thC n.	Mass g.	8thC n.	Mass g.	9thC n.	Mass g.
Bos taurus	55	2005.7	60	1448.3	137	2802
Sus domesticus	61	512.6	57	471.4	116	984.2
Ovis/Capra	15	95.9	45	279.3	69	388.1
Capra hircus			2	39.7	3	14.1
Ovis aries	2	17.4	10	106.8	8	95.3
Equus Spec	6	248.5	5	94.2	11	394.9
Canis familiaris					2	47.9
Felis domesticus	1	5.9			1	1.1
Gallus domesticus	2	1.4	13	20.9	25	22.5
Anser domesticus			1	4.5		
Columba domestica						
Total Domestic	**140**	**2870**	**181**	**2318.6**	**361**	**4640.7**
Canis lupus						
Capreolus capreolus	1	2.3	1	6.5	2	2.5
Cervus elaphus	2	26.4	3	45.4	6	94.2
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]						
Total Wild	**3**	**28.70**	**4**	**51.90**	**8**	**96.70**
Total Identified	**143**	**2898.7**	**185**	**2370.5**	**369**	**4737.4**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indeterminate	3	19.6	8	6.3	191	143.5
< Lepus					10	3.6
Bos/Cervus sized	64	312.2	48	322.9	137	972.6
Ovis sized	70	95.6	98	131.6	238	446.3
Aves	1	0.1	1	0.3	5	2.2
Total Unidentified	**138**	**427.5**	**155**	**461.1**	**581**	**1568.2**
% Identified	**50.89%**	**87.15%**	**54.41%**	**83.72%**	**38.84%**	**75.13%**
% Unidentified	**49.11%**	**12.85%**	**45.59%**	**16.28%**	**61.16%**	**24.87%**

Table 4-2a; contd

Species	GMZ (contd) 10thC n.	Mass g.	11thC n.	Mass g.	12thC n.	Mass g.
Bos taurus	50	1889.3	24	629.9	53	806.6
Sus domesticus	38	327.2	43	229.1	26	203.2
Ovis/Capra	17	136.5	15	47.4	16	43.9
Capra hircus						
Ovis aries	4	39.3	2	5.7	3	8.3
Equus Spec	9	294.2	1	12.2		
Canis familiaris						
Felis domesticus						
Gallus domesticus	3	7.8	3	2.1	9	7.3
Anser domesticus					2	3.1
Columba domestica						
Total Domestic	**117**	**2655**	**86**	**920.7**	**106**	**1064.1**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	1	1	1	4		
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.			1	0.9		
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix					2	0.6
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]						
Total Wild	**1**	**1.00**	**2**	**4.90**	**2**	**0.60**
Total Identified	**118**	**2656**	**88**	**925.6**	**108**	**1064.7**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indeterminate	100	66.1	1	0.3	4	3
< Lepus						
Bos/Cervus sized	70	360.2	20	76.3	19	100.2
Ovis sized	41	89.1	68	82.2	57	68.5
Aves	1	0.3				
Total Unidentified	**212**	**515.7**	**89**	**158.8**	**80**	**171.7**
% Identified	**35.76%**	**83.74%**	**49.72%**	**85.36%**	**57.45%**	**86.11%**
% Unidentified	**64.24%**	**16.26%**	**50.28%**	**14.64%**	**42.55%**	**13.89%**

Table 4-2a; contd

Species	Stadthof Early 7thC n.	Mass g.	Late 7thC n.	Mass g.	9thC n.	Mass g.
Bos taurus	29	545.4	126	3663.6	47	832.5
Sus domesticus	35	277.7	82	1042	50	685.2
Ovis/Capra	20	147.6	72	350.4	26	137.6
Capra hircus	5	52.3	3	19.3	1	2.3
Ovis aries	5	44.3	5	80.1	4	11
Equus Spec	1	19.2			7	792.6
Canis familiaris						
Felis domesticus			6	14.3		
Gallus domesticus	5	5.8	10	9.2		
Anser domesticus	2	3.4				
Columba domestica						
Total Domestic	**92**	**999.1**	**296**	**5079.5**	**130**	**2447.9**
Canis lupus						
Capreolus capreolus						
Cervus elaphus			2	54.1	4	65.9
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus	1	0.1				
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo			2	1.9		
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]	1	0.2				
Total Wild	**1**	**0.10**	**4**	**56.00**	**4**	**65.90**
Total Identified	**93**	**999.2**	**300**	**5135.5**	**134**	**2513.8**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indet.	4	1.6	34	59		
< Lepus	1	0.4				
Bos/Cervus sized	21	133.6	28	189.2	13	94.5
Ovis sized	43	122.6	20	48	25	74.2
Aves	2	0.9	1	0.1		
Total Unidentified	**71**	**259.1**	**83**	**296.3**	**38**	**168.7**
% Identified	**56.71%**	**79.41%**	**78.33%**	**94.55%**	**77.91%**	**93.71%**
% Unidentified	**43.29%**	**20.59%**	**21.67%**	**5.45%**	**22.09%**	**6.29%**

Table 4-2a contd

Species	Stadthof (contd.) 11thC n.	Mass g.	12thC n.	Mass g.
Bos taurus	97	1994.3	165	5109.8
Sus domesticus	53	587.6	98	950.7
Ovis/Capra	28	272.4	82	441
Capra hircus	6	152.1	6	31.4
Ovis aries	1	1.5	10	46.1
Equus Spec	2	181.6	6	578.6
Canis familiaris			6	46.5
Felis domesticus				
Gallus domesticus	6	4.7	12	14.9
Anser domesticus	2	2.6	6	8.8
Columba domestica				
Total Domestic	**188**	**3043.2**	**375**	**7150.3**
Canis lupus				
Capreolus capreolus				
Cervus elaphus	1	46.6		
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.				
Sciurus vulgaris				
Sus scrofa				
Talpa europaeus				
Ursus arctos				
Anas sp.				
Corvus c.c./cornix				
Corvus corone				
Corvus spec.			1	0.3
Garrulus glandarius				
Strix aluco				
Buteo Buteo				
Perdix perdix				
Amphibia [1]	5	1.2	2	0.2
Pisces [2]				
Rodentia [3]				
Total Wild	**1**	**46.60**	**1**	**0.30**
Total Identified	**189**	**3089.8**	**376**	**7150.6**
Cervid/Bovid				
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.			1	0.9
Small carnivore			1	0.2
Total Domestic/Wild	**0**	**0**	**2**	**1.1**
Indet.	12	25.9	8	25.1
< Lepus			2	2
Bos/Cervus sized	42	213.7	52	364.7
Ovis sized	60	159.2	112	335
Aves	3	2.8	5	3.7
Total Unidentified	**117**	**401.6**	**179**	**730.5**
% Identified	**61.76%**	**88.50%**	**67.75%**	**90.73%**
% Unidentified	**38.24%**	**11.50%**	**32.25%**	**9.27%**

Table 4-2a contd

Species	Gemeindezentrum (GMZ)			
	6thC		7thC	
	G2**n.	G2** g.	G4*n.	G4* g.
Bos taurus	42	1699.2	36	975.5
Sus domesticus	184	975.8	41	353.9
Ovis/Capra	14	87	8	63.7
Capra hircus				
Ovis aries	4	48.7		
Equus Spec	6	188.9	2	117.9
Canis familiaris				
Felis domesticus			1	5.9
Gallus domesticus	16	8.5	1	0.7
Anser domesticus				
Columba domestica				
Total Domestic	**262**	**2959.4**	**89**	**1517.6**
Canis lupus				
Capreolus capreolus			1	2.3
Cervus elaphus	1	38.1	1	18.9
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.				
Sciurus vulgaris				
Sus scrofa				
Talpa europaeus				
Ursus arctos				
Anas sp.				
Corvus c.c./cornix				
Corvus corone				
Corvus spec.				
Garrulus glandarius				
Strix aluco				
Buteo Buteo				
Perdix perdix				
Amphibia [1]				
Pisces [2]				
Rodentia [3]				
Total Wild	**1**	**38.1**	**2**	**21.2**
Total Id	**263**	**2997.5**	**91**	**1538.8**
Cervid/Bovid				
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore				
Total Domestic/Wild	**0**	**0**	**0**	**0**
Indet.	3770	472	2	15.1
< Lepus				
Bos/Cervus sized	81	921.9	39	219.6
Ovis sized	85	112.5	35	57.7
Aves	7	0.9		
Total Unidentified	**3943**	**1507.3**	**76**	**292.4**
% Identified	**6.25%**	**66.54%**	**54.49%**	**84.03%**
% Unidentified	**93.75%**	**33.46%**	**45.51%**	**15.97%**

Table 4-2b; Species representation in both number and weight from Reinach split by date and excavation area and the structures within it

[1] -see table 7.4-1; [2]- see table 7.5-1; [3]- see table 7.2-1.

Species	GMZ contd.					
	9thC		9thC		9thC	
	G11*n.	G11* g.	G13*n.	G13* g.	G12*n.	G12* g.
Bos taurus	41	1084	35	604.4	47	716.5
Sus domesticus	22	265.4	42	312.2	34	242.6
Ovis/Capra	17	125	20	141.3	26	103.2
Capra hircus	2	33.4			3	13.9
Ovis aries	2	33.4	1	22.8	5	39.1
Equus Spec	7	184.3	3	188.8	1	21.8
Canis familiaris	1	3.8			1	44.1
Felis domesticus					1	1.1
Gallus domesticus	7	9.5	4	4.2	14	7.3
Anser domesticus						
Columba domestica						
Total Domestic	**95**	**1672**	**104**	**1250.9**	**124**	**1136.6**
Canis lupus						
Capreolus capreolus			1	1.9		
Cervus elaphus	4	65.6	1	6.1		
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]						
Total Wild	**4**	**65.6**	**2**	**8**	**0**	**0**
Total Id	**99**	**1737.6**	**106**	**1258.9**	**124**	**1136.6**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indet.	48	28.3	100	84.9	34	20.7
< Lepus			4	1.3	6	2.3
Bos/Cervus sized	40	293.9	59	390.6	26	172.2
Ovis sized	36	90.7	104	169	73	134.5
Aves	3	2			1	0
Total Unidentified	**127**	**414.9**	**267**	**645.8**	**140**	**329.7**
% Identified	**43.81%**	**80.72%**	**28.42%**	**66.09%**	**46.97%**	**77.51%**
% Unidentified	**56.19%**	**19.28%**	**71.58%**	**33.91%**	**53.03%**	**22.49%**

Table 4-2b; Contd

	Stadthof					
	Late 7thC		9thC		11thC	
Species	GC n.	GC g.	GD* n.	GD* g.	GL n.	GL g.
Bos taurus	95	2938.7	47	832.5	79	1480.2
Sus domesticus	61	680.9	50	685.2	48	558.9
Ovis/Capra	62	289.1	26	137.6	13	61
Capra hircus	2	15.8	1	2.3		
Ovis aries	4	76.1	4	23.5		
Equus Spec			7	792.6	1	143.3
Canis familiaris						
Felis domesticus	6	14.3				
Gallus domesticus	4	3.5			4	3.5
Anser domesticus						
Columba domestica						
Total Domestic	**228**	**3926.5**	**130**	**2447.9**	**145**	**2246.9**
Canis lupus						
Capreolus capreolus						
Cervus elaphus			4	65.9	1	46.6
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.						
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus						
Ursus arctos						
Anas sp.						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo	2	1.9				
Perdix perdix						
Amphibia [1]					5	1.2
Pisces [2]						
Rodentia [3]						
Total Wild	**2**	**1.9**	**4**	**65.9**	**6**	**47.8**
Total Id	**230**	**3928.4**	**134**	**2513.8**	**151**	**2294.7**
Cervid/Bovid						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0**	**0**	**0**	**0**	**0**
Indet.	29	35.4			10	20.3
< Lepus	1	0.3				
Bos/Cervus sized	11	68.9	13	94.5	32	182.3
Ovis sized	6	20.2	25	74.2	46	125.5
Aves	1	0.1			2	1.3
Total Unidentified	**48**	**124.9**	**38**	**168.7**	**90**	**329.4**
% Identified	**82.73%**	**96.92%**	**77.91%**	**93.71%**	**62.66%**	**87.45%**
% Unidentified	**17.27%**	**3.08%**	**22.09%**	**6.29%**	**37.34%**	**12.55%**

Table 4-2b; Contd

Species	Stadthof (contd)			
	12thC.		12thC.	
	GH n.	GH g.	GM* n.	GM* g.
Bos taurus	59	2264.9	33	1568.6
Sus domesticus	42	404	39	424.7
Ovis/Capra	45	229.8	27	157.7
Capra hircus	4	16.2	1	5.2
Ovis aries	3	7.4	4	29.6
Equus Spec	2	322.9	3	204.9
Canis familiaris	3	6.9		
Felis domesticus				
Gallus domesticus	8	8	3	5.3
Anser domesticus	4	5.5		
Columba domestica				
Total Domestic	**163**	**3242**	**105**	**2361.2**
Canis lupus				
Capreolus capreolus				
Cervus elaphus				
Mustela erminea/nivalis				
Oryctolagos cunic./Lepus europ.				
Sciurus vulgaris				
Sus scrofa				
Talpa europaeus				
Ursus arctos				
Anas sp.				
Corvus c.c./cornix				
Corvus corone				
Corvus spec.	1	0.3		
Garrulus glandarius				
Strix aluco				
Buteo Buteo				
Perdix perdix				
Amphibia [1]				
Pisces [2]				
Rodentia [3]				
Total Wild	**1**	**0.3**	**0**	**0**
Total Id	**164**	**3242.3**	**105**	**2361.2**
Cervid/Bovid				
Small ruminents				
Canis lupus/Canis familiaris				
Vulpes v./Canis f.				
Small carnivore	1	0.2		
Total Domestic/Wild	**1**	**0.2**	**0**	**0**
Indet.	3	3.8	5	21.3
< Lepus	1	0.2	1	1.8
Bos/Cervus sized	21	146.6	15	109.3
Ovis sized	51	154.3	38	142.8
Aves	1	0.1	3	2.5
Total Unidentified	**77**	**305**	**62**	**277.7**
% Identified	**68.05%**	**91.40%**	**62.87%**	**89.48%**
% Unidentified	**31.95%**	**8.60%**	**37.13%**	**10.52%**

Table 4-2b; Contd

Species	Lausen Late 6thC n.	Mass g.	Late 7thC n.	Mass g.	8-9thC n.	Mass g.
Bos taurus	147	6541.10	25	953.40	12	377.40
Sus domesticus	135	1209.60	19	87.60	34	208.70
Ovis/Capra	87	681.00	28	59.80	22	153.40
Capra hircus	7	183.60	4	7.10	2	50.90
Ovis aries	6	168.60	1	1.00		
Equus Spec	13	611.70	5	517.90		
Canis familiaris	2	18.70				
Felis domesticus						
Gallus domesticus	2	4.40	7	4.00		
Anser domesticus						
Columba domestica						
Total Domestic	**386**	**9066.50**	**84**	**1622.70**	**68**	**739.50**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	4	100.80			1	4.60
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	1	1.30				
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus	1	0.20				
Ursus arctos						
Vulpes vulpes						
Anas sp.			1	0.80		
Cicconia ciconia						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.			1	0.60		
Garrulus glandarius						
Strix aluco	1	0.40				
Buteo Buteo						
Perdix perdix						
Amphibia [1]	3	0.20	2	0.20	3	0.60
Pisces [2]						
Rodentia [3]	1	0.10				
Homo sapiens						
Total Wild	**7**	**102.70**	**2**	**1.40**	**1**	**4.60**
Total Identified	**393**	**9169.20**	**86**	**1624.10**	**69**	**744.10**
Large ruminents	3	8.70				
Small ruminents						
Canis lupus/Canis familiaris	1	8.60				
Vulpes v./Canis f.	2	1.20				
Small carnivore						
Total Domestic/Wild	**6**	**18.50**	**0**	**0.00**	**0**	**0.00**
Indeterminate	65	22.40	82	9.70	17	7.30
< Lepus	2	0.30			34	208.70
Bos/Cervus sized	82	339.30	24	69.20	11	41.00
Ovis sized	203	203.70	88	58.90	61	52.50
Aves	3	2.10				
Total Unidentified	**355**	**567.80**	**194**	**137.80**	**123**	**309.50**
% Identified	**52.54%**	**94.17%**	**30.71%**	**92.18%**	**35.94%**	**70.62%**
% Unidentified	**47.46%**	**5.83%**	**69.29%**	**7.82%**	**64.06%**	**29.38%**

Table 4-3a; Species representation in both number and weight from Lausen excavation, split by period; [1] -see table 7.4-1; [2]- see table 7.5-1; [3]- see table 7.2-1.

Species	Lausen (contd) 9thC n.	Mass g.	10thC n.	Mass g.	Early 11thC n.	Mass g.
Bos taurus	434	10900.90	160	2802.10	46	1031.40
Sus domesticus	980	7995.30	532	3648.20	133	703.80
Ovis/Capra	507	2911.70	199	723.80	76	332.10
Capra hircus	8	74.80	5	53.80	2	34.80
Ovis aries	17	346.60	6	95.00	4	41.50
Equus Spec	30	1154.90	70	7870.50	6	244.10
Canis familiaris	6	11.90	1	2.70	1	0.60
Felis domesticus	1	1.20	1	1.40		
Gallus domesticus	44	46.50	35	26.50	3	1.00
Anser domesticus	12	33.40	16	32.90	1	2.20
Columba domestica						
Total Domestic	**2014**	**23055.80**	**1014**	**15108.10**	**266**	**2315.20**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	4	39.70	2	25.80	3	12.20
Mustela erminea/nivalis					2	0.10
Oryctolagos cunic./Lepus europ.	3	11.60			2	1.20
Sciurus vulgaris						
Sus scrofa			2	21.00		
Talpa europaeus						
Ursus arctos						
Vulpes vulpes	1	7.80				
Anas sp.			1	0.60		
Cicconia ciconia	7	10.00				
Corvus c.c./cornix	1	0.30			1	2.10
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]	5	0.60	3	0.30	4	0.10
Pisces [2]	1	>0.1				
Rodentia [3]					2	>0.1
Homo sapiens	1	4.90				
Total Wild	**16**	**69.40**	**5**	**47.40**	**8**	**15.60**
Total Identified	**2030**	**23125.20**	**1019**	**15155.50**	**274**	**2330.80**
Large ruminents	1	5.70	3	21.80	1	0.40
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**1**	**5.70**	**3**	**21.80**	**1**	**0.40**
Indeterminate	757	219.60	477	134.10	169	20.30
< Lepus	10	72.80	6	1.40	2	0.10
Bos/Cervus sized	1446	1721.70	343	778.50	101	228.10
Ovis sized	365	1763.00	740	673.60	246	188.50
Aves	34	17.90	7	3.90	9	2.00
Total Unidentified	**2612**	**3795.00**	**1573**	**1591.50**	**527**	**439.00**
% Identified	**43.73%**	**85.90%**	**39.31%**	**90.50%**	**34.21%**	**84.15%**
% Unidentified	**56.27%**	**14.10%**	**60.69%**	**9.50%**	**65.79%**	**15.85%**

Table 4-3a; contd

Species	Lausen (contd) c.11thC n.	Mass g.	Late11/12thC n.	Mass g.	mid 12thC n.	mass g.
Bos taurus	439	6711.80	54	728.50	61	2161.20
Sus domesticus	806	4916.30	99	340.50	38	320.50
Ovis/Capra	499	1685.90	50	128.70	43	166.10
Capra hircus	20	290.20	1	32.40	1	12.70
Ovis aries	17	200.20	1	8.30	2	5.40
Equus Spec	62	4152.20	7	160.80	6	155.60
Canis familiaris	5	11.70			1	21.80
Felis domesticus	1	1.70			1	0.40
Gallus domesticus	20	21.00	3	2.60	2	0.70
Anser domesticus	3	1.90			1	2.60
Columba domestica						
Total Domestic	**1835**	**17502.50**	**213**	**1361.10**	**153**	**2828.90**
Canis lupus	1	3.90				
Capreolus capreolus	1	3.30				
Cervus elaphus	9	108.50				
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	3	2.80				
Sciurus vulgaris	1	0.50				
Sus scrofa						
Talpa europaeus	1	0.10				
Ursus arctos	1	5.60				
Vulpes vulpes						
Anas sp.						
Cicconia ciconia						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius	1	0.30				
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]	5	0.60				
Pisces [2]						
Rodentia [3]	5	0.50				
Homo sapiens	1	1.50				
Total Wild	**18**	**125.00**	**0**	**0.00**	**0**	**0.00**
Total Identified	**1853**	**17627.50**	**213**	**1361.10**	**153**	**2828.90**
Large ruminents	10	36.50				
Small ruminents	1	0.50				
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**11**	**37.00**	**0**	**0.00**	**0**	**0.00**
Indeterminate	512	112.50	38	13.20	33	10.00
< Lepus	8	2.60			2	1.10
Bos/Cervus sized	433	1332.00			45	146.20
Ovis sized	1509	1265.60	114	82.90	103	98.80
Aves	19	8.10	2	0.70	4	0.80
Total Unidentified	**2481**	**2720.80**	**154**	**96.80**	**187**	**256.90**
% Identified	**42.75%**	**86.63%**	**58.04%**	**93.36%**	**45.00%**	**91.67%**
% Unidentified	**57.25%**	**13.37%**	**41.96%**	**6.64%**	**55.00%**	**8.33%**

Table 4-3a; contd

Species	Lausen					
	6-7th				9thC	
	G50 n.	g.	G56 n.	g.	G9n.	g.
Bos taurus	61	2440.90	59	2559.10	101	1855.00
Sus domesticus	60	434.00	61	658.10	165	564.60
Ovis/Capra	44	390.30	30	143.80	107	319.60
Capra hircus	4	99.60	1	22.80	1	2.00
Ovis aries	2	84.90	3	33.20	2	20.80
Equus Spec	10	351.00	3	260.70	8	106.30
Canis familiaris			2	18.70	1	0.30
Felis domesticus						
Gallus domesticus	1	4.30	1	0.10	2	1.80
Anser domesticus						
Columba domestica						
Total Domestic	**176**	**3620.50**	**156**	**3640.50**	**384**	**2847.60**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	3	61.40	1	39.40		
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	1	1.30				
Sciurus vulgaris						
Sus scrofa						
Talpa europaeus	1	0.20				
Ursus arctos						
Vulpes vulpes						
Anas sp.						
Cicconia ciconia						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco			1	0.40		
Buteo Buteo						
Perdix perdix						
Amphibia [1]	1	0.10	2	0.10		
Pisces [2]						
Rodentia [3]			1	0.10		
Homo sapiens						
Total Wild	**5**	**62.90**	**2**	**39.80**	**0**	**0.00**
Total Id	**181**	**3683.40**	**158**	**3680.30**	**384**	**2847.60**
Large ruminents	3	8.70			1	5.70
Small ruminents						
Canis lupus/Canis familiaris	1	8.60				
Vulpes v./Canis f.	1	0.80	1	0.40		
Small carnivore						
Total Domestic/Wild	**5**	**18.10**	**1**	**0.40**	**1**	**5.70**
Indet.	10	3.30	36	8.90	176	44.50
< Lepus	1	0.20	1	0.10	1	0.30
Bos/Cervus sized	31	134.00	30	138.40	114	252.00
Ovis sized	98	97.30	90	90.20	307	275.80
Aves			3	2.10	1	0.10
Total Unidentified	**140**	**234.80**	**160**	**239.70**	**599**	**572.70**
% Identified	**56.39%**	**94.01%**	**49.69%**	**93.89%**	**39.06%**	**83.26%**
% Unidentified	**43.61%**	**5.99%**	**50.31%**	**6.11%**	**60.94%**	**16.74%**

Table 4-3b; Species representation in both number and weight from Lausen excavation split by structure; [1] -see table 7.4-1; [2]- see table 7.5-1; [3]- see table 7.2-1.

Species	Lausen (contd) 9thC G28 n.	g.	10th G17 n.	g.	G54 n.	g.
Bos taurus	334	9051.10	41	429.00	118	2372.30
Sus domesticus	821	7450.90	86	347.60	444	3290.50
Ovis/Capra	403	2599.60	52	191.80	147	532.00
Capra hircus	4	34.90	2	33.60	3	20.20
Ovis aries	15	325.80	3	32.20	3	61.80
Equus Spec	22	1048.60	5	7.40	65	7863.10
Canis familiaris	5	11.60			1	2.70
Felis domesticus	1	1.20			1	1.40
Gallus domesticus	42	44.70	4	2.80	31	23.70
Anser domesticus	12	33.40			16	32.90
Columba domestica						
Total Domestic	**1640**	**20241.10**	**188**	**978.60**	**823**	**14118.60**
Canis lupus						
Capreolus capreolus						
Cervus elaphus	4	39.70			2	25.80
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	3	11.60				
Sciurus vulgaris						
Sus scrofa					2	21.00
Talpa europaeus						
Ursus arctos						
Vulpes vulpes	1	7.80				
Anas sp.	1	0.80			1	0.60
Cicconia ciconia	7	10.00				
Corvus c.c./cornix	1	0.30				
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]	5	0.60			3	0.30
Pisces [2]	1	0.00				
Rodentia [3]						
Homo sapiens	1	4.90				
Total Wild	**17**	**70.20**	**0**	**0.00**	**5**	**47.40**
Total Id	**1657**	**20311.30**	**188**	**978.60**	**828**	**14166.00**
Large ruminents					3	21.80
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0.00**	**0**	**0.00**	**3**	**21.80**
Indet.	597	205.40	165	37.80	311	96.10
< Lepus	9	72.50			6	1.40
Bos/Cervus sized	1153	1456.20	48	200.90	295	577.60
Ovis sized	254	1515.70	167	144.30	569	526.40
Aves	33	17.80			7	3.90
Total Unidentified	**2046**	**3267.60**	**380**	**383.00**	**1188**	**1205.40**
% Identified	**44.75%**	**86.14%**	**33.10%**	**71.87%**	**41.07%**	**92.16%**
% Unidentified	**55.25%**	**13.86%**	**66.90%**	**28.13%**	**58.93%**	**7.84%**

Table 4-3b; contd

Species	Lausen (contd)					
	11thC					
	G10 n.	g.	G20 n.	g.	G36 n.	g.
Bos taurus	194	2467.40	33	499.70	50	797.90
Sus domesticus	205	1394.70	81	399.00	106	580.90
Ovis/Capra	82	461.30	54	232.50	52	210.80
Capra hircus	6	159.90	3	33.50	1	13.90
Ovis aries	1	22.80	3	32.50	3	32.60
Equus Spec	11	327.70	10	510.50	8	219.90
Canis familiaris					2	1.50
Felis domesticus					1	1.70
Gallus domesticus	1	2.70	2	0.70	8	8.60
Anser domesticus						
Columba domestica						
Total Domestic	**493**	**4653.80**	**180**	**1642.40**	**227**	**1821.30**
Canis lupus						
Capreolus capreolus	1	3.30				
Cervus elaphus	2	25.70			1	5.30
Mustela erminea/nivalis						
Oryctolagos cunic./Lepus europ.	1	0.80				
Sciurus vulgaris			1	0.50		
Sus scrofa						
Talpa europaeus					1	0.10
Ursus arctos					1	5.60
Vulpes vulpes						
Anas sp.						
Cicconia ciconia						
Corvus c.c./cornix						
Corvus corone						
Corvus spec.						
Garrulus glandarius						
Strix aluco						
Buteo Buteo						
Perdix perdix						
Amphibia [1]						
Pisces [2]						
Rodentia [3]	2	0.20	1	0.10		
Homo sapiens			1	1.50		
Total Wild	**4**	**29.80**	**1**	**0.50**	**3**	**11.00**
Total Id	**497**	**4683.60**	**181**	**1642.90**	**230**	**1832.30**
Large ruminents						
Small ruminents						
Canis lupus/Canis familiaris						
Vulpes v./Canis f.						
Small carnivore						
Total Domestic/Wild	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Indet.	183	38.30	69	6.10	32	6.70
< Lepus			1	0.10	4	1.20
Bos/Cervus sized	165	507.20	32	110.40	52	141.80
Ovis sized	345	275.10	157	130.90	170	139.30
Aves	6	2.30			4	2.00
Total Unidentified	**699**	**822.90**	**259**	**247.50**	**262**	**291.00**
% Identified	**41.56%**	**85.06%**	**41.14%**	**86.91%**	**46.75%**	**86.29%**
% Unidentified	**58.44%**	**14.94%**	**58.86%**	**13.09%**	**53.25%**	**13.71%**

Table 4-3b; Contd

Species	Lausen (contd) 11thC G45 n.	g.	G19/52 n.	g.	Early 11thC G 11 n.	g.	mid 12thC G38 n.	g.
Bos taurus	37	772.10	76	836.80	46	1031.40	61	2161.20
Sus domesticus	215	1345.80	118	682.60	130	698.70	38	320.50
Ovis/Capra	85	378.60	81	237.50	76	332.10	43	166.70
Capra hircus	6	68.50	3	13.70	2	34.80	1	12.70
Ovis aries	2	22.70	6	32.10	4	41.50	2	5.40
Equus Spec	15	2597.90	9	180.70	6	244.10	6	155.60
Canis familiaris	3	10.20			1	0.60	1	21.80
Felis domesticus							1	0.40
Gallus domesticus	3	4.40	3	1.80	3	1.00	2	0.70
Anser domesticus	1	1.30	2	0.60	1	2.20	1	2.60
Columba domestica								
Total Domestic	**359**	**5110.30**	**289**	**1940.00**	**263**	**2310.10**	**153**	**2829.50**
Canis lupus	1	3.90						
Capreolus capreolus								
Cervus elaphus	3	56.10	3	21.40	3	12.20		
Mustela erminea/nivalis					2	0.10		
Oryctolagos cunic./Lepus europ.			2	2.00	2	1.20		
Sciurus vulgaris								
Sus scrofa								
Talpa europaeus								
Ursus arctos								
Vulpes vulpes								
Anas sp.								
Cicconia ciconia								
Corvus c.c./cornix					1	2.10		
Corvus corone								
Corvus spec.								
Garrulus glandarius	1	0.30						
Strix aluco								
Buteo Buteo								
Perdix perdix								
Amphibia [1]			4	0.50	4	0.10		
Pisces [2]								
Rodentia [3]	1	0.10	1	0.10	2	0.00		
Homo sapiens								
Total Wild	**5**	**60.30**	**5**	**23.40**	**8**	**15.60**	**0**	**0.00**
Total Id	**364**	**5170.60**	**294**	**1963.40**	**271**	**2325.70**	**153**	**2829.50**
Large ruminents	4	20.70	6	15.80				
Small ruminents			1	0.50	1	0.40		
Canis lupus/Canis familiaris								
Vulpes v./Canis f.								
Small carnivore								
Total Domestic/Wild	**4**	**20.70**	**7**	**16.30**	**1**	**0.40**	**0**	**0.00**
Indet.	82	25.20	127	29.20	167	19.60	33	10.00
< Lepus	2	1.10			2	0.10	2	1.10
Bos/Cervus sized	47	150.70	96	288.90	99	212.80	45	146.20
Ovis sized	291	270.60	414	320.70	242	183.50	103	98.80
Aves	2	0.90	2	0.40	8	1.30	4	0.80
Total Unidentified	**424**	**448.50**	**639**	**639.20**	**518**	**417.30**	**187**	**256.90**
% Identified	**46.19%**	**92.02%**	**31.51%**	**75.44%**	**34.35%**	**84.79%**	**45.00%**	**91.68%**
% Unidentified	**53.81%**	**7.98%**	**68.49%**	**24.56%**	**65.65%**	**15.21%**	**55.00%**	**8.32%**

Table 4-3b; Contd

Site	Date	n. Domestic	% Domestic	n.Wild	% Wild
Lausen	Late6th-Late7th C	386	98.22%	7	1.78%
Lausen	Late7th-Late8thC*	85	98.84%	1	1.16%
Lausen	8th-9thC*	68	98.55%	1	1.45%
Lausen	c9th C (excGh28)	374	100%	0	0.00%
Lausen	c9th C (inc Gh28)	2015	99.11%	8	0.89%
Lausen	c10th C	1015	99.61%	4	0.39%
Lausen	c11th C	1682	99.00%	17	1.00%
Lausen	Early 11th C	226	97.08%	7	2.92%
Lausen	late 11th/12th*	149	100%	0	0.00%
Lausen	mid 12th C*	153	100%	0	0.00%

Table 4.2.1.2-1; Proportions of domestic and wild species at Lausen split by period, amphibians and rodents are not included in the tables here; *denotes small samples

Structure	Date	Sample size	Domestic	Wild	Total No. spp	No. wild spp
grube 56	late 6th-late7th	158	98.73%	1.27%	7	2
grube 50	late 6th-late7th	181	97.24%	2.76%	8	3
grube 1*	late 6th-late7th*	54	100%	0.00%	3	0
grube 2 *	late 6th-late7th*	99	100%	0.00%	4	0
grube 22 *	late 6th-late7th*	113	97.35%	2.65%	8	2
grube 8*	8/9th*	69	98.55%	1.45%	4	1
grube 9	9th	374	100%	0.00%	6	0
grube 28	9th	1657	98.97%	1.03%	14	6
grube 17	10th	188	100%	0.00%	5	0
grube 54	10th	828	99.40%	0.60%	11	3
grube 20	11th	181	99.45%	0.55%	6	1
grube 36	11th	230	98.70%	1.30%	10	3
grube 19/52	11th	294	98.30%	1.70%	8	2
grube 45	11th	363	98.90%	1.10%	10	3
grube 10	11th	444	99.10%	0.90%	8	3
grube 7*	11th *	43	100%	0.00%	4	0
grube 57*	11th *	144	100%	0.00%	5	0
grube 11	Early 11th	271	97.05%	2.95%	11	4
grube 4*	late 11th-12th*	139	100%	0.00%	5	0
grube 38	mid 12th	153	100%	0.00%	8	0

Table 4.2.1.2-2; Proportions of domestic and wild species within different structures at Lausen, amphibians and rodents are not included in the tables here; *denotes small samples

Site	Date	n. Domestic	% Domestic	n.Wild	% Wild
KA-Jak	4th-6thC	203	89.04%	5	10.96%
KA-Adl	Mid 4thC	630	99.21%	5	0.79%
KA-Adl	450-500*	73	100%	0	0.00%
KA-Adl	mid5th-6thC	1040	98.02%	21	1.98%
KA-Jak	5-6thC	670	97.81%	15	2.19%
KA-Jak	6thC	1185	98.59%	17	1.33%
KA-Jak	beg. 7thC	530	99.07%	5	0.93%
KA-Adl	12thC*	86	100%	0	0.00%
KA-FStr.	12thC*	66	100%	0	0.00%

Table 4.2.1.3-1; Proportions of domestic and wild species at Kaiseraugst split by area and period, amphibians and rodents are not included in the tables here,* denotes small samples
KA-Jak - Kaiseraugst Jakobli-Haus; KA Adl - Gasthof Adler; KA - Kaiseraugst Fabrikstrasse

Area	Structure	Date	Sample size	Domestic	Wild	Total No. spp	No. wild spp
KA-Adl	F2/3	Mid 4thC	272	99.63%	0.37%	6	1
KA-Adl	F3/2	Mid 4thC	209	100.00%	0.00%	5	0
KA-Jak	Bodenniveau	4-6thC	227	89.43%	10.57%	14	10
KA-Jak	Gruben	4-6thC	198	95.45%	4.55%	6	2
KA-Jak	Ziegelschutthorizont all	5-6thC	686	97.67%	2.33%	13	5
KA-Jak	Ziegelschutthorizont D03279	5-6thC	213	99.53%	0.47%	7	1
KA-Jak	Ziegelschutthorizont D03165*	5-6thC	113	96.46%	3.54%	7	2
KA-Jak	Ziegelschutthorizont D03144*	5-6thC	114	97.37%	2.63%	7	3
KA-Adl	F2/4	mid 5-late 6thC	425	97.18%	2.82%	9	2
KA-Adl	F3/5*	mid 5-late 6thC	149	99.33%	0.66%	8	1
KA-Adl	F17/2 all	mid 5-late 6thC	487	98.36%	1.64%	8	2
KA-Adl	F17/2*	mid 5-late 6thC	140	97.86%	2.14%	7	1
KA-Adl	F17/2 oberer	mid 5-late 6thC	204	98.53%	1.47%	7	2
KA-Adl	F17/2 unterer*	mid 5-late 6thC	143	98.60%	1.40%	5	1
KA-Jak	Unterer Humusbereich all	6thC	1141	98.33%	1.67%	13	4
KA-Jak	Unterer Humusbereich D03774	6thC	174	98.83%	1.17%	6	2
KA-Jak	Unterer Humusbereich D03119	6thC	206	97.09%	2.91%	8	2
KA-Jak	Unterer Humusbereich D03116	6thC	150	100.00%	0.00%	4	0
KA-Jak	Oberer Humusbereich all	Beg. 7thC	502	98.41%	1.59%	8	2
KA-Jak	Oberer Humusbereich D03101	Beg. 7thC	128	99.22%	0.78%	6	1
KA-Jak	Oberer Humusbereich D03195*	Beg. 7thC	137	97.81%	2.19%	5	1
KA-Jak	Oberer Humusbereich D03764	Beg. 7thC	164	100.00%	0.00%	6	0

Table 4.2.1.3-2; Proportions of domestic and wild species within different structures at Kaiseraugst, amphibians and rodents are not included in the tables here,* denotes small samples
KA-Jak - Kaiseraugst Jakobli-Haus; KA Adl - Gasthof Adler; KA - Kaiseraugst Fabrikstrasse

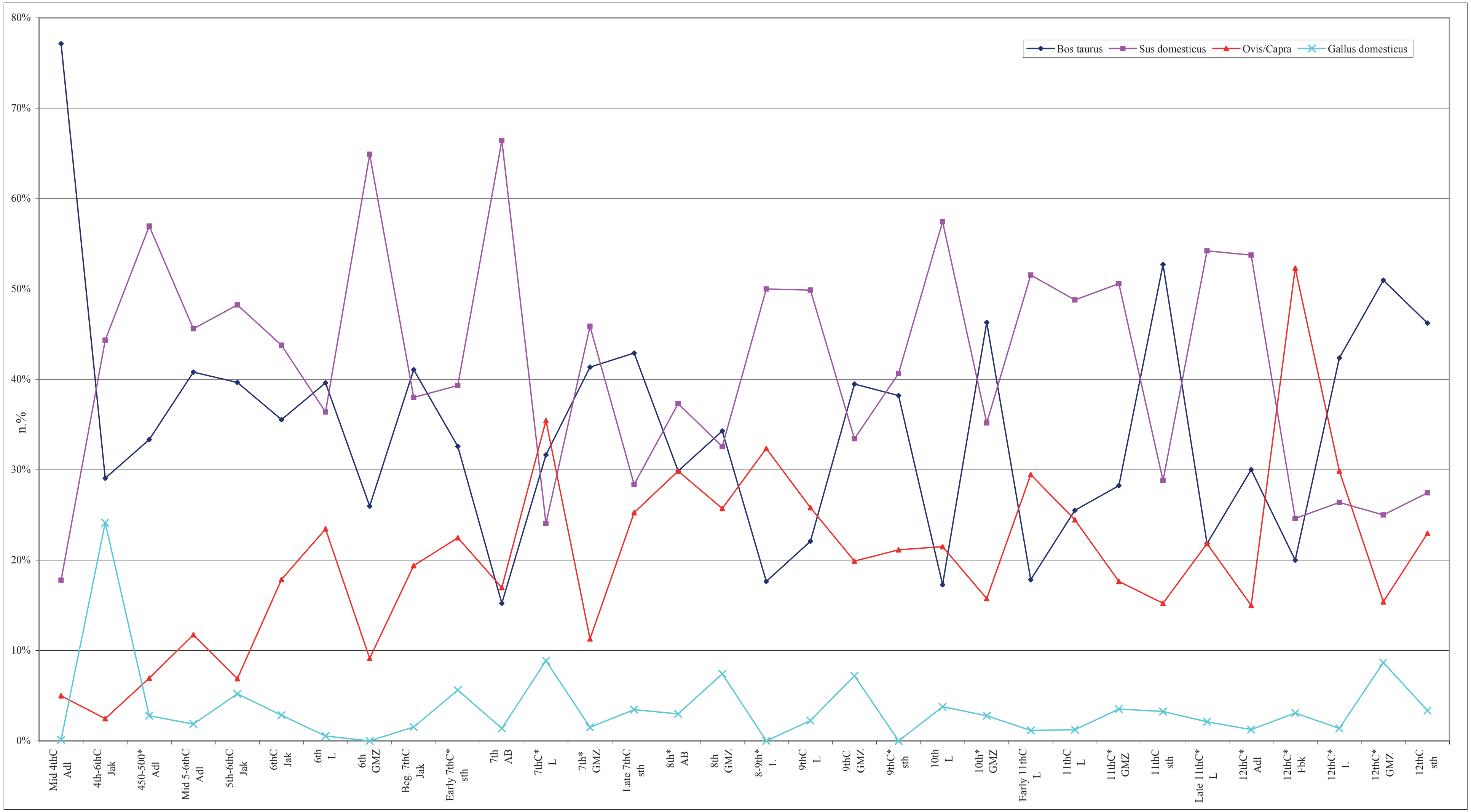

Fig 4.2.2-1; Proportions of the major domestic species through time at all sites, data is taken from tables; Reinach - 4.2.2.1-1, Lausen - 4.2.2.2-1, Kaiseraugst - 4.2.2.3-1
Adl - Gasthof Adler, Jak - Jakobli-Haus, L -Lausen, GMZ - Gemeindezentrum, sth -Stadthof, AB -Altebrauerei, Fbk - Fabrikstrasse; * denotes small samples

Date	6thC	7thC	Late 7thC	8thC	9thC	11thC	12thC
n.	208	511	289	309	470	269	461
Bos taurus	25.96%	25.05%	42.91%	32.36%	39.15%	44.98%	47.29%
Sus domesticus	64.90%	56.36%	28.37%	34.63%	35.32%	35.69%	26.90%
Ovis/Capra	9.13%	16.44%	25.26%	27.51%	20.21%	15.99%	21.26%
Gallus domesticus	0.00%	2.15%	3.46%	5.50%	5.32%	3.35%	4.56%

Table 4.2.2.1-1; Proportions of the main domesticated species at Reinach split into chronological periods

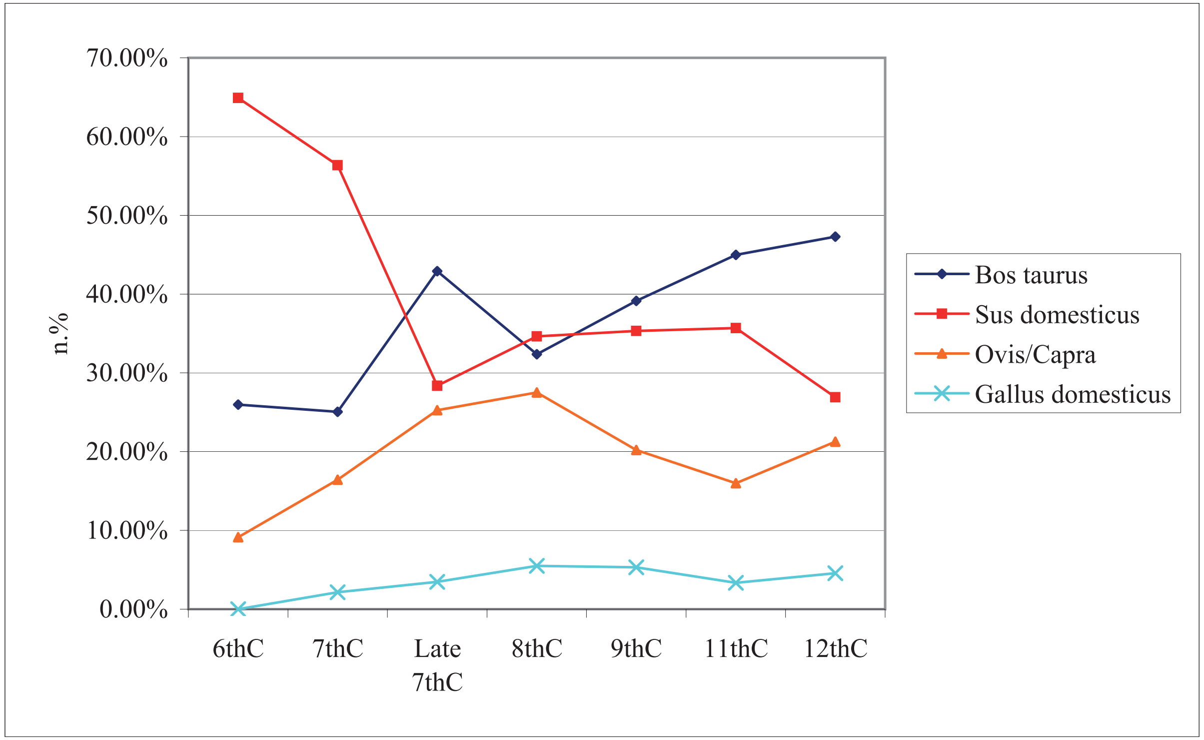

Figure 4.2.2.1-2; graphical representation of table 4.2.2.1-1

Area	GMZ		Sth		AB		GMZ		Sth		AB		GMZ		GMZ		Sth		GMZ		GMZ		Sth		GMZ		Sth	
Date	6thC		Early 7thC*		7thC		7thC*		Late 7thC		8thC*		8thC		9thC		9thC*		10thC*		11thC*		11thC		12thC*		12thC	
Bos taurus	54	25.96%	29	32.58%	44	15.22%	55	41.35%	124	42.91%	40	29.85%	60	34.29%	137	39.48%	47	38.21%	50	46.30%	24	28.24%	97	52.72%	53	50.96%	165	46.22%
Sus domesticus	135	64.90%	35	39.33%	192	66.44%	61	45.86%	82	28.37%	50	37.31%	57	32.57%	116	33.43%	50	40.65%	38	35.19%	43	50.59%	53	28.80%	26	25.00%	98	27.45%
Ovis/Capra	19	9.13%	20	22.47%	49	16.96%	15	11.28%	73	25.26%	40	29.85%	45	25.71%	69	19.88%	26	21.14%	17	15.74%	15	17.65%	28	15.22%	16	15.38%	82	22.97%
Gallus domesticus	0	0.00%	5	5.62%	4	1.38%	2	1.50%	10	3.46%	4	2.99%	13	7.43%	25	7.20%	0	0.00%	3	2.78%	3	3.53%	6	3.26%	9	8.65%	12	3.36%
Total	208		89		289		133		289		134		175		347		123		108		85		184		104		357	

Table 4.2.2.1-3; Proportions of the main domesticated species at Reinach split by area and date, AB -Altebrauerei, GMZ -Gemeindezentrum, Sth -Stadthof
* denotes small samples

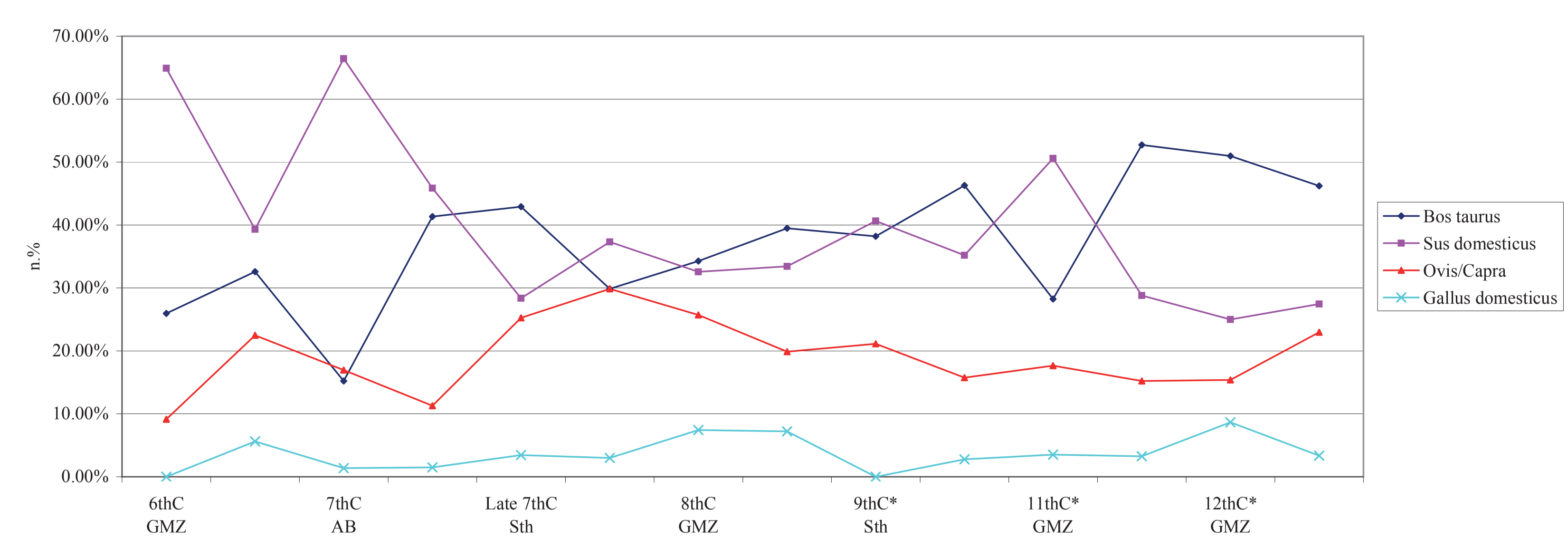

Figure 4.2.2.1-4; graphical representation of table 4.2.2.1-3; *denotes small samples

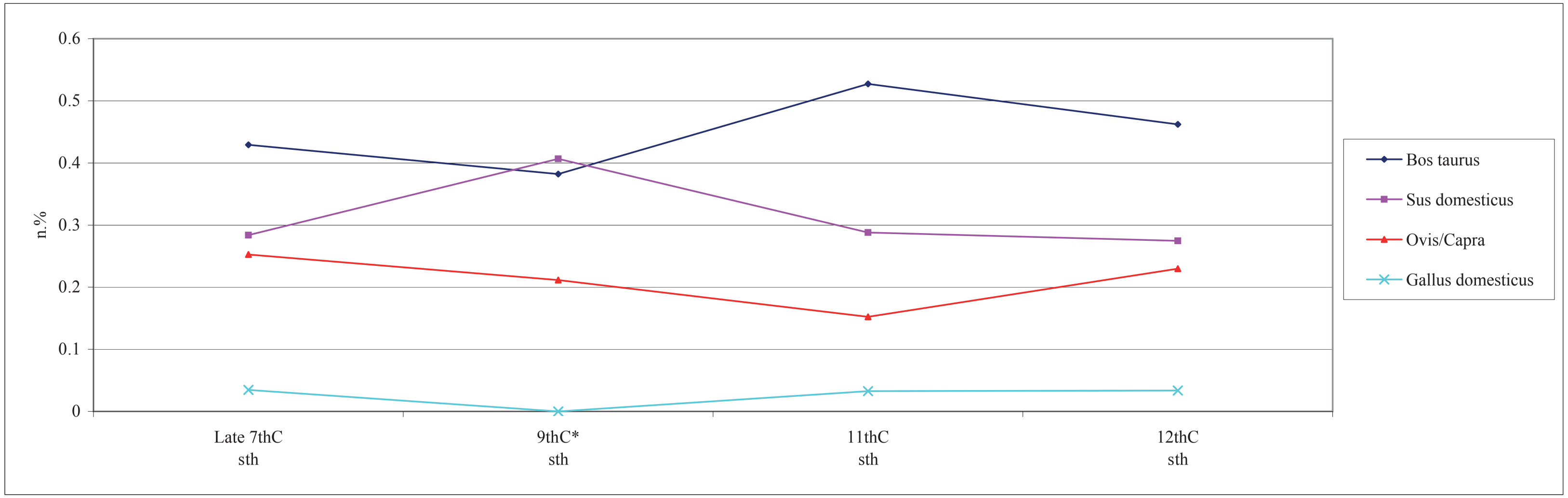

Figure 4.2.2.1-5; graphical representation of the Stadthof data from table 4.2.2.1-3; *denotes small samples

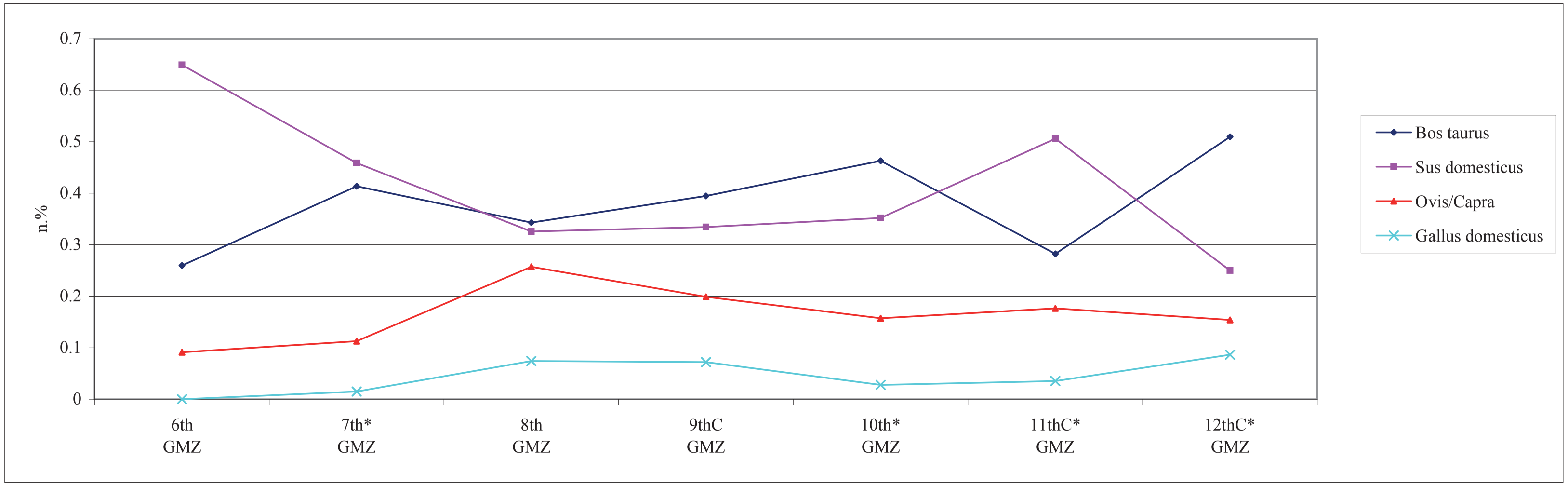

Figure 4.2.2.1-6; graphical representation of the Gemeindezentrum data from table 4.2.2.1-3; *denotes small samples

Date	7th		Mid 7th		Late 7th		Late 9th		11th		Mid 11th		Late 11th		Early 12th		Mid 12th		Late 12th	
Structure	S2*		S4		S3*		S5*		K2*		S7*		K1*		S10*		S9*		S13*	
Bos taurus	22	29.73%	95	42.79%	28	45.16%	47	38.21%	33	32.35%	18	46.15%	79	54.86%	7	63.64%	60	74.07%	56	39.16%
Sus domesticus	32	43.24%	61	27.48%	19	30.65%	50	40.65%	39	38.24%	4	10.26%	48	33.33%	2	18.18%	13	16.05%	38	26.57%
Ovis/Capra	15	20.27%	62	27.93%	9	14.52%	26	21.14%	27	26.47%	15	38.46%	13	9.03%	1	9.09%	8	9.88%	41	28.67%
Gallus domesticus	5	6.76%	4	1.80%	6	9.68%	0	0.00%	3	2.94%	2	5.13%	4	2.78%	1	9.09%	0	0.00%	8	5.59%
Total	74		222		62		123		102		39		144		11		81		143	

4.2.2.1-7; Proportions of main domesticated species by structure and date in the Stadthof area of the Reinach excavation; *denotes small samples

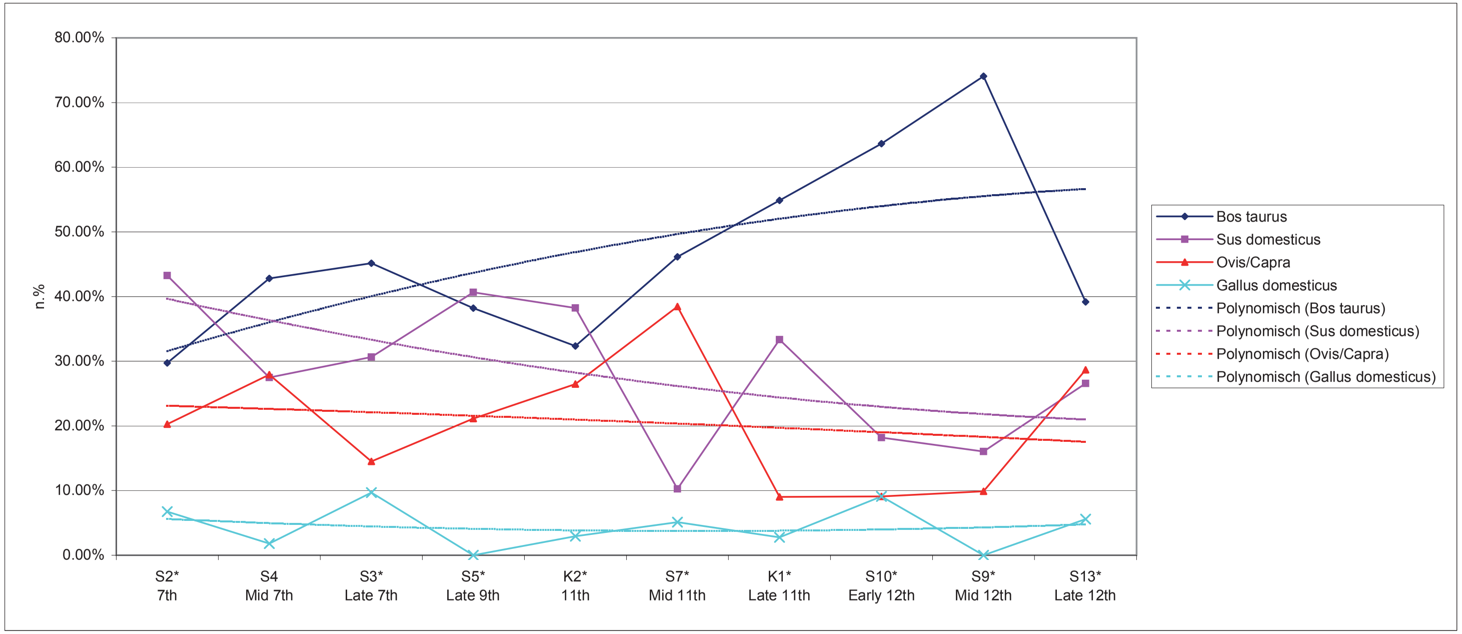

Figure 4.2.2.1-8; graphical representation of table 4.2.2.1-7; *denotes small samples

	late 6thC G2		Late 6thC G3*		Early 7thC G4*		Early 8thC G9*		Early 9thC G10*		Early 9thC G11*		Early 9thC G12*		9thC G7*		9thC G13*	
Bos taurus	41	23.43%	13	39.39%	36	41.86%	25	37.88%	10	38.46%	41	47.13%	47	39.17%	20	39.22%	35	35.00%
Sus domesticus	117	66.86%	15	45.45%	41	47.67%	25	37.88%	12	46.15%	22	25.29%	34	28.33%	17	33.33%	42	42.00%
Ovis/Capra	14	8.00%	5	15.15%	8	9.30%	15	22.73%	3	11.54%	17	19.54%	26	21.67%	11	21.57%	20	20.00%
Gallus domesticus	3	1.71%	0	0.00%	1	1.16%	1	1.52%	1	3.85%	7	8.05%	13	10.83%	3	5.88%	3	3.00%
Total	175		33		86		66		26		87		120		51		100	

	10thC G15*		late10thC G16*		Late 10thC G17*		late 10thC G18*		Early 11thC G20*		Early 11thC G21*		early 11thC G19*		Mid11-12thC G23*	
Bos taurus	10	52.63%	8	36.36%	6	37.50%	23	52.27%	7	17.95%	8	38.10%	17	36.96%	34	56.67%
Sus domesticus	6	31.58%	8	36.36%	3	18.75%	17	38.64%	21	53.85%	9	42.86%	22	47.83%	15	25.00%
Ovis/Capra	3	15.79%	4	18.18%	6	37.50%	4	9.09%	8	20.51%	3	14.29%	7	15.22%	6	10.00%
Gallus domesticus	0	0.00%	2	9.09%	1	6.25%	0	0.00%	3	7.69%	1	4.76%	0	0.00%	5	8.33%
Total	19		22		16		44		39		21		46		60	

4.2.2.1-9; Proportions of main domesticated species by structure and date in the Gemeindezentrum area of the Reinach excavation; *denotes small samples

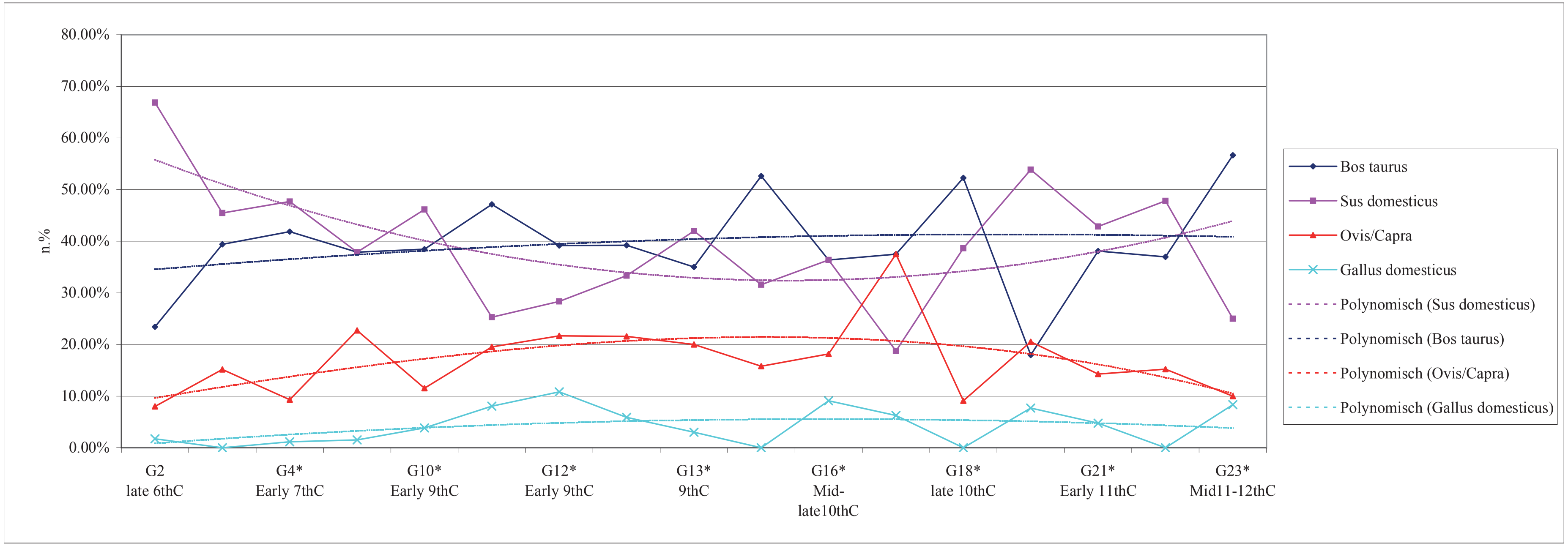

Figure 4.2.2.1-10; graphical representation of table 4.2.2.1-9; *denotes small samples

	6th		7thC*		8-9th*		9thC		10th		Early 11thC		11thC		Late 11thC*		12thC*	
Bos taurus	147	39.62%	25	31.65%	12	17.65%	434	22.09%	160	17.28%	46	17.83%	411	25.51%	31	21.83%	61	42.36%
Sus domesticus	135	36.39%	19	24.05%	34	50.00%	980	49.87%	532	57.45%	133	51.55%	786	48.79%	77	54.23%	38	26.39%
Ovis/Capra	87	23.45%	28	35.44%	22	32.35%	507	25.80%	199	21.49%	76	29.46%	394	24.46%	31	21.83%	43	29.86%
Gallus domesticus	2	0.54%	7	8.86%	0	0.00%	44	2.24%	35	3.78%	3	1.16%	20	1.24%	3	2.11%	2	1.39%
Total	371		79		68		1965		926		258		1611		142		144	

Table 4.2.2.2-1; Proportions of the main domesticated species at Lausen split into chronological periods; * denotes small samples

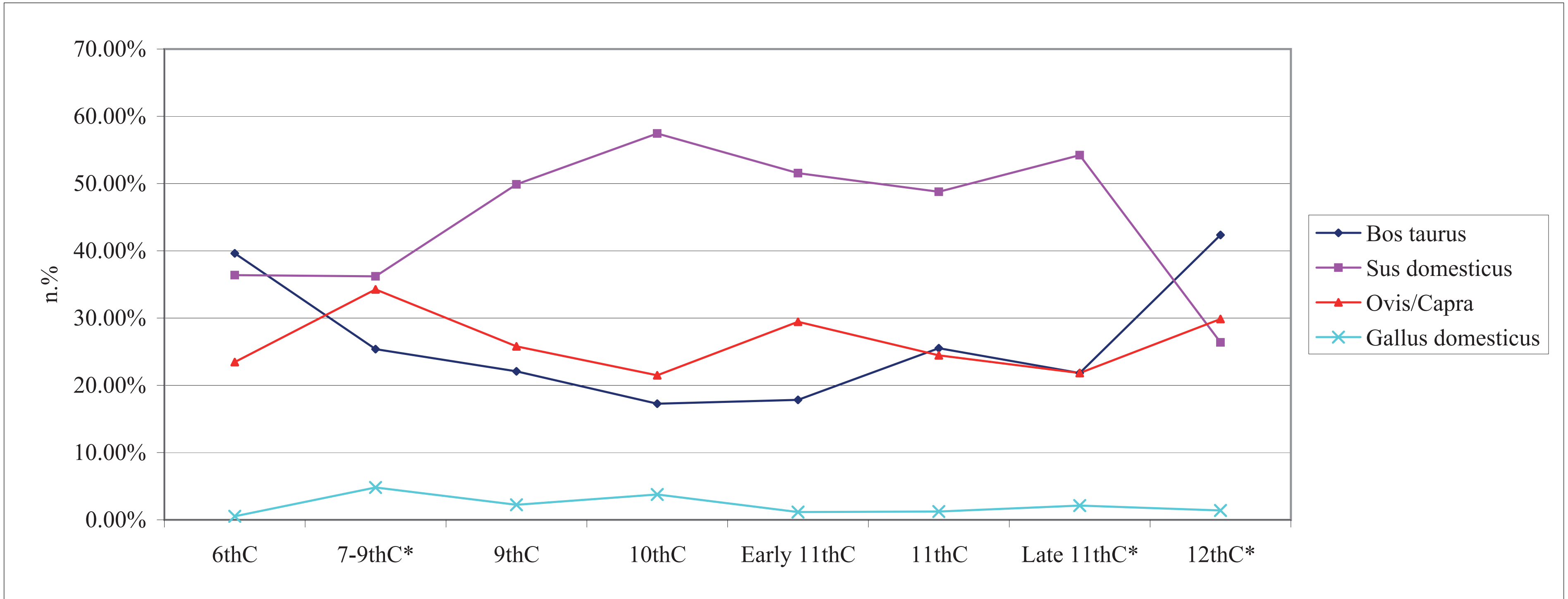

Figure 4.2.2.2-2; graphical representation of table 4.2.2.2-1, 7-9thC group created by adding data the 7thC and the 8-9thC data groups together

Structure	G50		G56		G28		G9		G17		G54		G11		G10		G19/52		G20		G36		G45		G38	
Date	late 6-late7thC		late 6-late7thC		9thC		9thC		10thC		10thC		Early 11thC		11thC		11thC		11thC		11thC		11thC		mid 12thC*	
Bos taurus	61	36.75%	59	39.07%	334	20.88%	100	27.40%	41	22.40%	118	15.95%	46	18.04%	166	38.69%	76	27.34%	33	19.41%	50	23.15%	37	10.88%	61	42.36%
Sus domesticus	60	36.14%	61	40.40%	821	51.31%	159	43.56%	86	46.99%	444	60.00%	130	50.98%	185	43.12%	118	42.45%	81	47.65%	106	49.07%	215	63.24%	38	26.39%
Ovis/Capra	44	26.51%	30	19.87%	403	25.19%	104	28.49%	52	28.42%	147	19.86%	76	29.80%	77	17.95%	81	29.14%	54	31.76%	52	24.07%	85	25.00%	43	29.86%
Gallus domesticus	1	0.60%	1	0.66%	42	2.63%	2	0.55%	4	2.19%	31	4.19%	3	1.18%	1	0.23%	3	1.08%	2	1.18%	8	3.70%	3	0.88%	2	1.39%
Total	166		151		1600		365		183		740		255		429		278		170		216		340		144	

Table 4.2.2.2-3; Proportions of the main domesticated species at Lausen split by structure and date; * denotes small samples

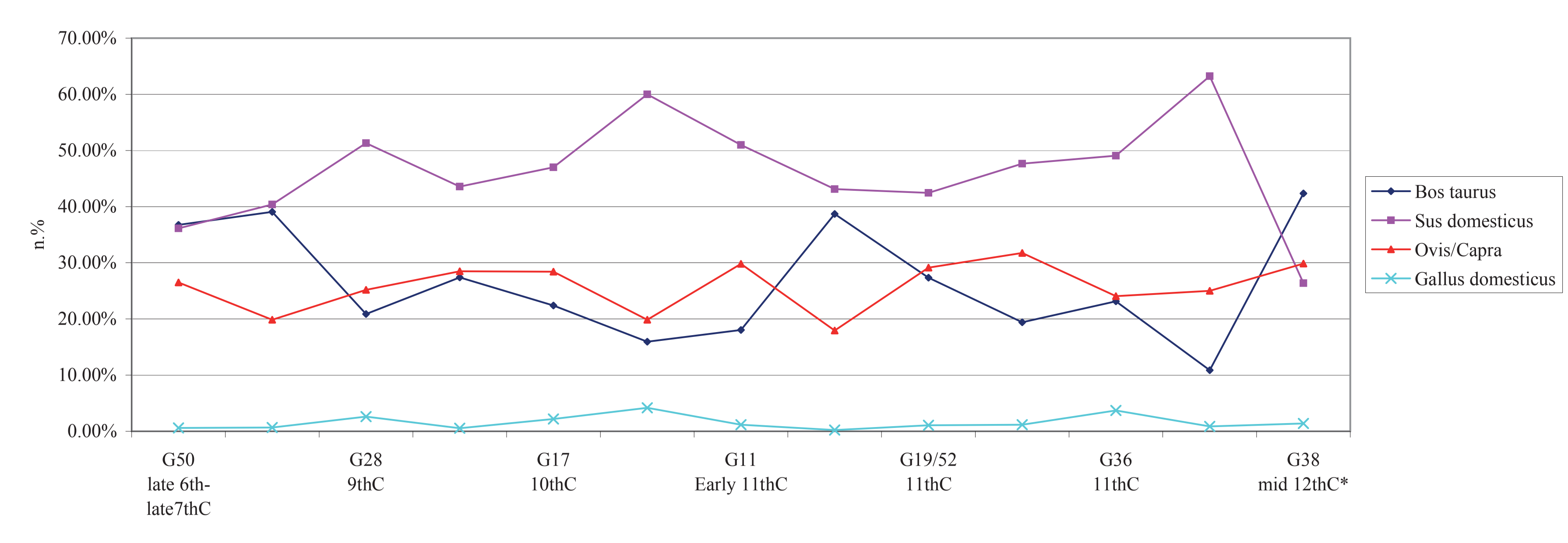

Figure 4.2.2.2-4; graphical representation of table 4.2.2.2-3; * denotes small samples

Area Date	Adl Mid 4thC		Jak 4th-6thC		Adl Mid 5-6thC		Jak 5th-6thC		Jak 6thC		Jak Beg. 7thC		Adl 12thC*		Fbk 12thC*	
Bos taurus	316	77.13%	59	29.06%	441	40.31%	259	39.66%	414	35.54%	214	41.07%	24	30.00%	13	20.00%
Sus domesticus	225	17.78%	90	44.33%	507	46.34%	315	48.24%	510	43.78%	198	38.00%	43	53.75%	16	24.62%
Ovis/Capra	67	4.99%	5	2.46%	125	11.43%	45	6.89%	208	17.85%	101	19.39%	12	15.00%	34	52.31%
Gallus domesticus	11	0.10%	49	24.14%	21	1.92%	34	5.21%	33	2.83%	8	1.54%	1	1.25%	2	3.08%
	619		203		1094		653		1165		521		80		65	

Table 4.2.2.3-1; Proportions of the main domesticated species at Kaiseraugst split by area and into chronological periods
Adl - Gasthof Adler area, Jak - Jakobli-Haus area, Fbk - Fabrikstrasse area

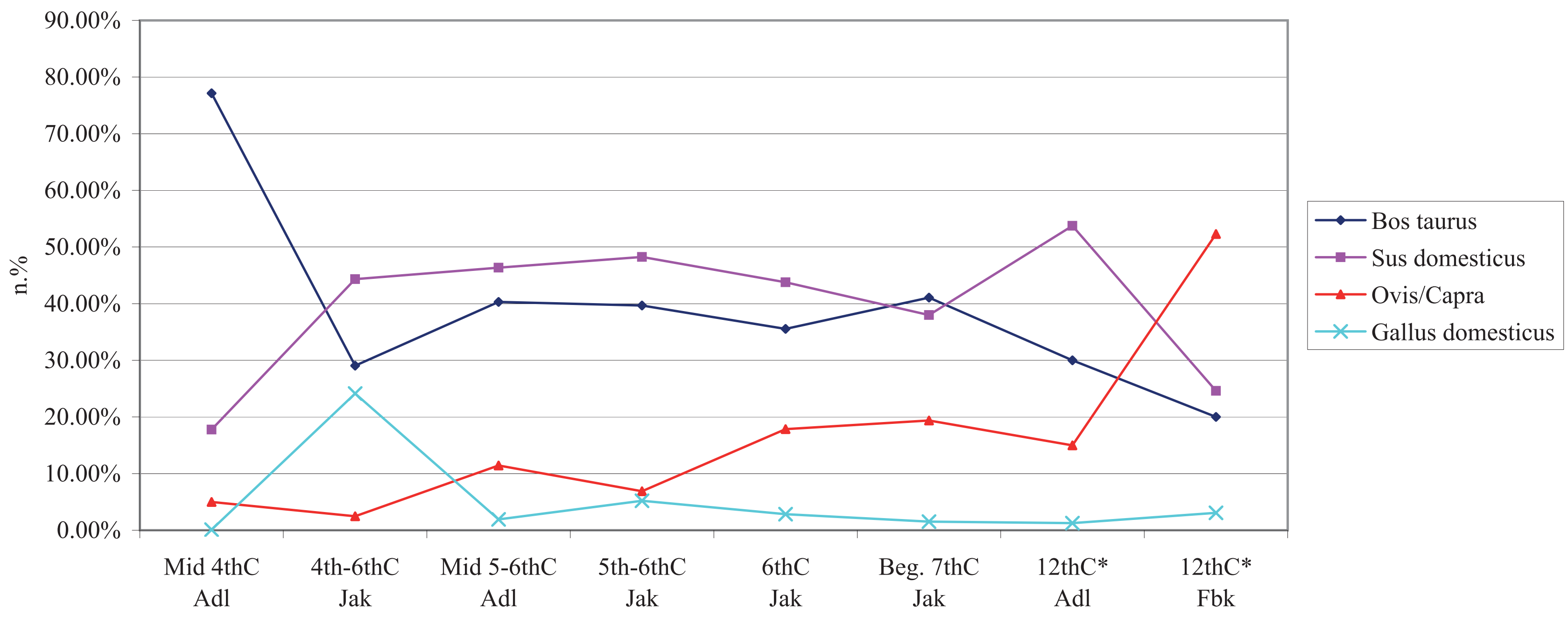

Figure 4.2.2.3-2; graphical representation of table 4.2.2.3-1, abbreviations as table 4.2.2.3-1

Area	Adl		Adl		Jak		Jak		Adl		Adl		Jak		Jak		Jak	
Date	Mid 4thC		Mid 4thC		4-6thC		4-6thC		mid5 - late6thC		mid5-late6thC		5-late6thC		6thC		7thC	
Structure	F3 2		F2 3		Boden niveau		Gruben		F17 2 all		F2 4		Zeigelschutthorizont all		Unterer Humusbereich all		Oberer Humusbereich all	
Bos taurus	121	60.20%	103	38.15%	59	29.06%	58	30.85%	213	44.75%	150	37.22%	259	39.66%	402	36.38%	202	41.65%
Sus domesticus	65	32.34%	118	43.70%	90	44.33%	97	51.60%	206	43.28%	190	47.15%	315	48.24%	472	42.71%	185	38.14%
Ovis/Capra	15	7.46%	41	15.19%	5	2.46%	21	11.17%	48	10.08%	55	13.65%	45	6.89%	203	18.37%	92	18.97%
Gallus domesticus	0	0.00%	8	2.96%	49	24.14%	12	6.38%	9	1.89%	8	1.99%	34	5.21%	28	2.53%	6	1.24%
Total	201		270		203		188		476		403		653		1105		485	

Table 4.2.2.3-3; Proportions of the main domesticated species at Kaiseraugst split by area, date and structure, Adl- Gasthof Adler, Jak- Jakobli-Haus

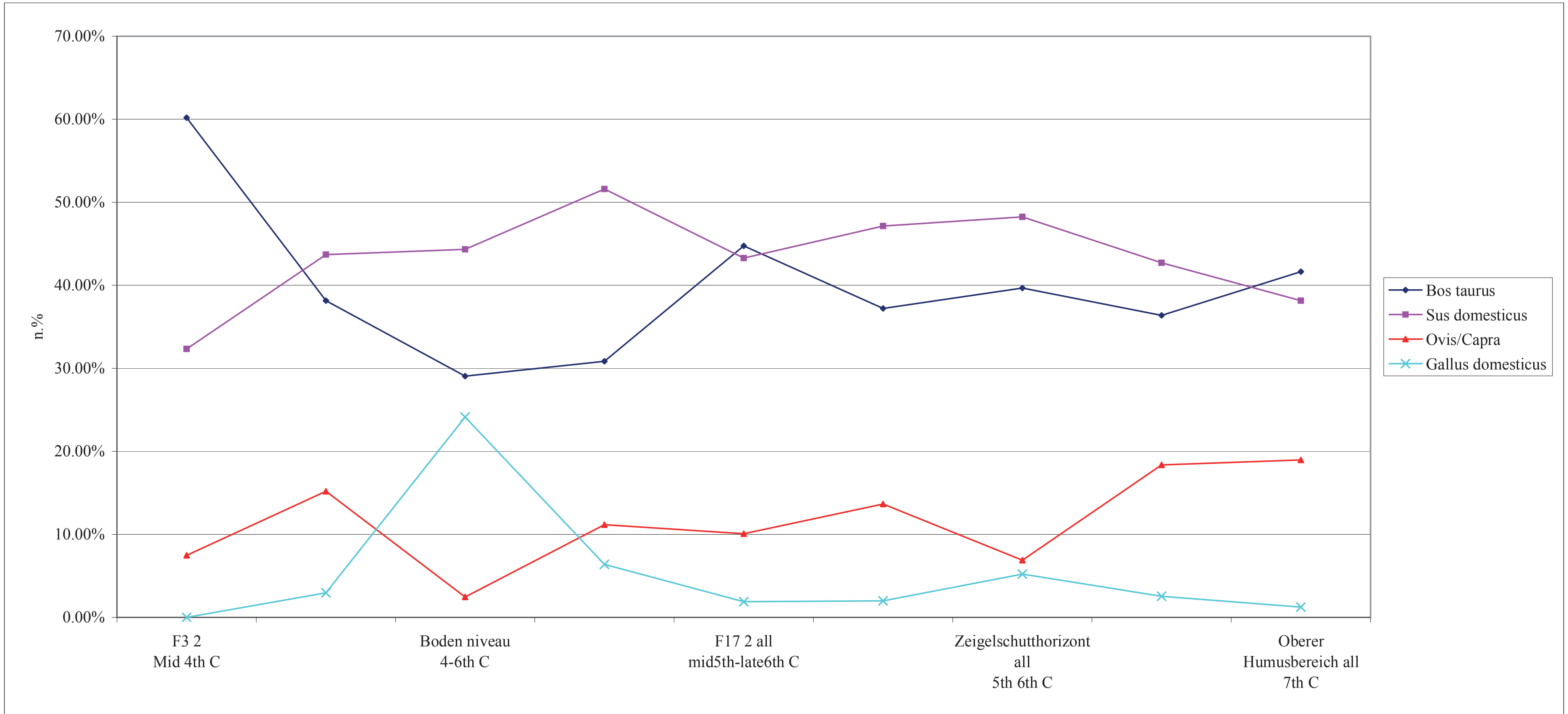

Figure 4.2.2.3-4; graphical representation of table 4.2.2.3-3

Area	Adl		Jak		Jak		Jak		Jak	
Date	mid5-late6thC		6thC		6thC		6thC		7thC	
Structure	F17 2 oberer		Unterer Humusbereich 3116		Unterer Humusbereich 3119		Unterer Humusbereich 3774		Oberer Humusbereich 3196	
Bos taurus	74	37.00%	51	34.00%	83	42.13%	70	41.42%	56	35.44%
Sus domesticus	96	48.00%	72	48.00%	74	37.56%	61	36.09%	72	45.57%
Ovis/Capra	24	12.00%	26	17.33%	37	18.78%	35	20.71%	26	16.46%
Gallus domesticus	6	3.00%	1	0.67%	3	1.52%	3	1.78%	4	2.53%
Total	200		150		197		169		158	

Table 4.2.2.3-5; Proportions of the main domesticated species from selected contexts within the structures of table 4.2.2.3-3, Adl- Gasthof Adler, Jak- Jakobli-Haus

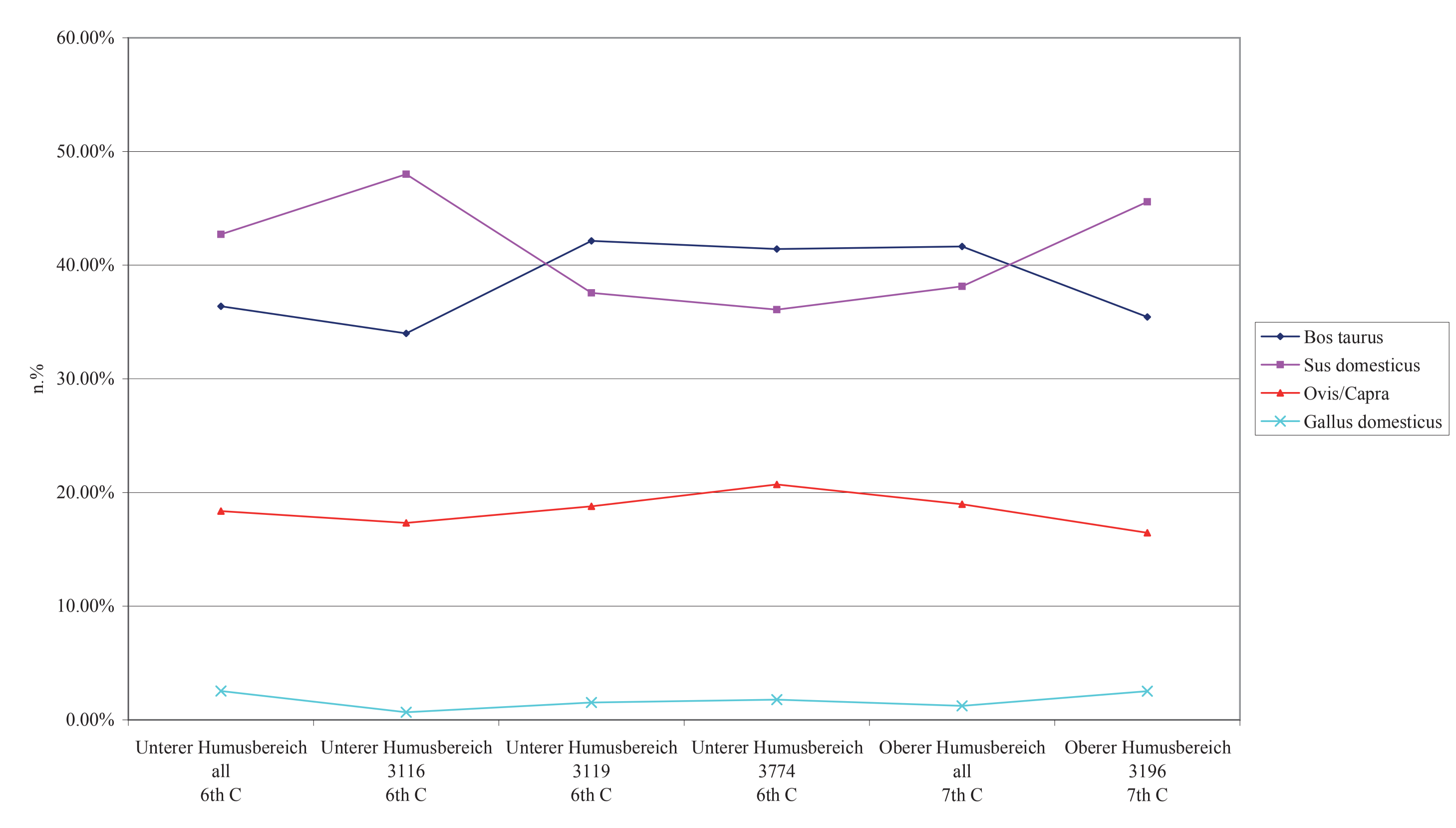

figure 4.2.2.3-6; Proportions of the main domesticated species from selected contexts and structures within the Kaiseraugst excavation

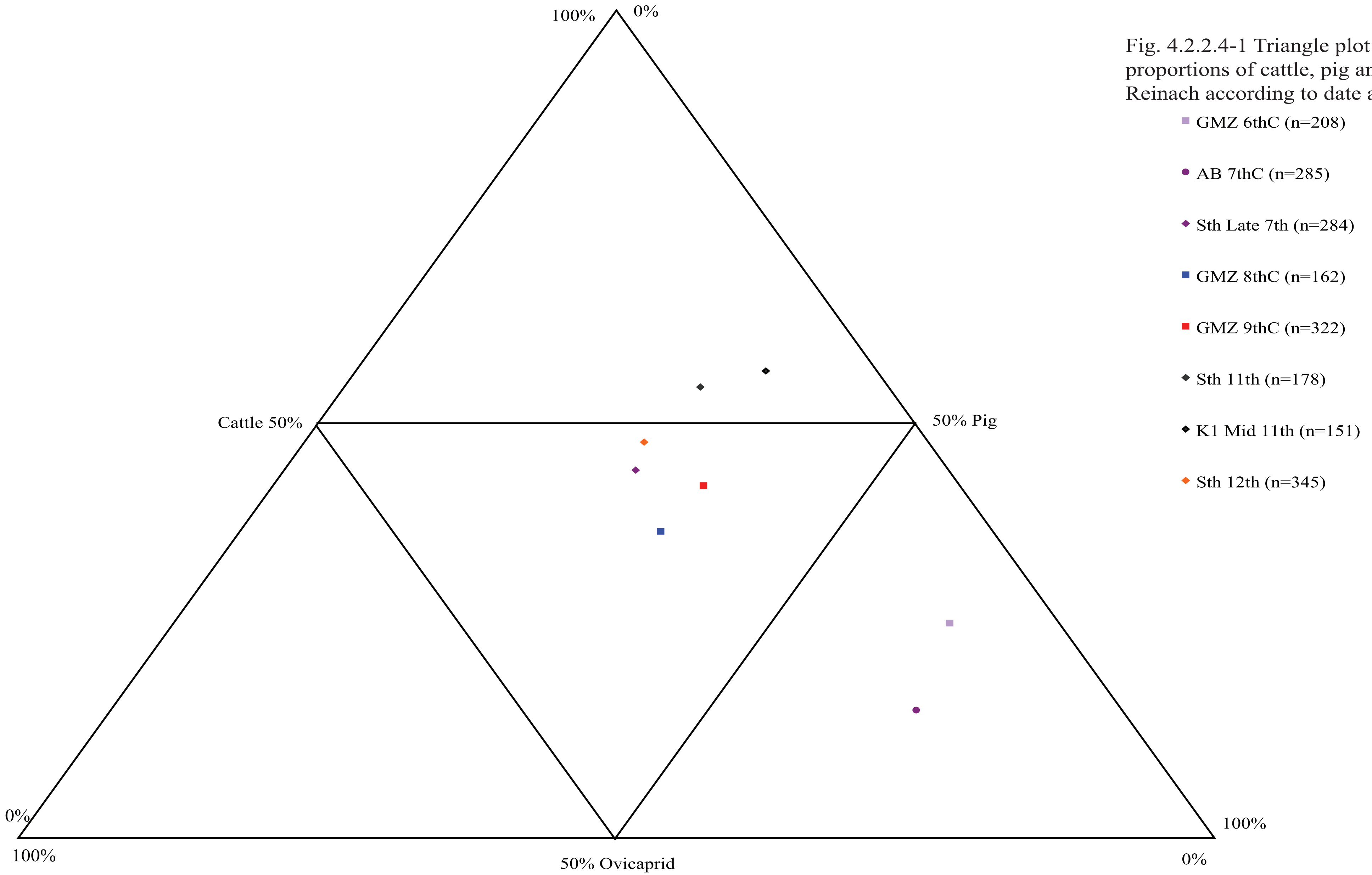

Fig. 4.2.2.4-1 Triangle plot showing the proportions of cattle, pig and ovicaprids at Reinach according to date and area.

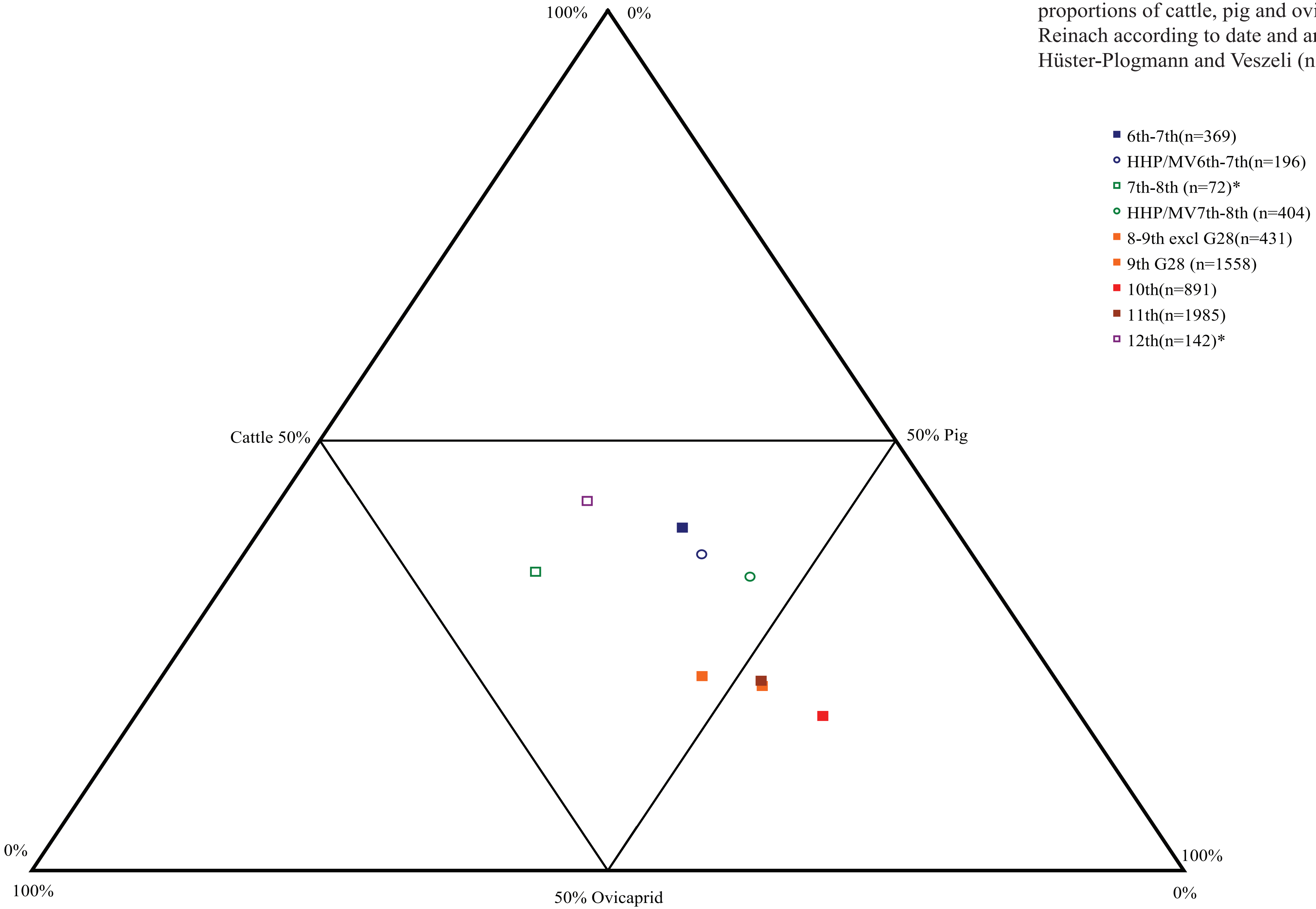

Fig. 4.2.2.4-2 Triangle plot showing the proportions of cattle, pig and ovicaprids at Reinach according to date and area. HHP/MV - Hüster-Plogmann and Veszeli (n.d.)

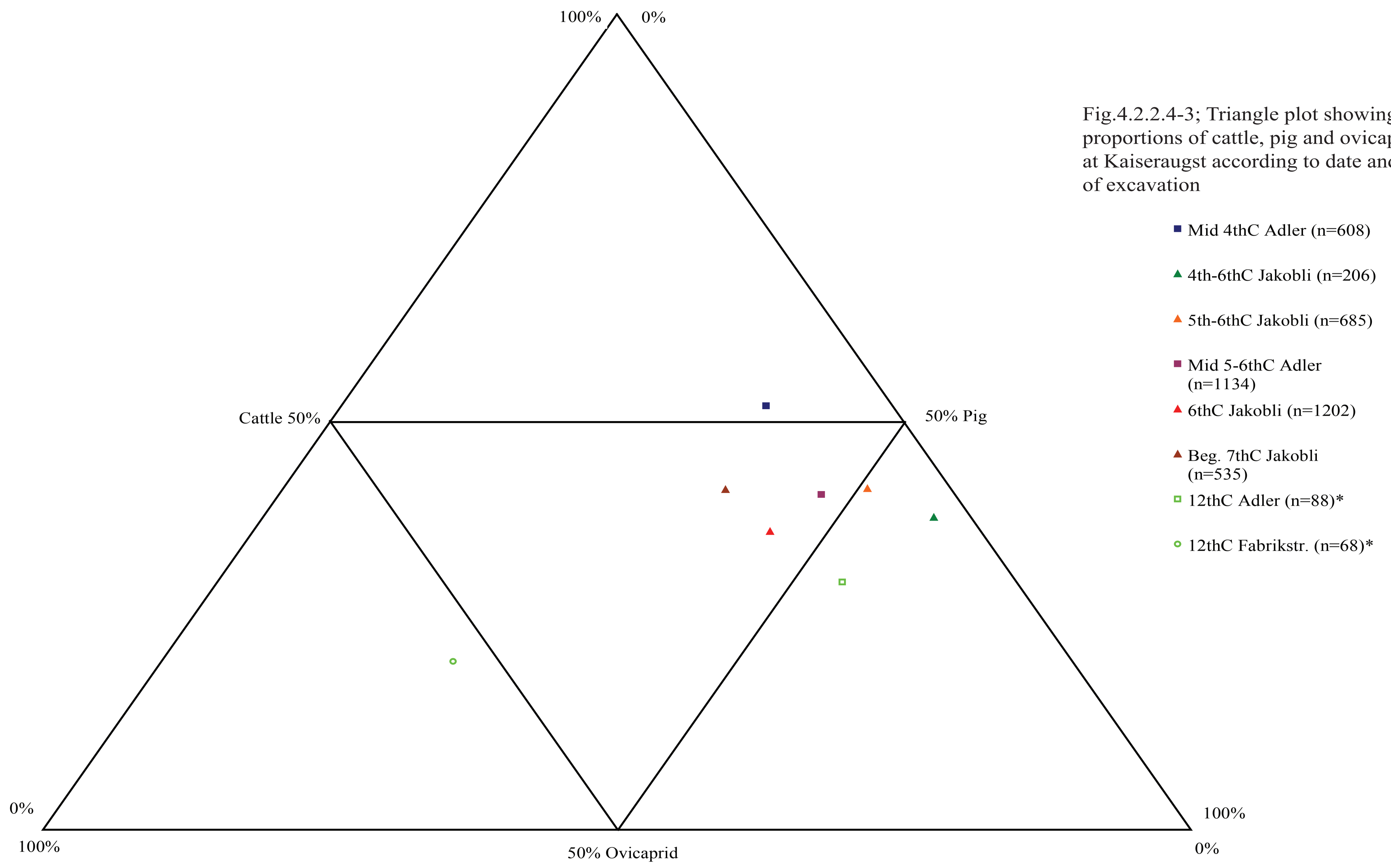

Fig.4.2.2.4-3; Triangle plot showing the proportions of cattle, pig and ovicaprids at Kaiseraugst according to date and area of excavation

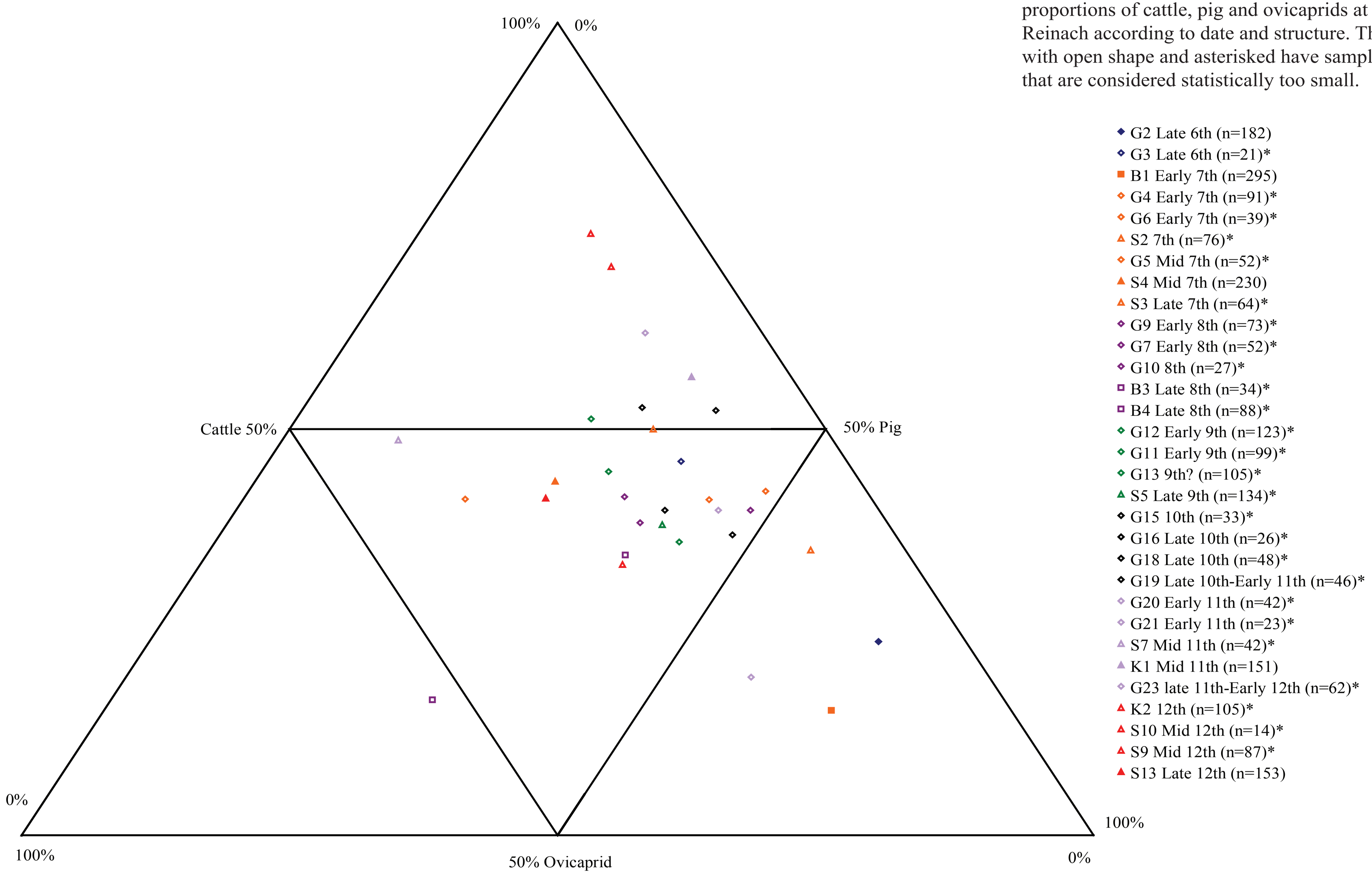

Fig. 4.2.2.4-4 Triangle plot showing the proportions of cattle, pig and ovicaprids at Reinach according to date and structure. Those with open shape and asterisked have samples that are considered statistically too small.

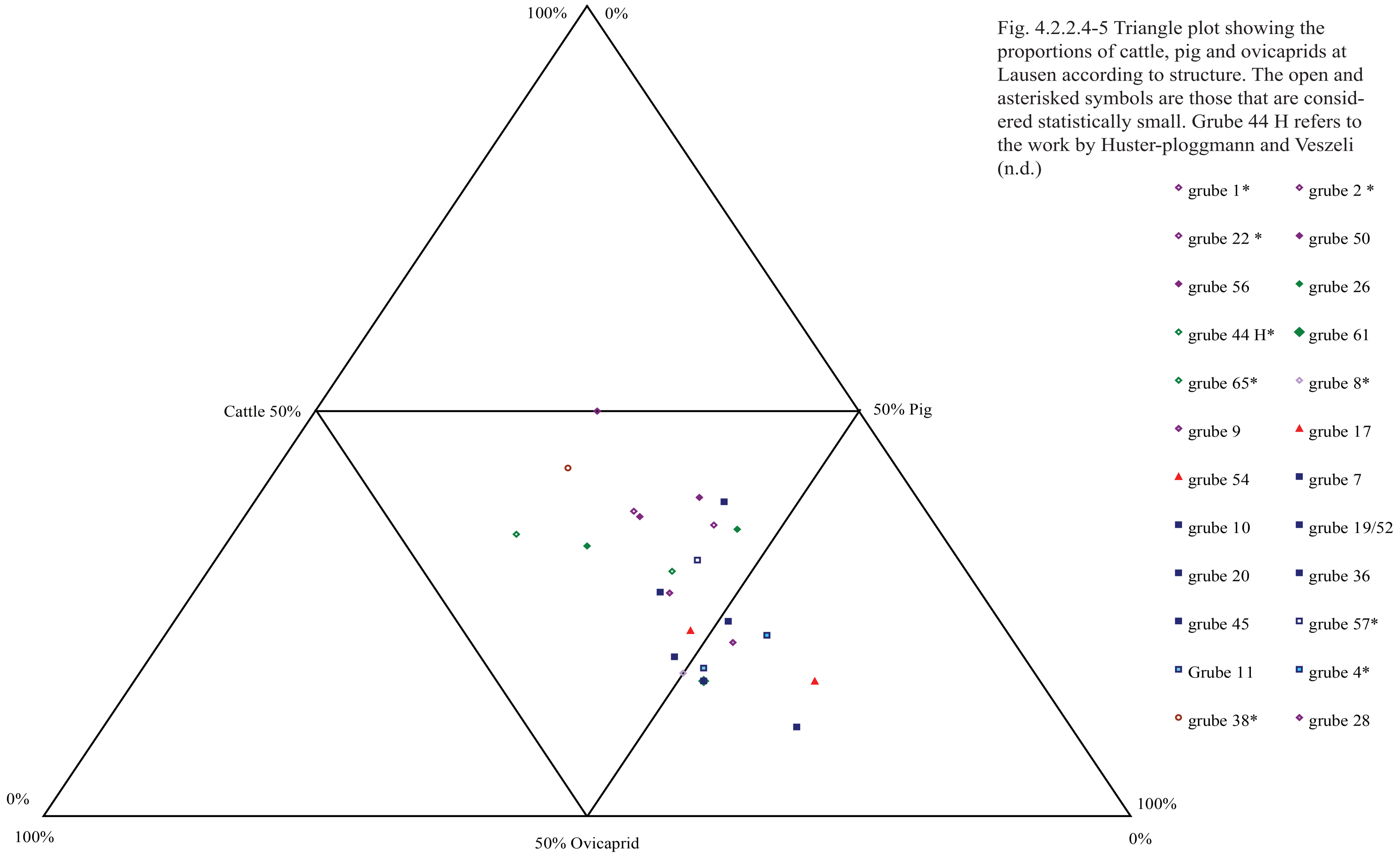

Fig. 4.2.2.4-5 Triangle plot showing the proportions of cattle, pig and ovicaprids at Lausen according to structure. The open and asterisked symbols are those that are considered statistically small. Grube 44 H refers to the work by Huster-ploggmann and Veszeli (n.d.)

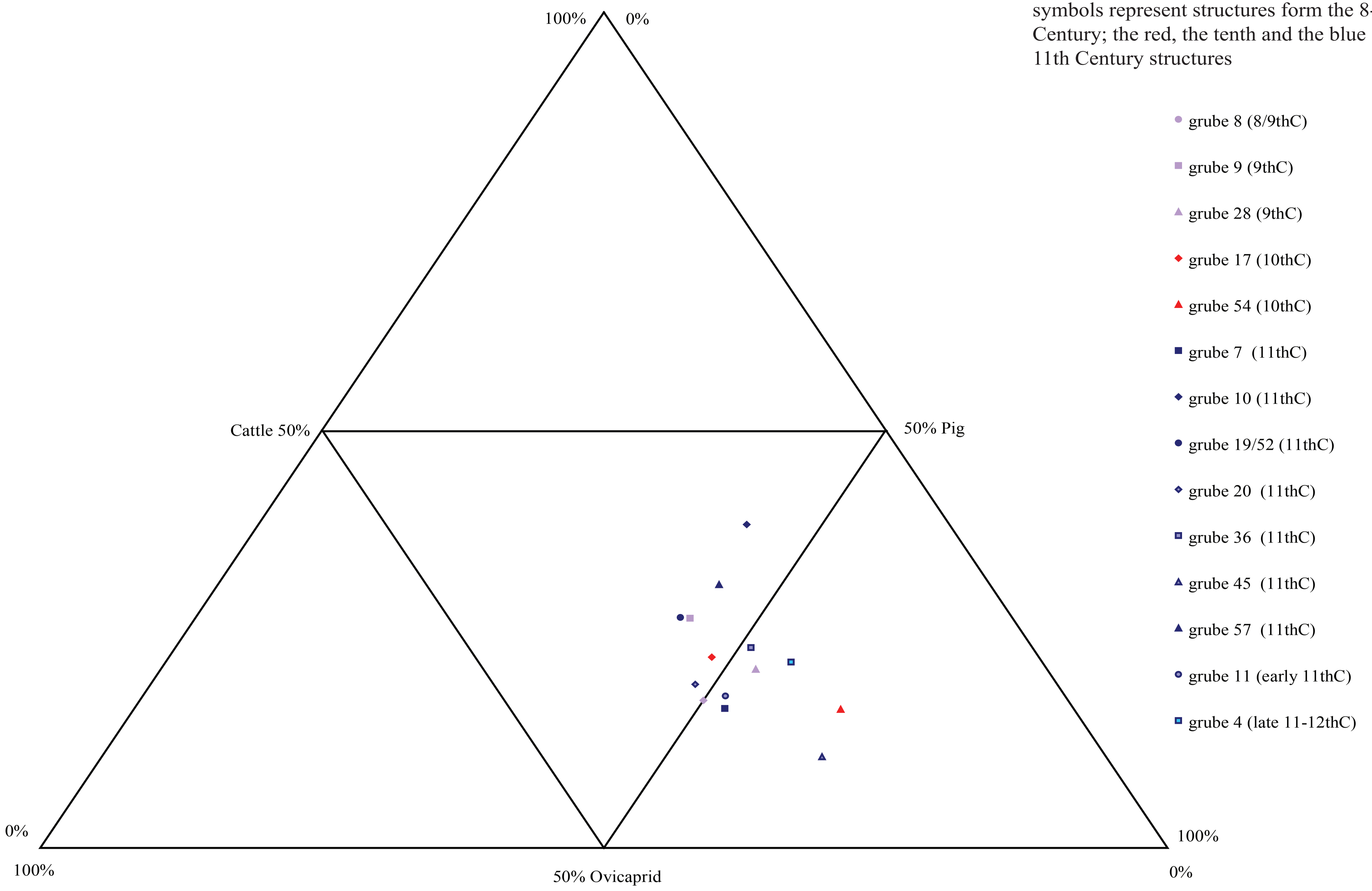

Fig. 4.2.2.4-5a Triangle plot showing the proportions of cattle, pig and ovicaprids at Lausen according to structure. The purple symbols represent structures form the 8-9th Century; the red, the tenth and the blue sybols 11th Century structures

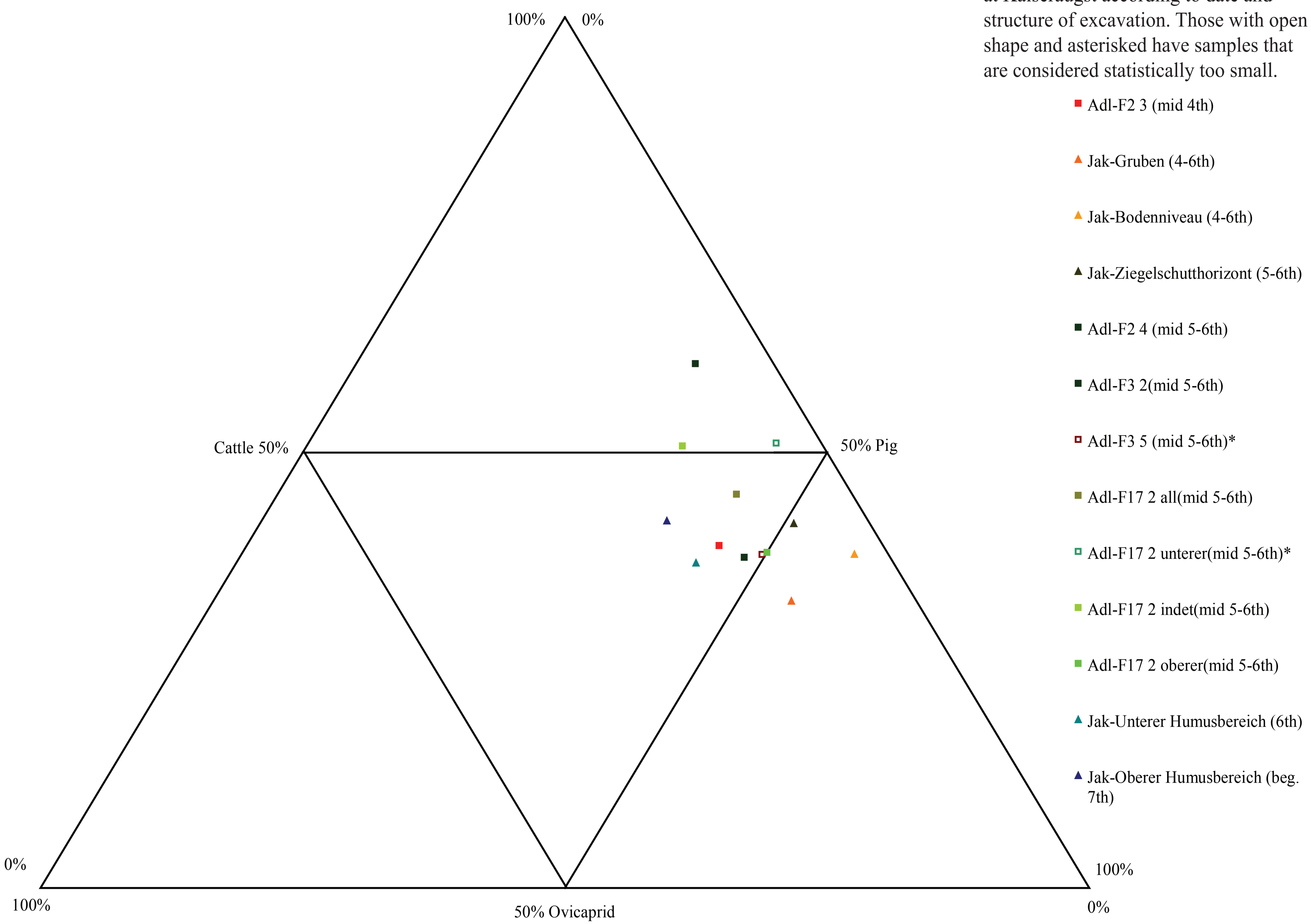

Fig.4.2.2.4-6; Triangle plot showing the proportions of cattle, pig and ovicaprids at Kaiseraugst according to date and structure of excavation. Those with open shape and asterisked have samples that are considered statistically too small.

Manching	Max.	Min.	Total	mid-point	approx carcass proptn of lwt
Bos taurus	275	250	525	262.5	45%
Sus domesticus	75	100	175	87.5	66%
Ovis/Capra	40	35	75	37.5	45%

Table 4.2.2.5-1; The liveweights (in kgs) used in the Manching analysis (after Boessneck *et al* . 1971)
max. - maximum, min. - minimum, lwt - liveweight

Area	Adl		Jak		Adl		Adl		Jak		Jak		Jak		Adl		Fbk	
Date	Mid 4thC		4-6thC		450-500*		5-6thC		5-6thC		6thC		Beg. 7thC		12thC*		12thC*	
Bos taurus	82950	78.89%	15487.5	65.76%	6300	62.53%	109462.5	70.74%	67987.5	69.92%	108675	67.46%	56175	72.68%	6300	59.93%	3412.5	56.06%
Sus domesticus	19687.5	18.72%	7875	33.44%	3587.5	35.61%	40775	26.35%	27562.5	28.35%	44625	27.70%	17325	22.42%	3762.5	35.79%	1400	23.00%
Ovis/Capra	2512.5	2.39%	187.5	0.80%	187.5	1.86%	4500	2.91%	1687.5	1.74%	7800	4.84%	3787.5	4.90%	450	4.28%	1275	20.94%
Total	105150		23550		10075		154737.5		97237.5		161100		77287.5		10512.5		6087.5	

Table 4.2.2.5-2; Calculation of the total liveweight (in Kgs) and proportions (%) of the three main domestic species at Kaiseraugst split by area and date by multiplying the number of fragments (table 4-1) by the midpoint from the Manching data (table 4.2.2.5-1) of that species, Jak -Kaiseraugst Jakobli-Haus, Adl - Kaiseraugst Gasthof Adler, Fbk -Kaiseraugst Fabrikstrasse; * denotes small samples

Area	Adl	Jak	Adl	Adl	Jak	Jak	Jak	Adl	Fbk
Date	Mid 4thC	4th-6thC	450-500*	5-6thC	5th-6thC	6thC	Beg. 7thC	12thC*	12thC*
Bos taurus	4.21	1.97	1.76	2.68	2.47	2.44	3.24	1.67	2.44
Sus domesticus	1	1	1	1	1	1	1	1	1
Ovis/Capra	0.13	0.02	0.05	0.11	0.06	0.17	0.22	0.12	0.91

Table 4.2.2.5-3; Meat ratios of the three main domestic species at Kaiseraugst compared to those of pig, abbreviations as table 4.2.2.5-2; * denotes small samples

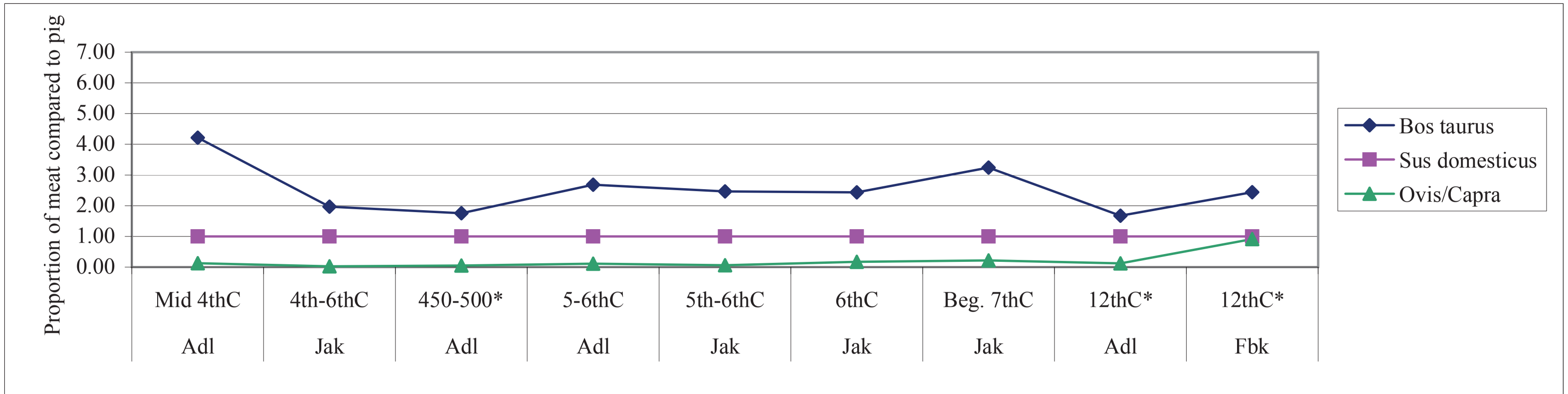

Figure 4.2.2.5-4; The meat proportions provided by the three main domestic species at Kaiseraugst with pig set as the standard, abbreviations as table 4.2.2.5-2
* denotes small samples

	GMZ 6th		Sth Early 7th*		AB 7th		GMZ 7th*		Sth Late 7th		AB 8th*		GMZ 8th		GMZ 9th	
Bos taurus	14175	53.09%	7612.5	66.63%	11550	38.26%	14437.5	70.99%	32550	76.66%	10500	64.12%	15750	70.23%	35962.5	73.84%
Sus domesticus	11812.5	44.24%	3062.5	26.81%	16800	55.65%	5337.5	26.24%	7175	16.90%	4375	26.72%	4987.5	22.24%	10150	20.84%
Ovis/Capra	712.5	2.67%	750	6.56%	1837.5	6.09%	562.5	2.77%	2737.5	6.45%	1500	9.16%	1687.5	7.53%	2587.5	5.31%
Total	26700		11425		30187.5		20337.5		42462.5		16375		22425		48700	

Table 4.2.2.5-5; Calculation of total liveweight (in Kgs) and proportions (%) of the three main domestic species at Reinach split by area and date by multiplying the number of fragments (table 4-2a) by the midpoint from the Manching data (table 4.2.2.5-1) of that species, GMZ -Reinach Gemeindezentrum, Sth - Reinach Stadthof, AB -Reinach Altebrauerei; * denotes small samples

	Sth 9thC*		GMZ 10th*		GMZ 11thC*		Sth 11thC		GMZ 12thC*		Sth 12thC	
Bos taurus	12337.5	69.75%	13125	76.81%	6300	59.29%	25462.5	81.74%	13912.5	82.87%	43312.5	78.80%
Sus domesticus	4375	24.73%	3325	19.46%	3762.5	35.41%	4637.5	14.89%	2275	13.55%	8575	15.60%
Ovis/Capra	975	5.51%	637.5	3.73%	562.5	5.29%	1050	3.37%	600	3.57%	3075	5.59%
Total	17687.5		17087.5		10625		31150		16787.5		54962.5	

Table 4.2.2.5-5 contd

	GMZ 6thC	Sth Early 7thC*	AB 7thC	GMZ 7thC*	Sth Late 7thC	AB 8thC*	GMZ 8thC	GMZ 9thC	Sth 9thC*	GMZ 10thC*	GMZ 11thC*	Sth 11thC	GMZ 12thC*	Sth 12thC
Bos taurus	1.20	2.49	0.69	2.70	4.54	2.40	3.16	3.54	2.82	3.95	1.67	5.49	6.12	5.05
Sus domesticus	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ovis/Capra	0.06	0.24	0.11	0.11	0.38	0.34	0.34	0.25	0.22	0.19	0.15	0.23	0.26	0.36

Table 4.2.2.5-6; Meat ratios of the three main domestic species at Reinach compared to those of pig, abbreviations as table 4.2.2.5-2; * denotes small samples

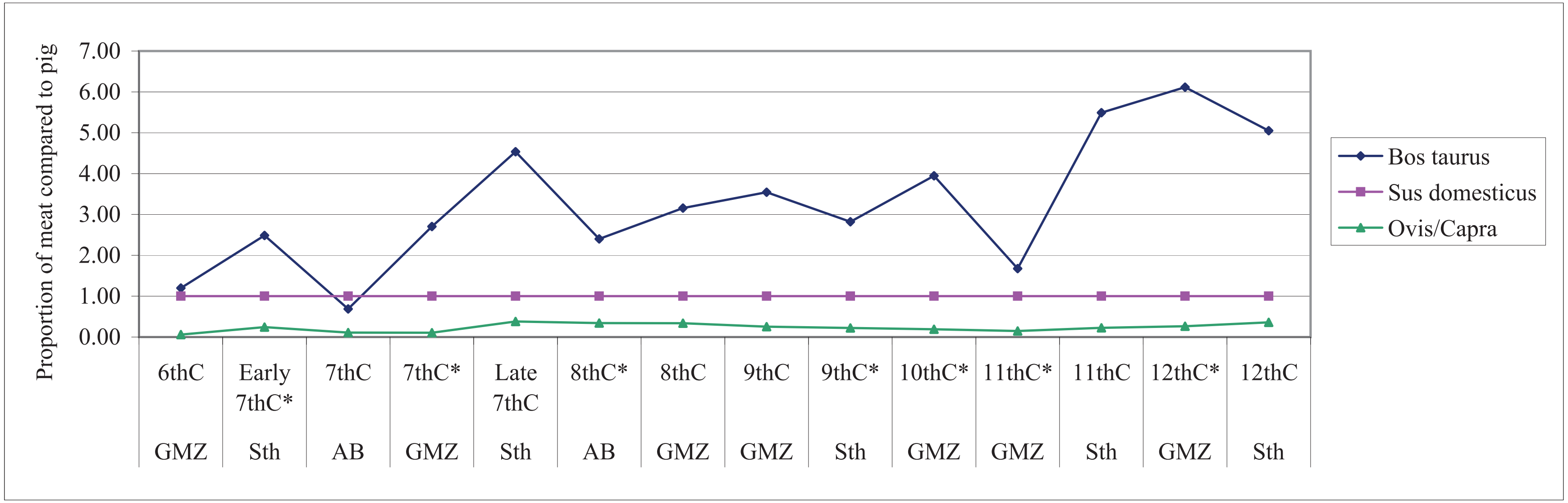

Figure 4.2.2.5-7; The meat proportions provided by the three main domestic species at Reinach with pig set as the standard, abbreviations as table 4.2.2.5-5; *denotes small samples

Lausen	6th		7th*		8-9th*		9th		10th		Early 11th		11th		Late 11th*		12th*	
Bos taurus	38587.5	71.91%	6562.5	70.75%	3150	45.32%	113925	52.09%	42000	43.74%	12075	45.46%	107887.5	56.36%	8137.5	50.74%	16012.5	76.43%
Sus domesticus	11812.5	22.01%	1662.5	17.92%	2975	42.81%	85750	39.21%	46550	48.48%	11637.5	43.81%	68775	35.93%	6737.5	42.01%	3325	15.87%
Ovis/Capra	3262.5	6.08%	1050	11.32%	825	11.87%	19012.5	8.69%	7462.5	7.77%	2850	10.73%	14775	7.72%	1162.5	7.25%	1612.5	7.70%
Total	53662.5		9275		6950		218687.5		96012.5		26562.5		191437.5		16037.5		20950	

Table 4.2.2.5-8; Calculation of the total liveweight (in Kgs) and proportions (%) of the three main domestic species at Lausen split by date, by multiplying the number of fragments (table 4-2) by the midpoint from the Manching data (table 4.2.2.5-1) of that species, GMZ -Reinach Gemeindezentrum, Sth - Reinach Stadthof, AB -Reinach Altebrauerei; *denotes small samples

	6th	7thC*	8-9th*	9thC	10th	Early 11thC	11thC	Late 11thC*	12thC*
Bos taurus	3.27	3.95	1.06	1.33	0.90	1.04	1.57	1.21	4.82
Sus domesticus	1	1	1	1	1	1	1	1	1
Ovis/Capra	0.28	0.63	0.28	0.22	0.16	0.24	0.21	0.17	0.48

Table 4.2.2.5-9; Meat ratio of the three main domestic species at Lausen compared to those of pig; *denotes small samples

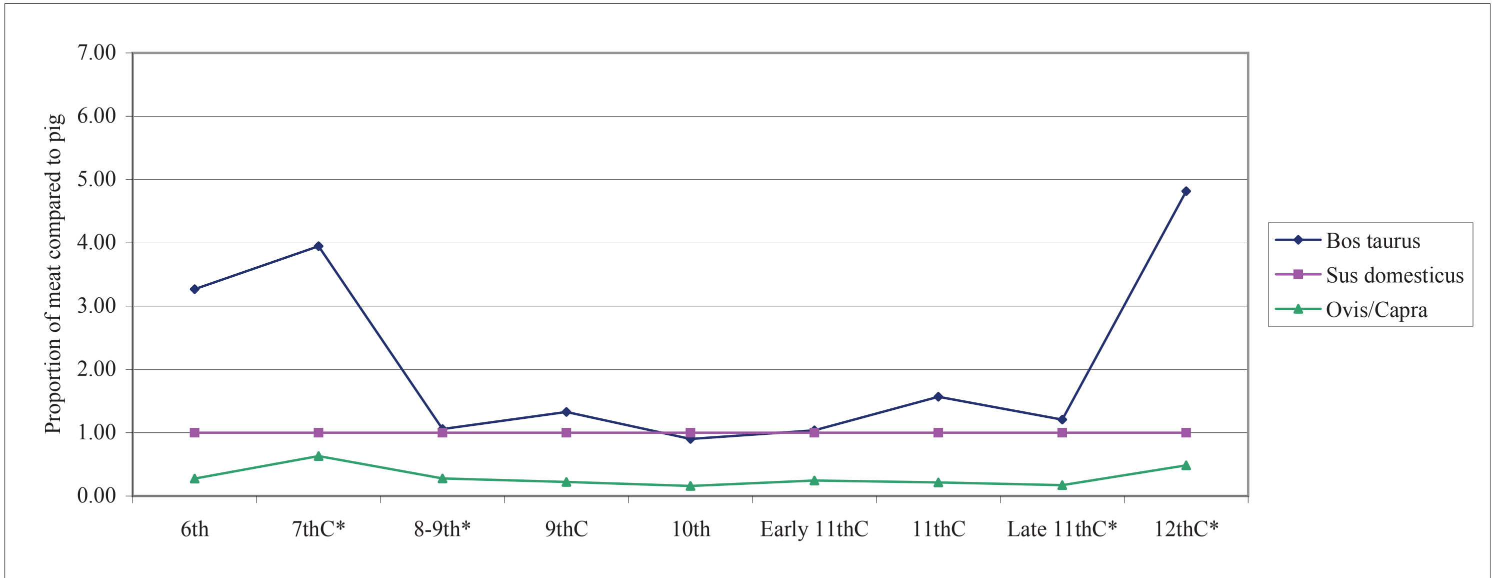

Figure 4.2.2.5-10; The meat proportions provided by the three main domestic species at Lausen with pig set as the standard; *denotes small samples

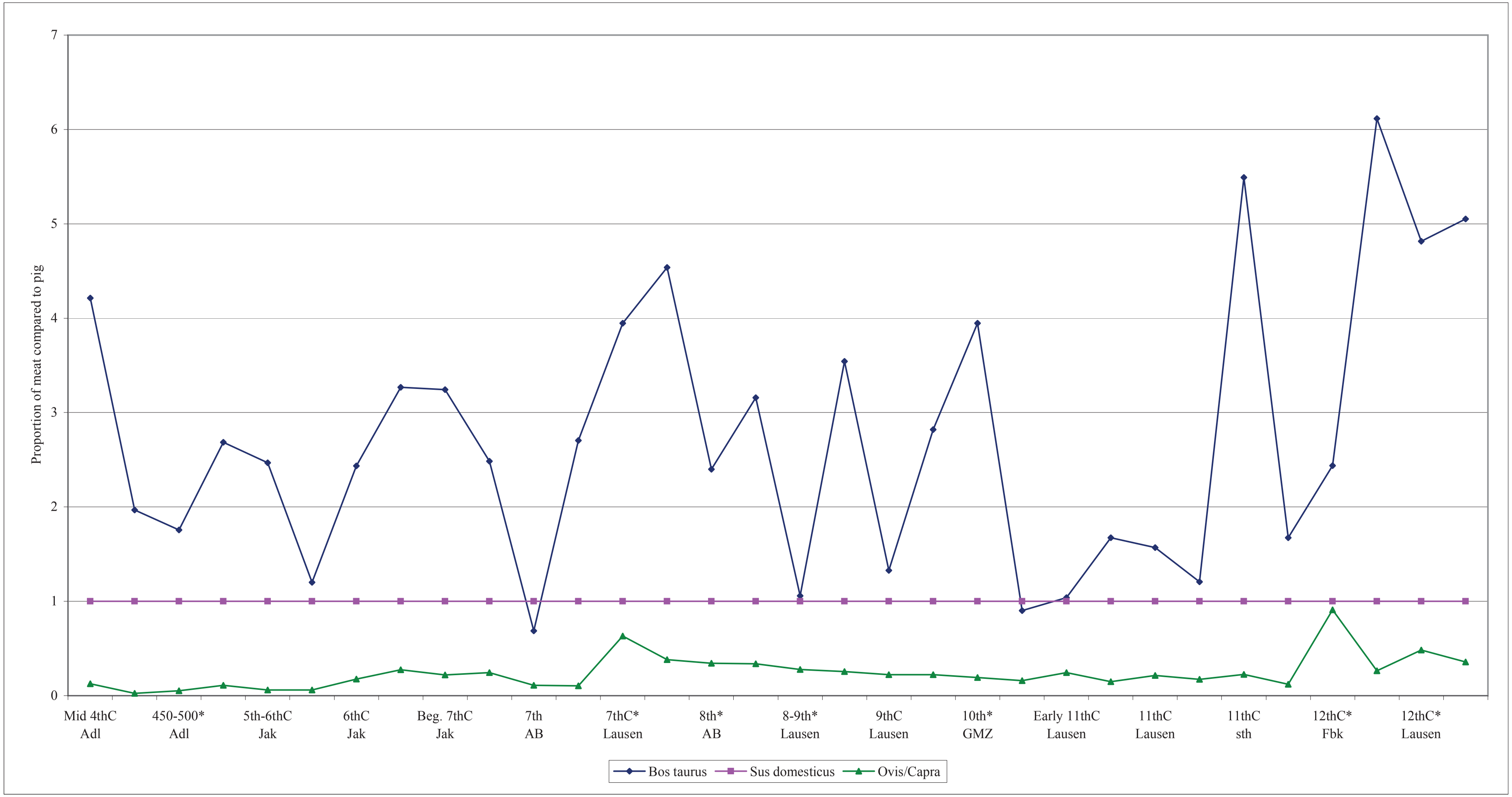

Figure 4.2.2.5-11; The meat ratios from all sites and areas of the excavations in the studies here; Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Reinach Gemeindezentrum, sth- Reinach Stadthof, AB- Reinach Altebrauerei, Fbk- Kaiseraugst Fabrikstrasse*denotes small samples

	Alte Brauerei (AB)				**Gemeindezentrum**			
Grouping	7thC n.	Mass g.	8thC n.	Mass g.	Late 6thC n.**	Mass g.**	Late 7thC n.	Mass g.
Domestic Mammals	288	2064.90	130	1737.80	214	3303.10	138	2868.60
Main Domestic Mammals	285	1987.00	130	1737.80	208	3114.20	131	2614.20
Minor Domestic Mammals	3	77.90	0	0.00	6	188.90	7	254.40
Domestic Birds	5	2.60	4	1.50	0	0.00	2	1.40
Wild Mammals	9	786.30	1	1.20	0	0.00	3	28.70
Wild Birds	0	0.00	0	0.00	0	0.00	0	0.00

Table 4.2.3.1-1; Fragment count and weight of the grouped data t Reinach across different periods and areas; *denotes small samples n. - number, g. grammes, rodents and amphibians removed from the data, ** - Not including the seived remains

	Gemeindezentrum (GMZ) contd.							
Grouping	8thC n.	Mass g.	9thC n.	Mass g.	10thC n.	Mass g.	11thC n.	Mass g.
Domestic Mammals	167	2293.20	336	4618.20	114	2647.20	83	918.60
Main Domestic Mammals	162	2199.00	322	4174.30	105	2353.00	82	906.40
Minor Domestic Mammals	5	94.20	14	443.90	9	294.20	1	12.20
Domestic Birds	14	25.40	25	22.50	3	7.80	3	2.10
Wild Mammals	4	51.90	8	96.70	1	1.00	2	4.90
Wild Birds	0	0.00	0	0.00	0	0.00	0	0.00

Table 4.2.3.1-1contd

	GMZ (contd)		**Stadthof**					
Grouping	12thC n.	Mass g.	Early 7thC n.	Mass g.	Late 7thC n.	Mass g.	9thC n.	Mass g.
Domestic Mammals	95	1053.70	85	989.90	285	5053.80	130	2447.90
Main Domestic Mammals	95	1053.70	84	970.70	279	5039.50	123	1655.30
Minor Domestic Mammals	0	0.00	1	19.20	6	14.30	7	792.60
Domestic Birds	11	10.40	7	9.20	10	9.20	0	0.00
Wild Mammals	0	0.00	1	0.10	2	54.10	4	65.90
Wild Birds	2	0.60	0	0.00	2	1.90	0	0.00

Table 4.2.3.1-1contd

	Stadthof (contd.)			
Species	11thC n.	Mass g.	12thC n.	Mass g.
Domestic Mammals	180	3035.90	357	7126.60
Main Domestic Mammals	178	2854.30	345	6501.50
Minor Domestic Mammals	2	181.60	12	625.10
Domestic Birds	8	7.30	18	23.70
Wild Mammals	1	46.60	0	0.00
Wild Birds	0	0.00	1	0.30

Table 4.2.3.1-1 contd

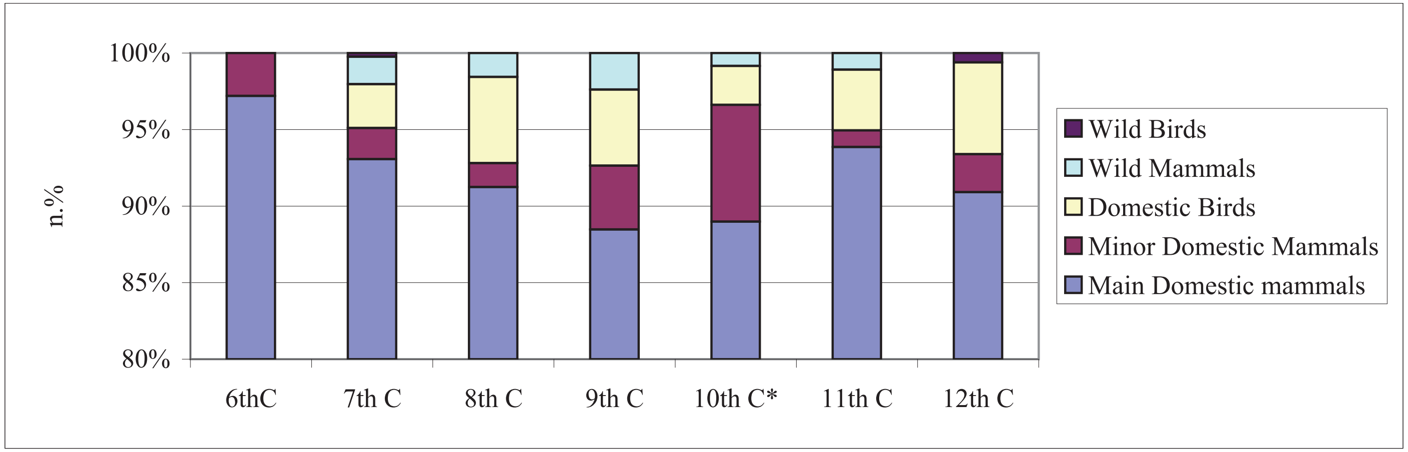

Figure 4.2.3.1-2; Grouped Count Data from the Reinach excavation by period, rodents and amphibians removed; *denotes small samples

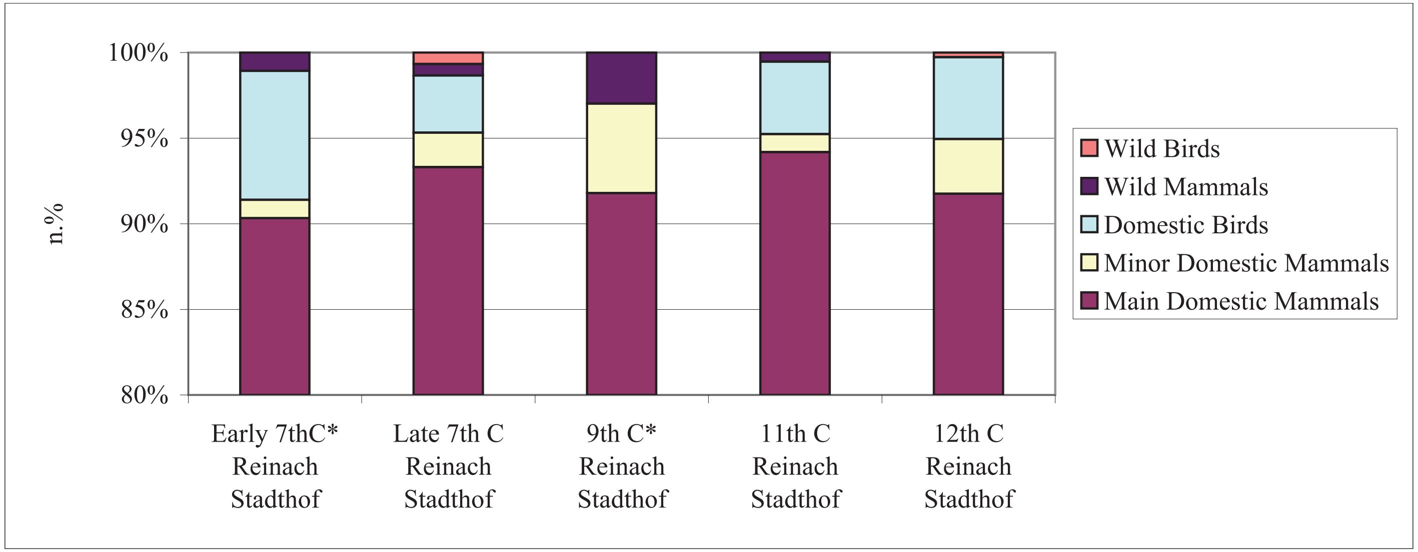

Figure 4.2.3.1-3; Grouped Count Data from Reinach Stadthof by period, rodents and amphibians removed; *denotes small samples

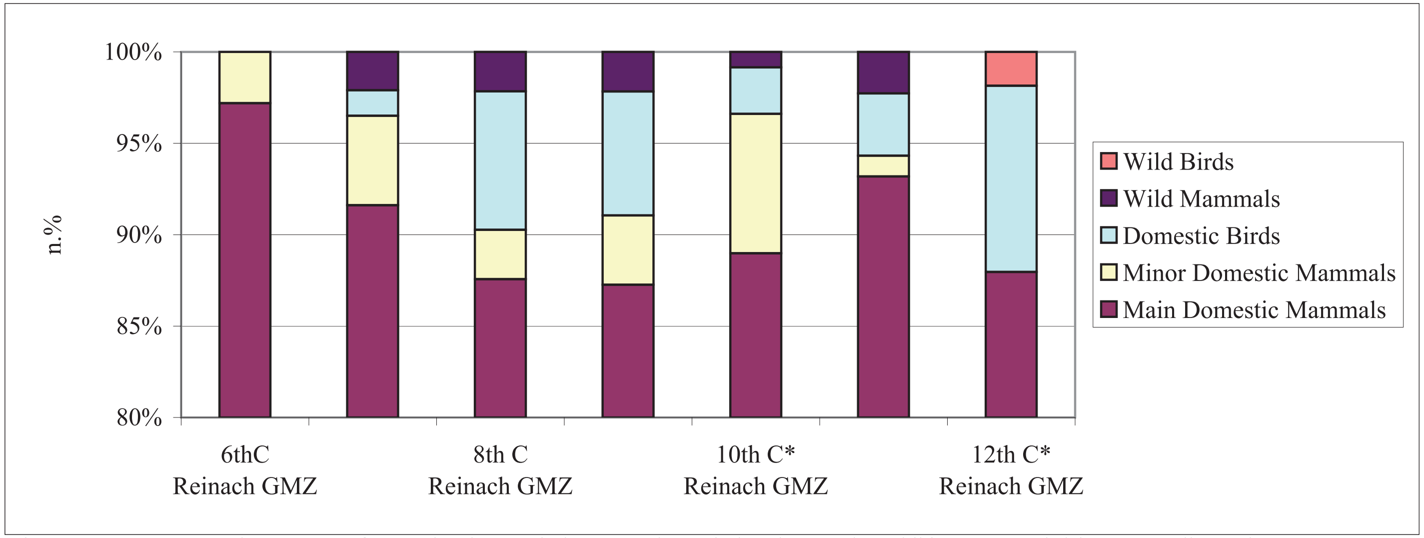

Figure 4.2.3.1-4; Grouped Count Data from Reinach Gemeindezentrum by period, rodents and amphibians removed; *denotes small samples

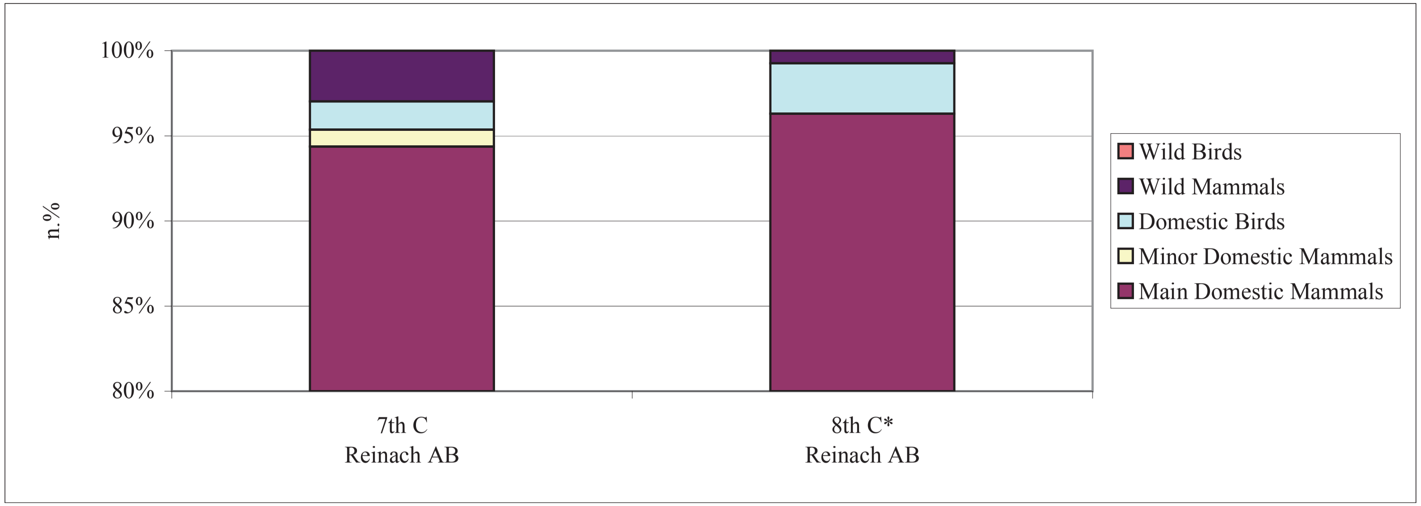

Figure 4.2.3.1-5; Grouped Count Data from Reinach Altebrauerei by period, rodents and amphibians removed; *denotes small samples

	Lausen							
Species	Late 6thC n.	Mass g.	Late 7thC n.	Mass g.	8-9thC n.	Mass g.	9thC n.	Mass g.
Domestic Mammals	384	9062.10	77	1618.70	68	739.50	1958	22975.90
Main Domestic Mammals	369	8431.70	72	1100.80	68	739.50	1921	21807.90
Minor Domestic Mammals	15	630.40	5	517.90	0	0.00	37	1168.00
Domestic Birds	2	4.40	7	4.80	0	0.00	56	79.90
Wild Mammals	6	102.30	0	0.00	12	377.40	8	59.10
Wild Birds	1	0.40	2	0.60	0	0.00	9	11.10

Table 4.2.3.2-1; Fragment count and weight of the grouped data from Lausen across different periods,
n. - number, g. grammes, rodents and amphibians removed from the data; denotes small samples

	Lausen (contd)							
Species	10thC n.	Mass g.	Early 11thC n.	Mass g.	c.11thC n.	Mass g.	Late11/12thC n.	Mass g.
Domestic Mammals	963	15048.70	262	2312.00	1659	16788.70	146	1081.90
Main Domestic Mammals	891	7174.10	255	2067.30	1591	43.50	139	921.10
Minor Domestic Mammals	72	7874.60	7	244.70	68	111.30	7	160.80
Domestic Birds	51	60.00	4	3.20	23	22.90	3	2.60
Wild Mammals	4	46.80	7	13.50	17	124.70	0	0.00
Wild Birds	1	0.60	1	2.10	1	0.30	0	0.00

Table 4.2.3.2-1contd

	Lausen (contd)	
Species	mid 12thC n.	mass g.
Domestic Mammals	150	2825.60
Main Domestic Mammals	142	2647.80
Minor Domestic Mammals	8	177.80
Domestic Birds	3	3.30
Wild Mammals	0	0.00
Wild Birds	0	0.00

Table 4.2.3.2-1contd

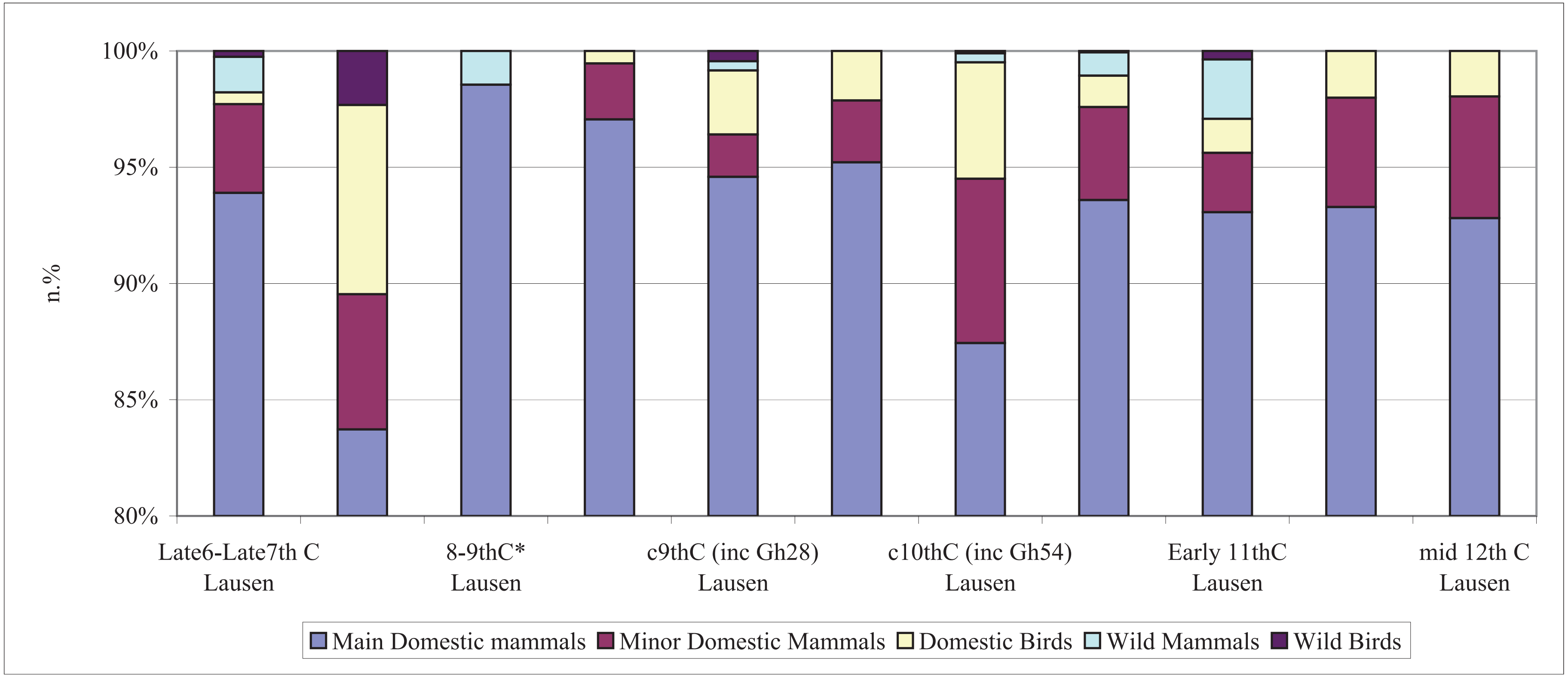

Figure 4.2.3.2-2; Grouped Count Data from the Lausen excavation by period, rodents and amphibians removed; denotes small samples

Species	Jakobli-Haus 4-6thC n.	Mass g.	5th-6th C n.	Mass g.	6th C n.	Mass g.	Beg. 7th C n.	Mass g.
Domestic Mammals	344	9308.00	631	19935.60	1146	39144.90	522	13025.70
Main Domestic Mammals	344	9308.00	619	19559.10	1132	37819.20	513	12515.10
Minor Domestic Mammals	0	0.00	12	376.50	14	1325.70	9	510.60
Domestic Birds	67	91.20	39	71.80	38	82.70	8	14.30
Wild Mammals	13	275.30	13	650.90	17	1158.20	5	225.20
Wild Birds	24	3.20	2	1.60	1	1.00	0	0.00

Figure 4.2.3.3-1; Grouped Count Data from the Kaiseraugst excavation by period, rodents and amphibians removed
n. - number, g. grammes, rodents and amphibians removed from the data; denotes small samples

Species	Gasthof Adler Mid 4th C n.	Mass g.	5th-6th C n.	Mass g.	12thC* n.	Mass g.
Domestic Mammals	617	17793.70	1091	33036.90	82	1753.60
Main Domestic Mammals	608	17098.40	1073	32426.70	79	1418.10
Minor Domestic Mammals	9	695.30	18	610.20	3	335.50
Domestic Birds	13	25.40	22	37.10	3	4.40
Wild Mammals	5	229.30	21	844.00	0	0.00
Wild Birds	0	0.00	0	0.00	1	0.70

Figure 4.2.3.3-1 contd

Species	Fabrikstrasse 12thC n.*	Mass g.
Domestic Mammals	64	681.40
Main Domestic Mammals	63	681.30
Minor Domestic Mammals	1	0.10
Domestic Birds	2	0.60
Wild Mammals	0	0.00
Wild Birds	0	0.00

Figure 4.2.3.3-1 contd

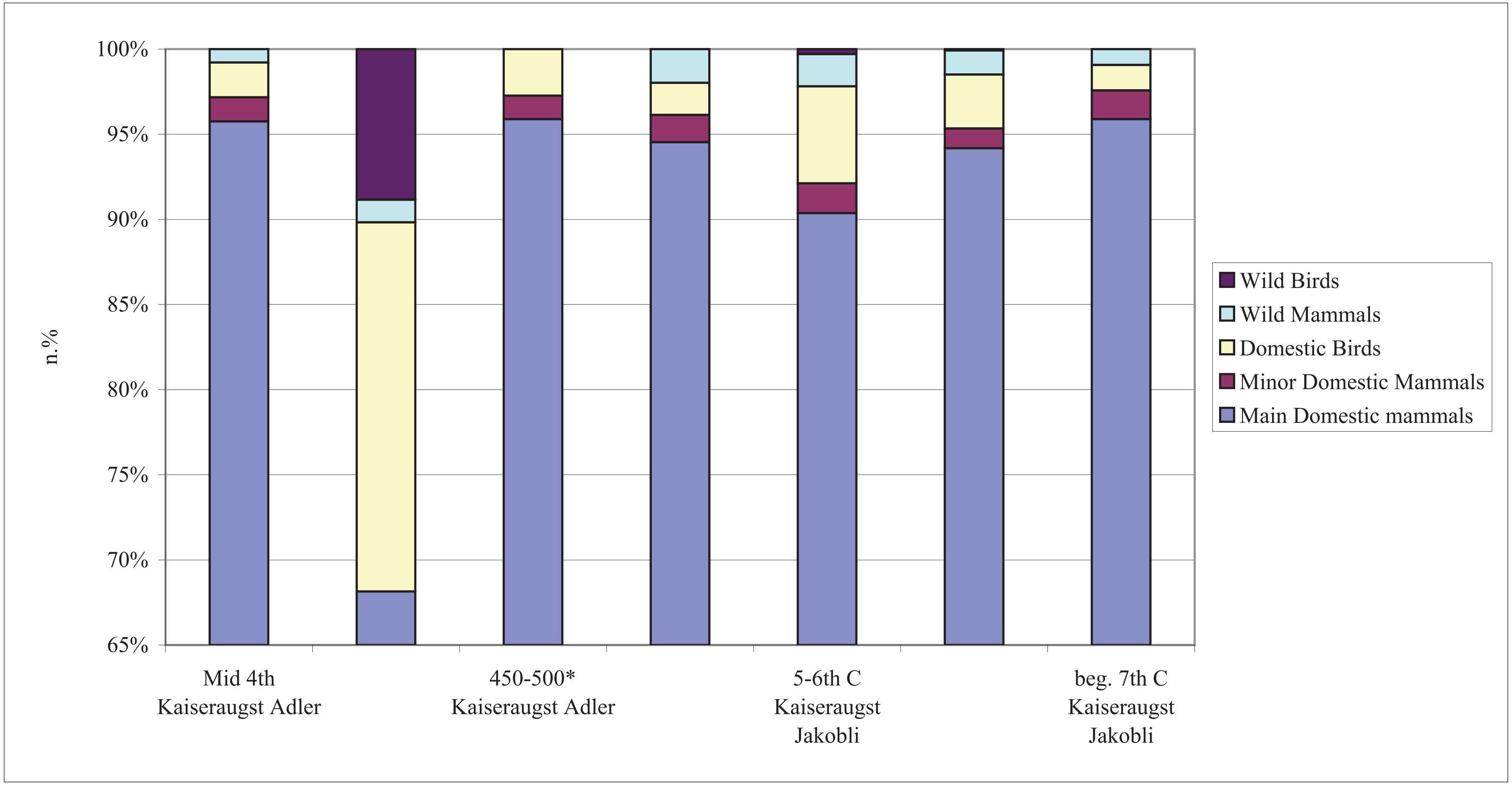

Figure 4.2.3.3-2; Grouped Count Data from the Kaiseraugst excavation by period, rodents and amphibians removed; denotes small samples

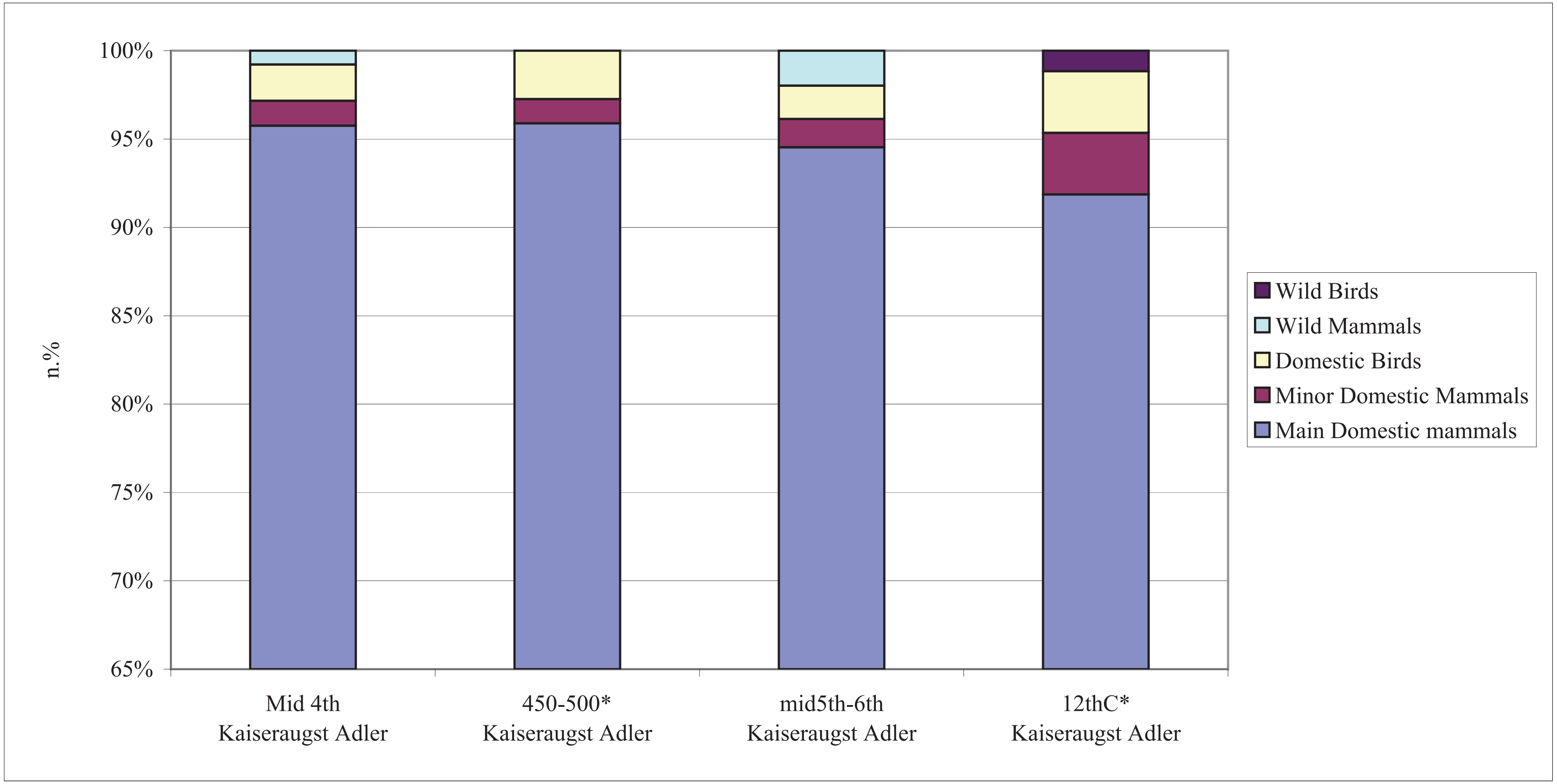

Figure 4.2.3.3-3; Grouped Count Data from Kaiseraugst Gasthof Adler by period, rodents and amphibians removed; denotes small samples

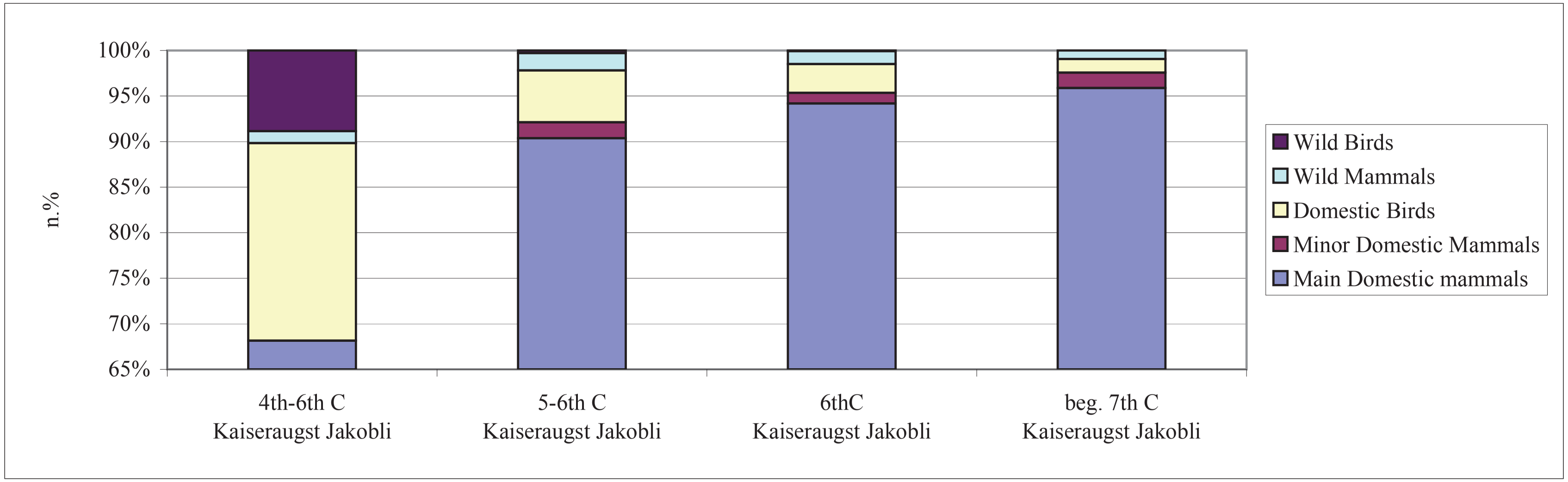

Figure 4.2.3.3-4; Grouped Count Data from Kaiseraugst Jakoblihaus by period, rodents and amphibians removed

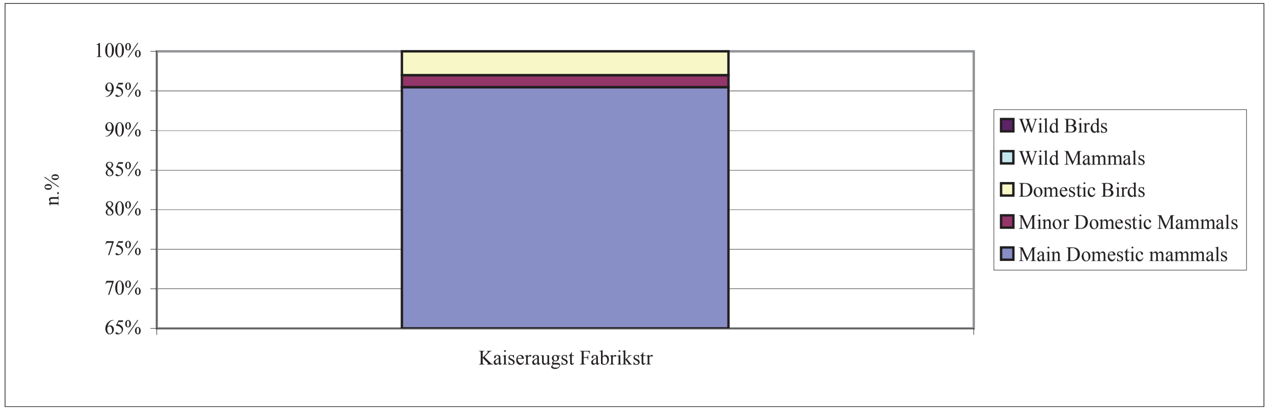

Figure 4.2.3.3-5; Grouped Count Data from Kaiseraugst Fabrikstrasse by period, rodents and amphibians removed

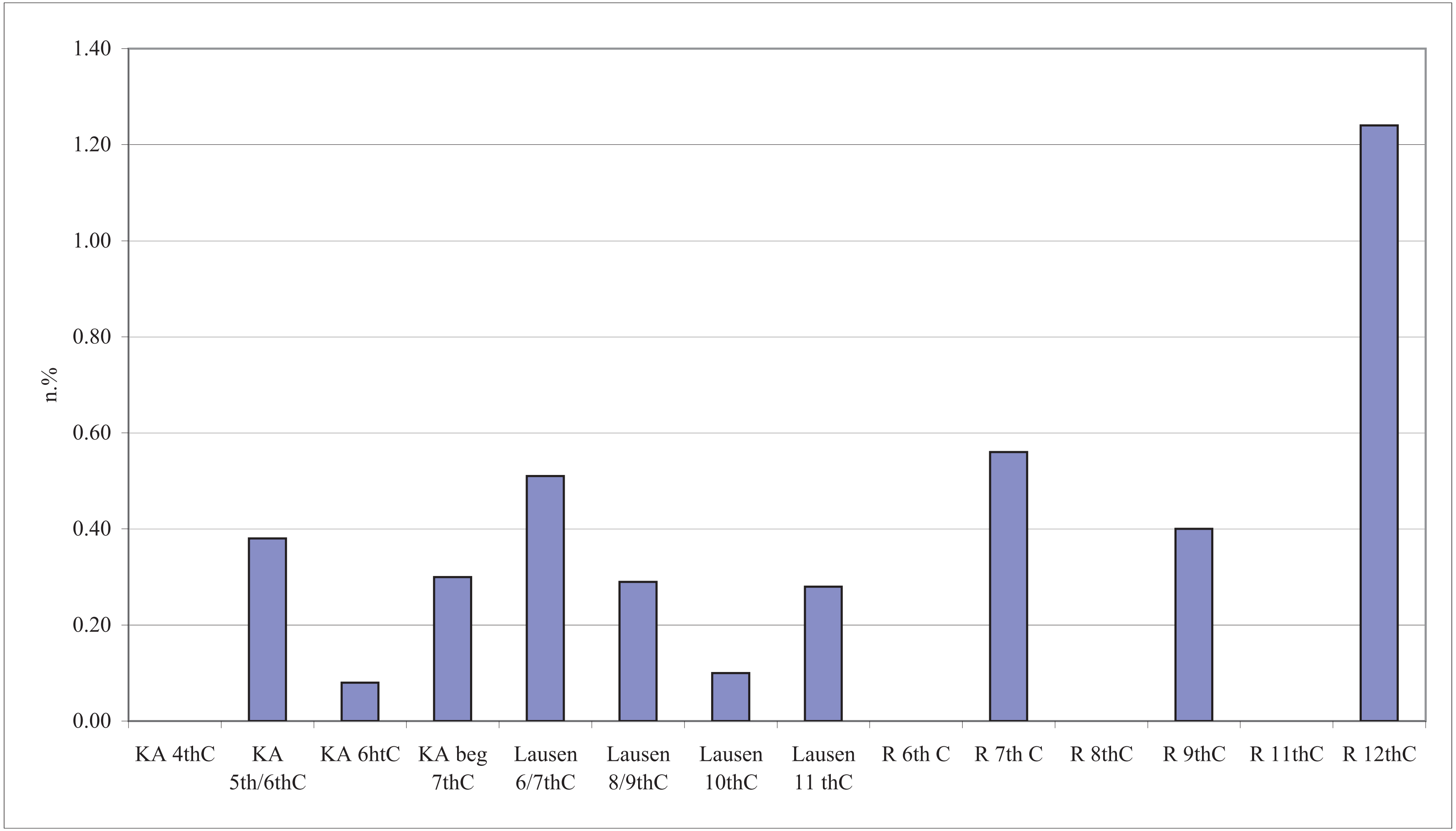

Figure 4.2.3-1; Proportions of dogs present in all excavations by period, KA -Kaiseraugst, R - Reinach

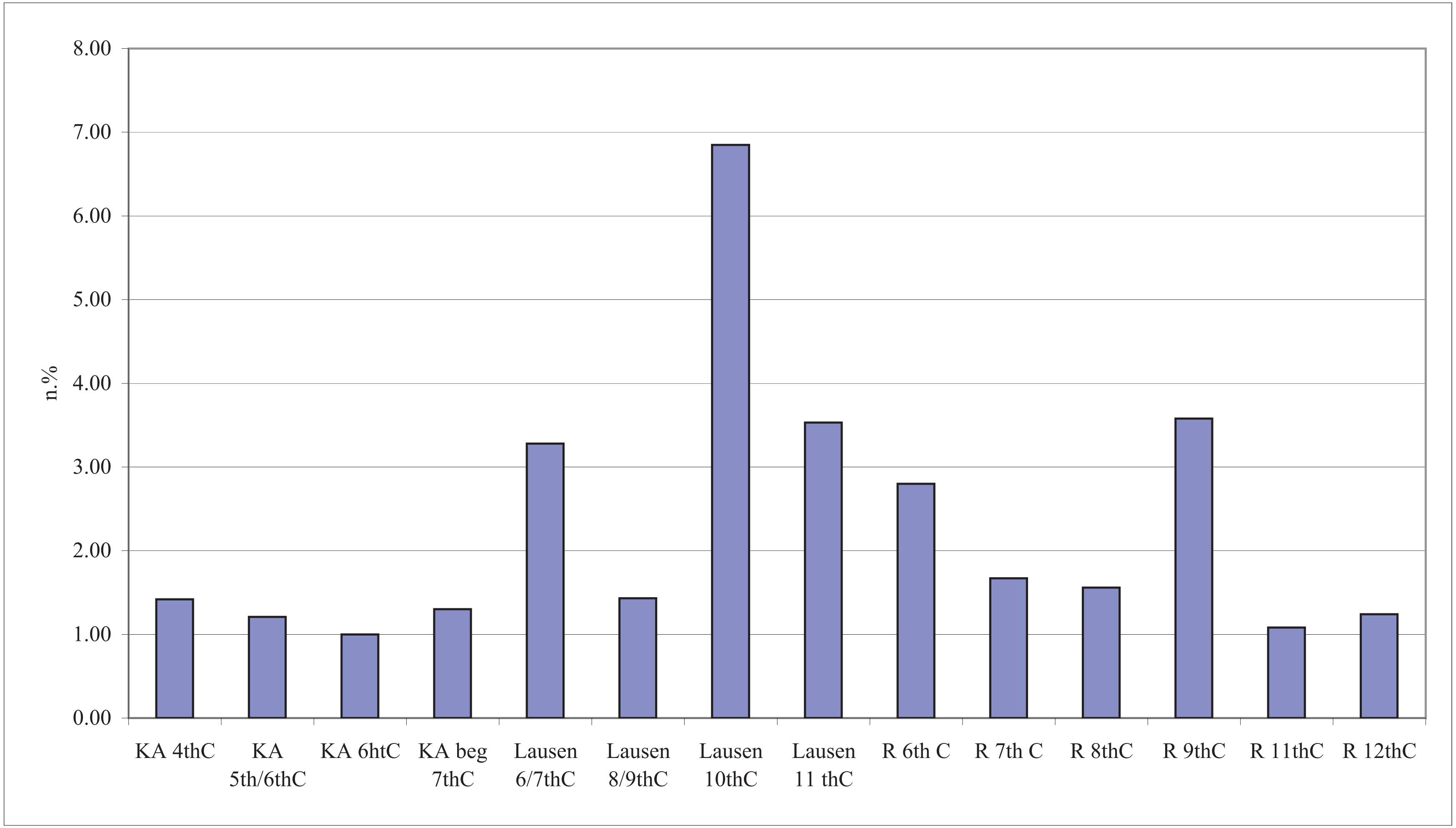

Figure 4.2.3.-2; Proportions of equids present in all excavations by period, KA -Kaiseraugst, R - Reinach

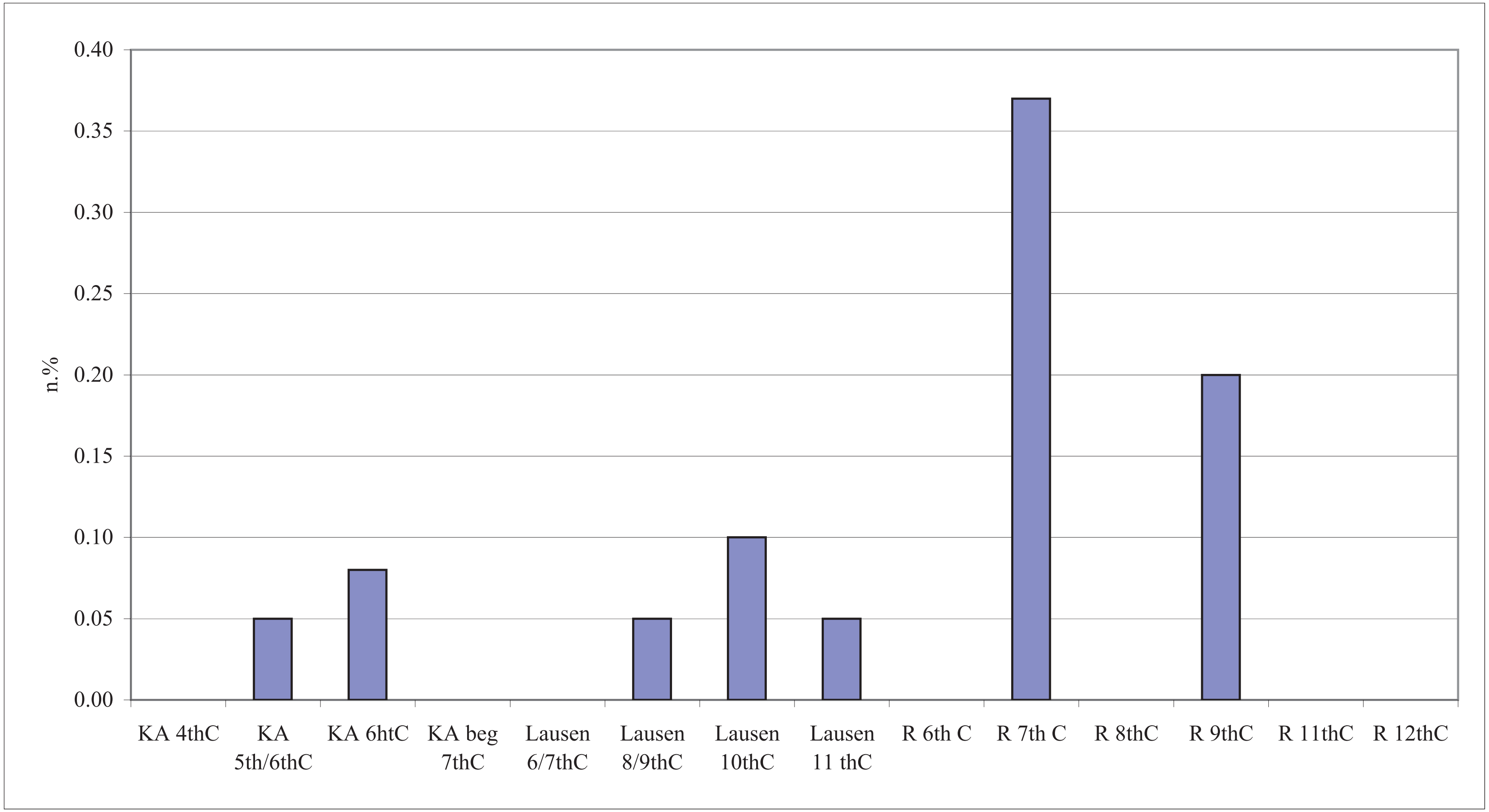

Figure 4.2.3-3; Proportions of felids present in all excavations by period, KA -Kaiseraugst, R - Reinach

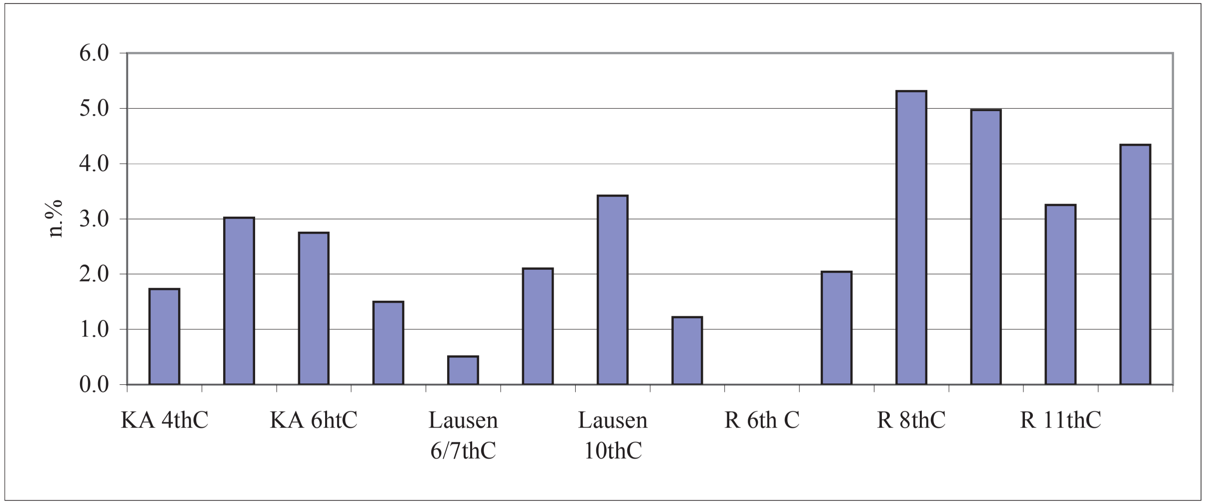

Figure 4.2.4.-1; Proportions of chickens present in all excavations by period, KA -Kaiseraugst, R - Reinach

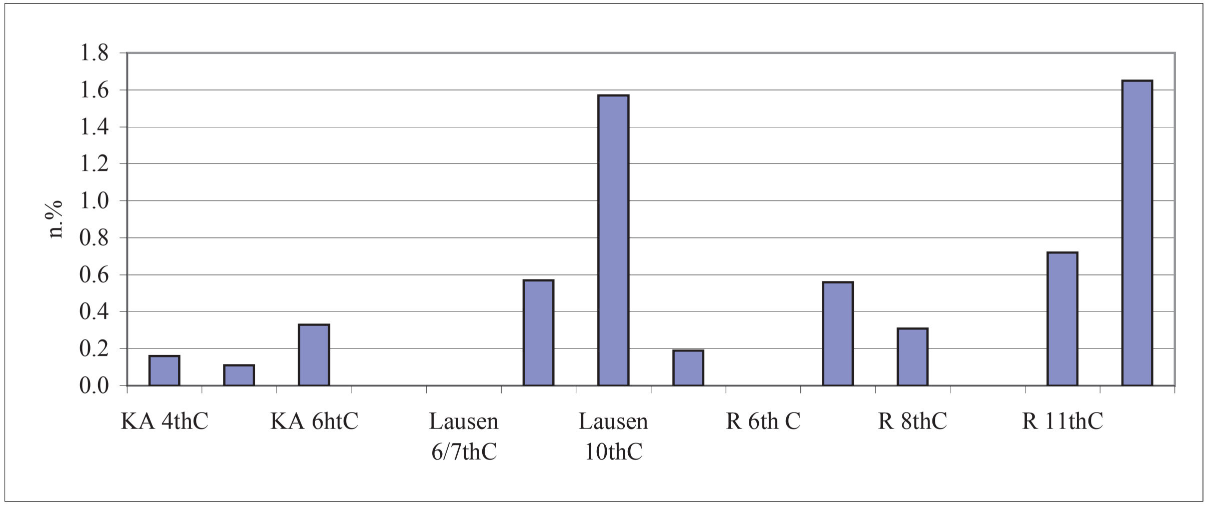

Figure 4.2.4.-2; Proportions of goose present in all excavations by period, KA -Kaiseraugst, R - Reinach

Site	Date	n.	Bos g.	OC g.	Sus g.	Bos g.%	OC g.%	Sus g.%
Reinach GMZ	6thC	202	1886.0	108.7	1119.5	60.56%	3.49%	35.95%
Reinach Stadthof	Early 7thC*	84	545.4	147.6	277.7	56.19%	15.21%	28.61%
Reinach AB	7th C	285	1000.5	191.5	795.0	50.35%	9.64%	40.01%
Reinach GMZ	7th C*	131	2005.7	95.9	512.6	76.72%	3.67%	19.61%
Reinach Stadthof	Late 7th C	279	3650.2	347.3	1042.0	72.43%	6.89%	20.68%
Reinach AB	8th C*	130	1224.7	167.9	345.2	70.47%	9.66%	19.86%
Reinach GMZ	8th C	162	1448.3	305.3	471.4	65.09%	13.72%	21.19%
Reinach GMZ	9th C	322	2802.0	388.1	984.2	67.13%	9.30%	23.58%
Reinach Stadthof	9th C*	123	832.5	137.6	685.2	50.29%	8.31%	41.39%
Reinach GMZ	10th C*	105	1889.3	136.5	327.2	80.29%	5.80%	13.91%
Reinach GMZ	11th C*	82	629.9	47.4	229.1	69.49%	5.23%	25.28%
Reinach Stadthof	11th C	178	1994.3	272.4	587.6	69.87%	9.54%	20.59%
Reinach Stadthof	12th C	345	5109.8	441	950.7	78.59%	6.78%	14.62%
Reinach GMZ	12th C*	95	806.6	43.9	203.2	76.55%	4.17%	19.28%

Table 4.3.1-1; The total weight of fragments for the three main domestic species at Reinach split by area and date; * denotes small samples
Bos - Bos taurus, OC - Ovis/Capra, Sus - sus domesticus, g. -grammes, n. -number, GMZ -Gemeindezentrum, AB -Altebrauerei

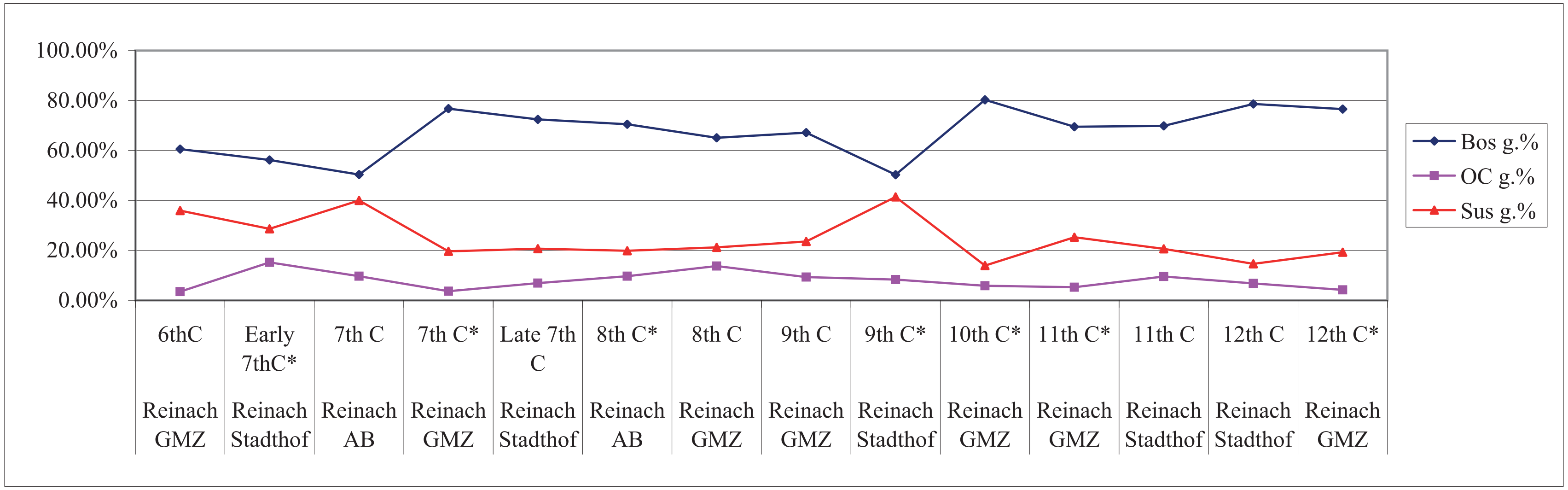

Table 4.3.1-2; The proportions of fragment weight at Reinach by period and area, abbreviations as 4.3.1-1; * denotes small samples

Site	Date	n.	Bos g.	OC g.	Sus g.	Bos g.%	OC g.%	Sus g.%
Lausen	Late6th-Late7th C	369	6541.1	681	1209.6	77.58%	8.08%	14.35%
Lausen	Late7th-Late8thC*	72	953.4	59.8	87.6	86.61%	5.43%	7.96%
Lausen	8th-9thC*	68	377.4	153.4	208.7	51.03%	20.74%	28.22%
Lausen	c9th C (inc Gh28)	1921	10900.9	2911.7	7995.3	49.99%	13.35%	36.66%
Lausen	c10th C	891	2802.1	723.8	3648.2	39.06%	10.09%	50.85%
Lausen	Early 11th C	255	1031.4	329.1	703.8	49.96%	15.94%	34.09%
Lausen	c11th C	1591	6280.7	1643	4699.4	49.76%	13.02%	37.23%
Lausen	late 11th/12th	203	728.5	128.7	340.5	60.82%	10.75%	28.43%
Lausen	mid 12th C*	142	2161.2	166.1	320.5	81.62%	6.27%	12.10%

Table 4.3.2-1; The total weight of fragments for the three main domestic species at Lausen split by date; denotes small samples
Bos - Bos taurus, OC - Ovis/Capra, Sus - sus domesticus, g. -grammes, n. -number

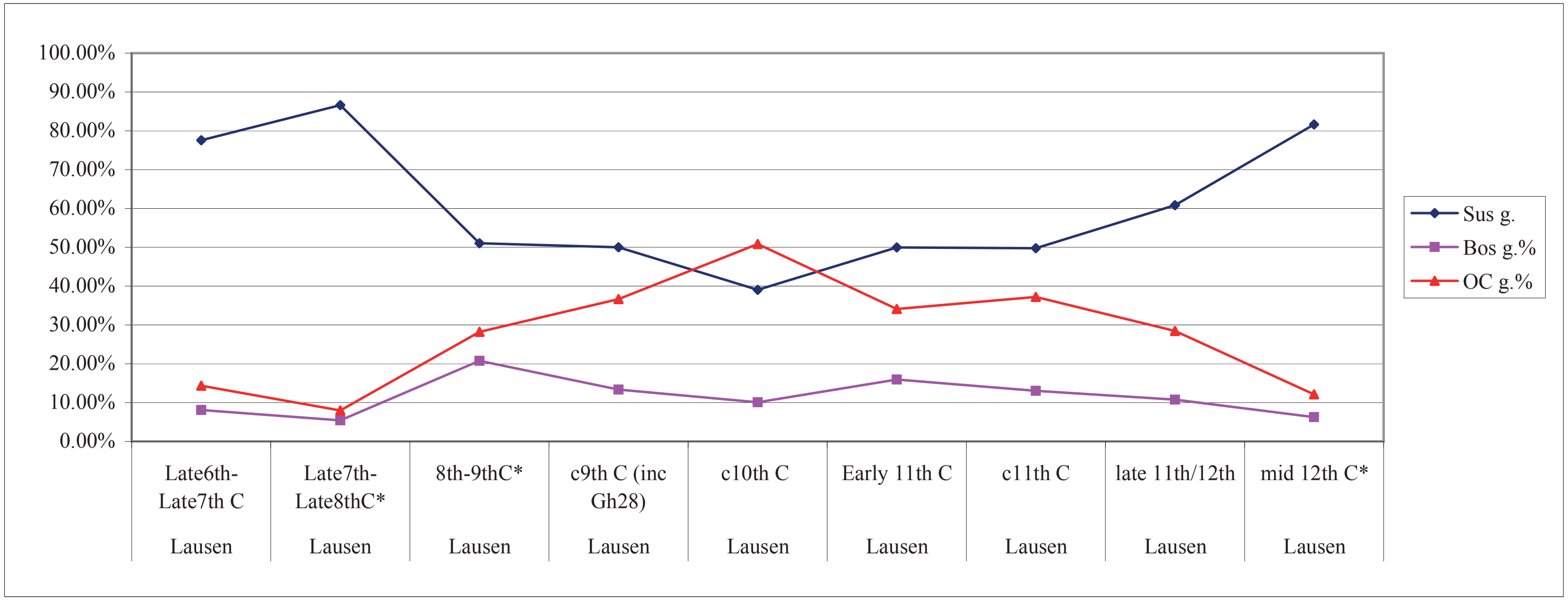

Table 4.3.2-2; The proportions of fragment weight at Lausen by period, abbreviations as 4.3.1-1; denotes small samples

Site	Date	n.	Bos g.	OC g.	Sus g.	Bos g.%	OC g.%	Sus g.%
Kaiseraugst Gasthof Adler	Mid 4th	608	13201.6	853.8	3043.0	77.21%	4.99%	17.80%
Kaiseraugst Jakobli-Haus	4th-6th C	154	2356.8	37.5	973.5	69.98%	1.11%	28.91%
Kaiseraugst Gasthof Adler	450-500*	70	1127.9	241	738.3	53.53%	11.44%	35.04%
Kaiseraugst Jakobli-Haus	5-6th C	349	15196.5	553.5	3809.1	77.70%	2.83%	19.47%
Kaiseraugst Gasthof Adler	mid5th-6th	1114	22798.3	3290.4	7649.9	67.57%	9.75%	22.67%
Kaiseraugst Jakobli-Haus	6thC	1129	25576.0	2897.4	9345.8	67.63%	7.66%	24.71%
Kaiseraugst Jakobli-Haus	beg. 7th C	513	8225.5	1294.7	2994.9	65.72%	10.35%	23.93%
Kaiseraugst Gasthof Adler	12thC*	82	638.1	192.9	639.5	43.39%	13.12%	43.49%
Kaiseraugst Fabrikstrasse	12thC*	63	358.9	214.6	107.8	52.68%	31.50%	15.82%

Table 4.3.3-1; The total weight of fragments for the three main domestic species at Kaiseraugst split by area and date; * denotes small samples
Bos - Bos taurus, OC - Ovis/Capra, Sus - sus domesticus, g. -grammes, n. -number

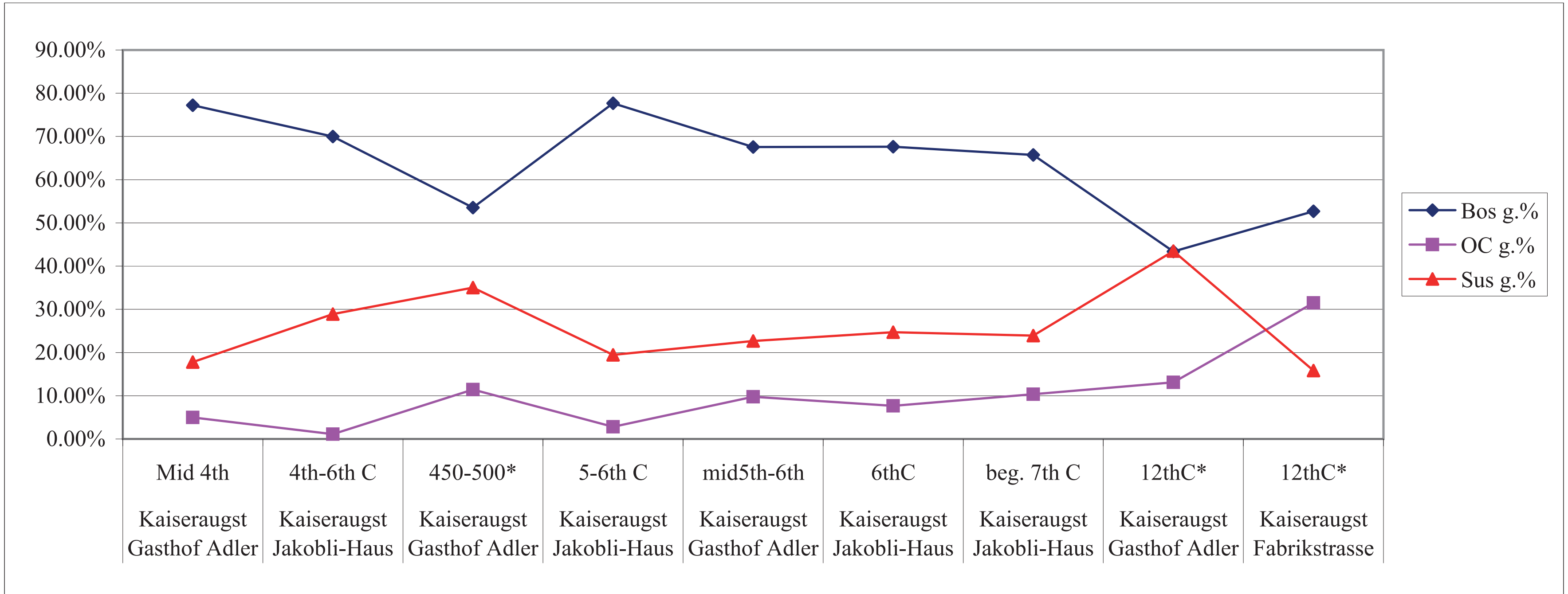

Table 4.3.3-2; The proportions of fragment weight at Kaiseraugst by period and area, abbreviations as 4.3.1-1; *denotes small samples

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	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Crania	24	46	18	110	36	17	4
Teeth	17	17	5	39	15	12	3
Mandible	10	23	9	54	30	20	3
Scapula	17	21	14	53	21	5	0
Humerus	27	36	14	83	28	14	1
Radius	8	22	11	53	17	16	1
Ulna	10	5	6	16	10	7	1
Metacarpals	6	28	11	64	20	10	3
Vertebra	37	43	30	114	36	16	2
Ribs	43	50	33	132	52	16	1
Pelvis	16	22	18	60	18	11	2
Femur	28	41	23	103	25	17	3
Tibia	19	19	8	46	16	15	2
Astragalus	6	9	3	19	3	3	0
Calcaneus	5	5	6	16	5	2	1
Metatarsals	13	21	10	52	27	13	4
Carpals+Tarsals other	3	11	5	26	6	3	1
Phalanges	20	36	32	102	33	12	3
Total	309	455	256	1142	398	209	35

Table 5.2.1.1-1; The total fragment count of each element from Cattle at the Kaiseraugst site,
Adl- Gasthof Adler, Jak- Jakobli-Haus, Fbk- Fabrikstrasse

	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Crania	619.20	1902.90	489.00	2391.90	1263.2	490.70	60.60
Teeth	281.20	276.60	72.50	349.10	293.4	230.00	30.80
Mandible	382.40	1992.10	805.90	2798.00	2140.2	497.20	94.70
Scapula	1133.90	1055.40	1436.10	2491.50	2161	198.50	0.00
Humerus	1310.30	2368.70	745.00	3113.70	3196.5	711.70	29.70
Radius	611.90	2363.30	1161.30	3524.60	2257.1	666.00	17.10
Ulna	353.50	244.10	155.20	399.30	332.4	106.70	21.60
Metacarpals	480.80	1664.60	1320.80	2985.40	1871.9	562.10	178.10
Vertebra	1706.70	2364.00	1191.20	3555.20	1705	625.60	21.20
Ribs	1001.50	1226.10	819.80	2045.90	1174.5	313.70	7.80
Pelvis	963.90	1022.30	783.50	1805.80	1111.8	550.10	81.90
Femur	1176.30	1575.50	1668.50	3244.00	1977.3	774.60	99.90
Tibia	595.00	1213.10	1215.70	2428.80	1324.9	728.40	39.90
Astragalus	428.20	756.70	194.70	951.40	172.2	155.60	0.00
Calcaneus	445.00	363.10	521.50	884.60	344.9	164.50	25.10
Metatarsals	866.00	1493.50	1140.60	2634.10	2327.9	909.00	75.60
Carpals+Tarsals other	66.50	320.20	184.00	504.20	102.4	96.80	21.40
Phalanges	554.30	1097.30	962.80	2060.10	916.5	253.20	94.20
Total	12976.60	23299.50	14868.10	38167.60	24673.1	8034.40	899.60

Table 5.2.1.1-2; The total weight of fragments (in g.) of each element from Cattle at Kaiseraugst,
abbreviations as in table 5.2.1.1-1

	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Skull + Hc	1455.9	4761.4	1685.6	6447	4561.4	1398.5	258.7
Stylopodium	4584.4	6021.9	4633.1	10655	8446.6	2234.9	211.5
Trunk	2708.2	3590.1	2021.2	5611.3	2879.5	939.3	29
Zygopodium	1560.4	3820.5	2532.2	6352.7	3914.4	1501.1	78.6
Autopodium	2840.8	5695.4	4324.4	10019.8	5745.6	2151.7	394.4
Total	13149.7	23889.3	15196.5	39085.8	25547.5	8225.5	972.2

Table 5.2.1.1-3; The total weight of fragments (in g.) by body region from Cattle at Kaiseraugst,
abbreviations as in table 5.2.1.1-1

KA Adl.	Std.	%Std.	mid 4thC (n=316)	%diff from std.	5-6thC (n=465)	%diff from std.	12thC* (n=24)	%diff from std.
Head	2953.5	18.63%	1454.5	-7.61%	4761.4	1.27%	190.6	11.24%
Trunk	5023.3	31.69%	2708.2	-11.17%	3590.1	-16.68%	29	-27.14%
Stylopodium	4137.7	26.10%	4636.3	9.02%	6058.8	-0.78%	122.1	-6.97%
Zygopodium	1793.4	11.31%	1560.4	0.51%	3820.5	4.65%	64.8	-1.16%
Autopodium	1944.6	12.27%	2840.8	9.25%	5695.4	11.54%	231.6	24.03%
Total	15852.5		13200.2		23926.2		638.1	

KA Jak.	Std.	%Std.	4-6thC* (n=59)	%diff from std.	5-6thC (n=259)	%diff from std.	6thC (n=414)	%diff from std.	beg. 7thC (n=214)	%diff from std.
Head	2953.5	18.63%	282	-6.67%	1685.6	-7.54%	4561.4	-0.80%	1398.5	-1.63%
Trunk	5023.3	31.69%	907.4	6.81%	2021.2	-18.39%	2879.5	-20.43%	939.3	-20.27%
Stylopodium	4137.7	26.10%	402.8	-9.01%	4633.1	4.39%	8475.1	7.04%	2234.9	1.07%
Zygopodium	1793.4	11.31%	242.7	-1.02%	2532.2	5.35%	3914.4	3.99%	1501.1	6.94%
Autopodium	1944.6	12.27%	521.9	9.88%	4324.4	16.19%	5745.6	10.20%	2151.7	13.89%
Total	15852.5		2356.8		15196.5		25576.0		8225.5	

Table 5.2.1.1-4; Comparison of cattle body part proportions from Kaiseraugst using a standard cattle skeleton
std- standard, KA- Kaiseraugst, Adl, Gasthof Adler, Jak- Jakobli-Haus

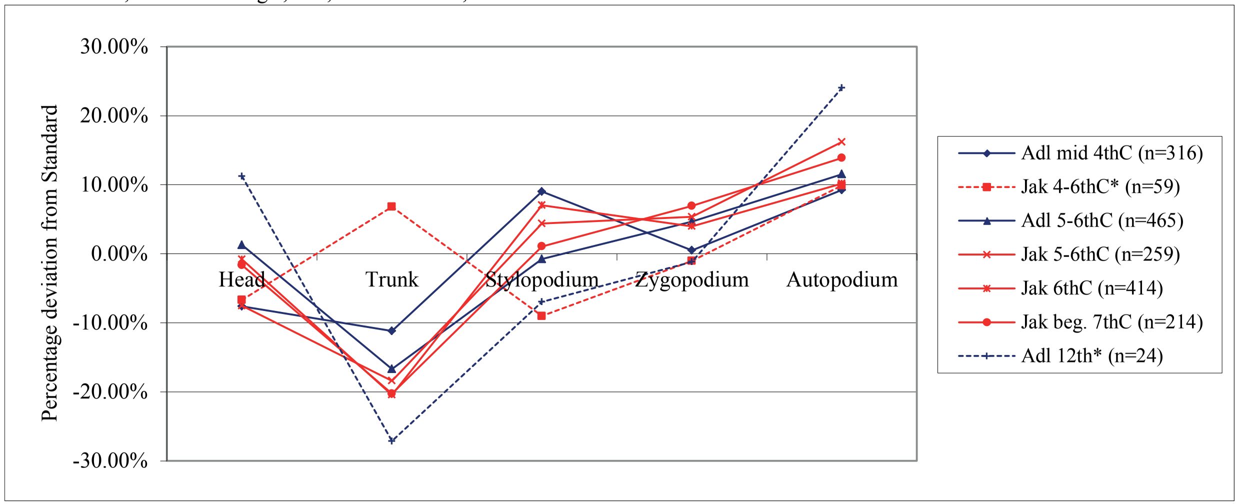


Fig. 5.2.1.1-5; Graphical illustration of table 5.2.1.1-4, abbreviations as in table, dotted lines and asterisks show samples that are considered statistically small

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Crania	25	60	22	123	4
Teeth	17	26	19	54	9
Mandible	12	37	8	17	4
Scapula	10	20	6	19	5
Humerus	13	29	5	25	4
Radius	10	12	4	12	3
Ulna	4	11	5	4	0
Metacarpals	7	11	7	11	5
Vertebra	12	42	12	34	1
Ribs	10	20	9	16	3
Pelvis	7	42	8	42	3
Femur	10	24	6	43	4
Tibia	16	35	25	27	5
Astragalus	6	4	0	7	2
Calcaneus	3	8	4	7	2
Metatarsals	6	20	5	15	2
Carpals+Tarsals other	2	6	2	10	2
Phalanges	4	32	10	18	3
Total	174	439	157	484	61

Table 5.2.1.2-1; The total fragment count of each element for each period from Cattle at Lausen,

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Crania	583.10	600.60	118.50	917.50	31.00
Teeth	176.00	403.90	87.70	282.30	49.10
Mandible	614.20	1277.70	115.80	609.70	78.20
Scapula	615.50	468.40	92.10	327.00	209.60
Humerus	473.70	1437.40	173.40	621.10	395.50
Radius	672.30	419.60	188.20	434.60	260.90
Ulna	337.70	292.90	28.40	25.60	0.00
Metacarpals	544.30	318.10	124.90	405.70	338.10
Vertebra	635.40	572.60	63.10	584.90	12.80
Ribs	184.40	308.70	118.30	216.20	52.70
Pelvis	207.70	1236.20	427.20	833.30	15.60
Femur	880.20	1040.30	143.70	972.70	80.40
Tibia	1046.30	1132.70	598.30	638.20	401.20
Astragalus	240.30	174.50	0.00	222.40	70.60
Calcaneus	140.80	287.00	148.70	147.40	58.70
Metatarsals	363.60	853.20	135.50	327.30	49.20
Carpals+Tarsals other	49.90	41.90	9.70	111.00	14.40
Phalanges	62.20	453.20	167.20	215.60	43.20
Total	7827.60	11318.90	2740.70	7892.50	2161.20

Table 5.2.1.2-2; The total weight of fragments (in g.) of each element for each period from Cattle at Lausen

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Skull + Hc	1373.30	2296.20	383.40	1524.00	158.30
Stylopodium	2177.10	4086.90	836.40	2754.10	701.10
Trunk	819.80	881.30	181.40	801.10	65.50
Zygopodium	1723.20	1743.80	814.90	1098.40	662.10
Autopodium	1401.10	2171.50	586.00	1458.30	574.20
Total	7494.50	11179.70	2802.10	7635.90	2161.20

Table 5.2.1.2-3; The total weight of fragments (in g.)by body region from Cattle at Lausen,

	Std	%Std.	6/7thC (n=172)	%diff from std.	8/9thC (n=446)	%diff from std.	10thC (n=160)	%diff from std.	11thC (n=488)	%diff from std.	12thC* (n=61)	%diff from std.
Head	2953.5	18.63%	1373.3	-0.31%	2296.2	1.73%	383.4	-4.95%	1527.2	1.36%	158.3	-11.31%
Trunk	5023.3	31.69%	819.8	-20.75%	881.3	-23.87%	181.4	-25.21%	801.1	-21.20%	65.5	-28.66%
Stylopodium	4137.7	26.10%	2177.1	2.95%	4182.3	10.98%	836.4	3.75%	2754.1	9.95%	701.1	6.34%
Zygopodium	1793.4	11.31%	1723.2	11.68%	1743.8	4.15%	814.9	17.77%	1098.4	3.07%	662.1	19.32%
Autopodium	1944.6	12.27%	1401.1	6.43%	2174.7	7.02%	586	8.65%	1458.3	6.82%	574.2	14.30%
Total	15852.5		7494.5		11278.3		2802.1		7639.1		2161.2	

Table 5.2.1.2-4; Comparison of cattle body part proportions from different time periods at Lausen using a standard cattle skeleton
* denotes samples that are statistically small

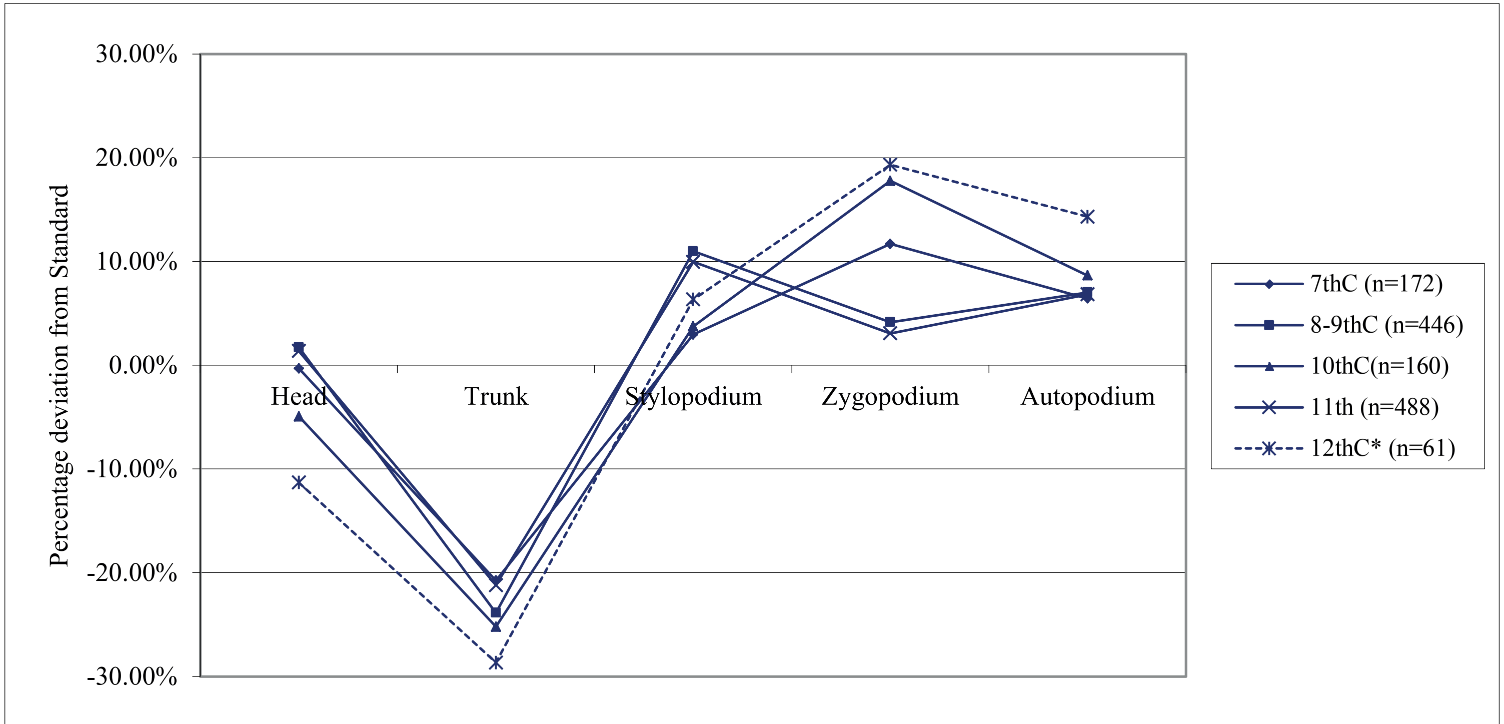


Fig. 5.2.1.2-5; Graphical illustration of table 5.2.1.2-4, dotted lines and asterisks show samples that are considered statistically small

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	4	9	6	48	**67**	15	9	28	26	**78**	7	4	66	**77**	15	56	**71**
Teeth	11	8	5	10	**34**	6	2	21	8	**37**	8	1	2	**11**	5	12	**17**
Mandible	1	2	8	11	**22**	0	8	9	4	**21**	6	1	4	**11**	3	8	**11**
Scapula	2	1	0	5	**8**	2	3	7	1	**13**	2	0	1	**3**	2	3	**5**
Humerus	1	1	4	8	**14**	0	1	11	1	**13**	3	3	5	**11**	1	11	**12**
Radius	11	0	2	3	**16**	1	3	5	0	**9**	2	0	2	**4**	2	10	**12**
Ulna	2	3	1	2	**8**	1	1	6	0	**8**	2	1	0	**3**	2	1	**3**
Metacarpals	0	0	0	10	**10**	0	3	3	0	**6**	2	2	2	**6**	2	2	**4**
Vertebra	3	4	7	7	**21**	0	5	10	2	**17**	3	5	5	**13**	7	7	**14**
Ribs	0	3	1	7	**11**	0	4	4	0	**8**	0	0	1	**1**	4	16	**20**
Pelvis	1	0	8	7	**16**	2	4	5	0	**11**	0	2	4	**6**	4	9	**13**
Femur	1	6	6	9	**22**	1	2	6	2	**11**	2	0	2	**4**	0	1	**1**
Tibia	1	0	1	17	**19**	1	1	6	0	**8**	4	1	0	**5**	4	10	**14**
Astragalus	0	0	0	0	**0**	1	1	0	0	**2**	2	0	0	**2**	0	5	**5**
Calcaneus	0	0	1	1	**2**	0	1	0	0	**1**	1	0	1	**2**	0	2	**2**
Metatarsals	1	1	3	5	**10**	2	1	5	0	**8**	3	2	1	**6**	1	4	**5**
Carpals+Tarsals other	3	3	0	1	**7**	3	2	3	1	**9**	1	0	0	**1**	1	1	**2**
Phalanges	12	1	1	4	**18**	3	9	6	0	**18**	2	2	1	**5**	2	3	**5**
Total	54	42	54	155	**305**	38	60	135	45	**278**	50	24	97	**171**	55	161	**216**

Table 5.2.1.3-1; The total fragment count of each element from cattle at all areas and periods of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	176.80	154.10	67.00	586.90	**984.80**	59.70	134.70	225.80	366.20	**786.40**	111.00	14.40	890.30	**1015.70**	103.50	510.70	**614.20**
Teeth	351.60	65.90	41.90	169.60	**629.00**	53.00	4.40	199.80	178.00	**435.20**	102.70	12.70	27.60	**143.00**	80.40	143.90	**224.30**
Mandible	14.40	380.80	553.90	333.40	**1282.50**	0.00	309.40	160.30	53.00	**522.70**	316.90	1.10	112.10	**430.10**	39.30	1280.90	**1320.20**
Scapula	32.40	70.20	0.00	76.00	**178.60**	407.30	169.80	184.10	68.10	**829.30**	31.90	0.00	32.50	**64.40**	39.00	111.40	**150.40**
Humerus	5.70	16.60	194.80	400.40	**617.50**	0.00	8.80	342.10	7.00	**357.90**	77.50	221.40	246.20	**545.10**	42.90	473.30	**516.20**
Radius	368.00	0.00	22.60	90.10	**480.70**	10.40	128.20	216.80	0.00	**355.40**	74.50	0.00	48.60	**123.10**	27.00	328.50	**355.50**
Ulna	46.70	18.50	16.40	9.20	**90.80**	1.60	12.90	185.60	0.00	**200.10**	113.90	37.60	0.00	**151.50**	27.00	2.40	**29.40**
Metacarpals	0.00	0.00	0.00	354.40	**354.40**	0.00	51.90	27.60	0.00	**79.50**	259.90	149.90	166.10	**575.90**	66.90	158.00	**224.90**
Vertebra	32.30	53.00	213.30	253.60	**552.20**	0.00	87.20	284.50	104.60	**476.30**	82.40	61.30	118.10	**261.80**	49.90	296.30	**346.20**
Ribs	0.00	80.10	6.60	98.20	**184.90**	0.00	54.00	38.40	0.00	**92.40**	0.00	0.00	11.90	**11.90**	50.60	343.20	**393.80**
Pelvis	56.50	0.00	318.10	214.40	**589.00**	108.30	151.50	61.80	0.00	**321.60**	0.00	43.00	72.40	**115.40**	73.30	347.80	**421.10**
Femur	1.10	113.40	376.30	362.80	**853.60**	23.80	27.80	391.70	31.10	**474.40**	66.40	0.00	163.30	**229.70**	0.00	63.60	**63.60**
Tibia	28.10	0.00	18.60	689.50	**736.20**	13.90	45.80	269.60	0.00	**329.30**	210.30	24.40	0.00	**234.70**	151.90	526.10	**678.00**
Astragalus	0.00	0.00	0.00	0.00	**0.00**	42.00	63.70	0.00	0.00	**105.70**	96.60	0.00	0.00	**96.60**	0.00	174.90	**174.90**
Calcaneus	0.00	0.00	47.60	63.70	**111.30**	0.00	36.20	0.00	0.00	**36.20**	26.00	0.00	44.50	**70.50**	0.00	40.60	**40.60**
Metatarsals	3.60	4.90	99.20	404.00	**511.70**	236.30	8.90	143.60	0.00	**388.80**	281.80	39.60	35.90	**357.30**	4.60	114.20	**118.80**
Carpals+Tarsals other	53.10	19.20	0.00	32.40	**104.70**	57.10	16.50	59.20	8.70	**141.50**	2.50	0.00	0.00	**2.50**	37.70	29.70	**67.40**
Phalanges	715.70	21.90	26.10	70.40	**834.10**	52.60	136.60	71.50	0.00	**260.70**	35.00	24.50	24.80	**84.30**	39.60	51.80	**91.40**
Total	1886.00	998.60	2002.40	4209.00	**9096.00**	1066.00	1448.30	2862.40	816.70	**6193.40**	1889.30	629.90	1994.30	**4513.50**	833.60	4997.30	**5830.90**

Table 5.2.1.3-2; The total weight of fragments (in g.) of each element from cattle at all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Skull + Hc	542.80	602.70	666.10	1089.90	**2901.50**	181.00	448.50	594.70	607.30	**1831.50**	530.60	28.20	1030.00	**1588.80**	223.20	1981.20	**2204.40**
Stylopodium	95.70	200.20	889.20	1053.60	**2238.70**	539.40	357.90	979.70	106.20	**1983.20**	175.80	264.40	514.40	**954.60**	155.20	996.10	**1151.30**
Trunk	32.30	133.10	219.90	351.80	**737.10**	0.00	141.20	322.90	104.60	**568.70**	82.40	61.30	130.00	**273.70**	100.50	639.50	**740.00**
Zygopodium	442.80	18.50	57.60	788.80	**1307.70**	25.90	186.90	579.50	0.00	**792.30**	398.70	62.00	48.60	**509.30**	178.90	923.80	**1102.70**
Autopodium	772.40	46.00	172.90	924.90	**1916.20**	388.00	313.80	301.90	14.40	**1018.10**	701.80	214.00	271.30	**1187.10**	148.80	569.20	**718.00**
Total	1886.00	1000.50	2005.70	4209.00	**9101.20**	1134.30	1448.30	2778.70	832.50	**6193.80**	1889.30	629.90	1994.30	**4513.50**	806.60	5109.80	**5916.40**

Table 5.2.1.3-3; The total weight of fragments (in g.) by body area from cattle at all areas of the Reinach excavation

	Std	%Std.	6/7thC (n=309)	%diff from std.	late 7/8thC* (n=99)	%diff from std.	9thC (n=184)	%diff from std.	10thC* (n=50)	%diff from std.	11thC* (n=121)	%diff from std.	12thC (n=218)	%diff from std.
Head	2953.5	18.63%	2661.0	10.66%	629.5	-9.71%	1202	14.65%	530.6	9.45%	1058.2	21.69%	2204.4	18.63%
Trunk	5023.3	31.69%	1071.3	-19.90%	1071.3	-16.50%	427.5	-19.85%	82.4	-27.33%	191.3	-24.40%	740	-19.18%
Stylopodium	4137.7	26.10%	2725.1	3.90%	2725.1	12.53%	1085.9	3.97%	175.8	-16.80%	778.8	3.58%	1151.3	-6.64%
Zygopodium	1793.4	11.31%	1300.6	3.00%	1300.6	7.13%	579.5	4.73%	398.7	9.79%	110.6	-7.10%	1102.7	7.32%
Autopodium	1944.6	12.27%	1326.8	2.34%	1326.8	6.54%	316.3	-3.51%	701.8	24.88%	485.3	6.23%	718	-0.13%
Total	15852.5		9084.8		7053.3		3611.2		1889.3		2624.2		5916.4	

Table 5.2.1.3-4; Comparison of cattle body part proportions from different time periods at Reinach using a standard cattle skeleton

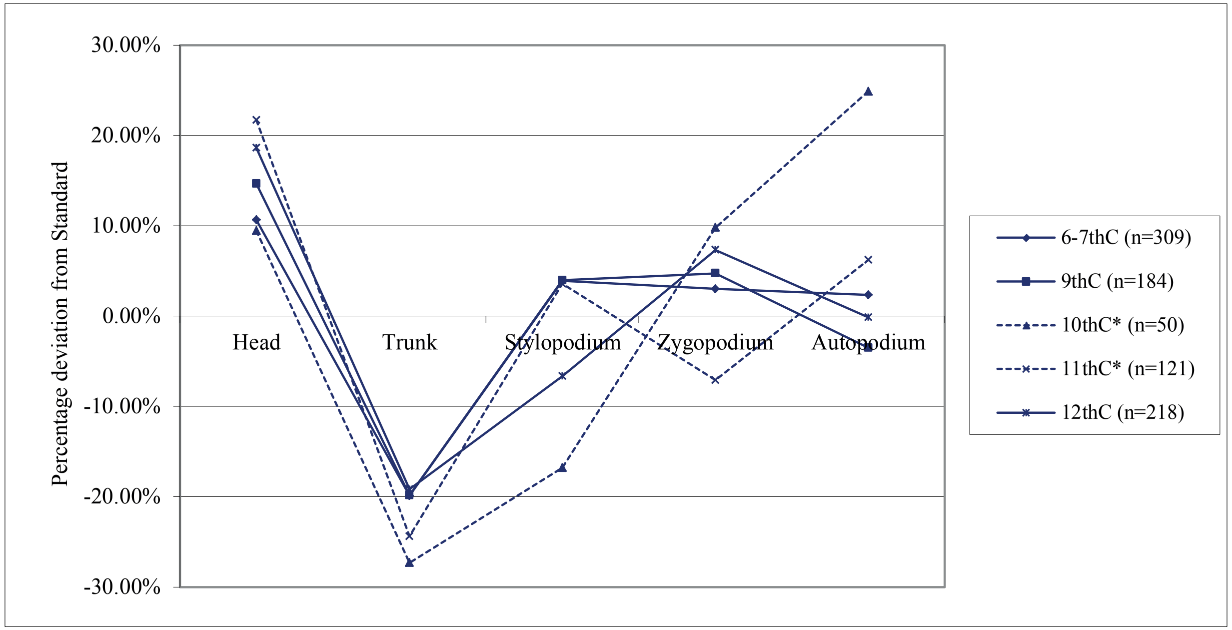


Figure 5.2.1.3-5; Cattle body parts represented from different time periods at Reinach as a deviation from a standard cattle skeleton asterisks and dashed lines represent statistically small samples

GMZ	Std	%Std.	6thC* (n=54)	%diff from std.	7thC* (n=55)	%diff from std.	8thC* (n=60)	%diff from std.	9thC* (n=137)	%diff from std.	10thC* (n=50)	%diff from std.	11thC* (n=24)	%diff from std.	12thC* (n=53)	%diff from std.
Head	2953.5	18.63%	302.3	-2.60%	666.1	14.85%	448.5	12.34%	594.7	2.77%	530.6	9.45%	28.2	-14.15%	223.2	9.04%
Trunk	5023.3	31.69%	366.5	-12.26%	219.9	-20.63%	141.2	-21.94%	322.9	-20.07%	82.4	-27.33%	61.3	-21.96%	100.5	-19.23%
Stylopodium	4137.7	26.10%	582.1	4.76%	889.2	18.60%	357.9	-1.39%	979.7	9.16%	175.8	-16.80%	264.4	15.87%	155.2	-6.86%
Zygopodium	1793.4	11.31%	452.1	12.66%	41.2	-9.24%	186.9	1.59%	579.5	9.54%	398.7	9.79%	62	-1.47%	178.9	10.87%
Autopodium	1944.6	12.27%	183	-2.56%	172.9	-3.58%	313.8	9.40%	301.9	-1.40%	701.8	24.88%	214	21.71%	148.8	6.18%
Total	15852.5		1886.0		1989.3		1448.3		2778.7		1889.3		629.9		806.6	

Table 5.2.1.3-6; Comparison of cattle body part proportions from different time periods in the Gemeindezentrum area using a standard cattle skeleton

Sth	Std	%Std.	7thC (n=155)	%diff from std.	9thC* (n=47)	%diff from std.	11thC* (n=97)	%diff from std.	12thC (n=165)	%diff from std.
Head	2953.5	18.63%	1089.9	7.26%	607.3	54.32%	1030	33.02%	1981.2	20.14%
Trunk	5023.3	31.69%	351.8	-23.33%	104.6	-19.12%	130	-25.17%	639.5	-19.17%
Stylopodium	4137.7	26.10%	1053.6	-1.07%	106.2	-13.34%	514.4	-0.31%	996.1	-6.61%
Zygopodium	1793.4	11.31%	788.8	7.43%	0	-11.31%	48.6	-8.88%	923.8	6.77%
Autopodium	1944.6	12.27%	924.9	9.71%	14.4	-10.54%	271.3	1.34%	569.2	-1.13%
Total	15852.5		4209.0		832.5		1994.3		5109.8	

Table 5.2.1.3-7; Comparison of cattle body part proportions from different time periods in the Stadthof area of reinach using a standard cattle skeleton

AB	Std	%Std.	6-7thC* (n=44)	%diff from std.	7-8thC* (n=39)	%diff from std.
Head	2953.5	18.63%	602.7	41.61%	181	-2.67%
Trunk	5023.3	31.69%	133.1	-18.38%	0	-31.69%
Stylopodium	4137.7	26.10%	200.2	-6.09%	539.4	21.45%
Zygopodium	1793.4	11.31%	18.5	-9.46%	25.9	-9.03%
Autopodium	1944.6	12.27%	46	-7.67%	388	21.94%
Total	15852.5		1000.5		1134.3	

Table 5.2.1.3-8; Comparison of cattle body part proportions from different time periods in the Altebrauerei area at Reinach using a standard cattle skeleton
asterisks represent statistically small samples

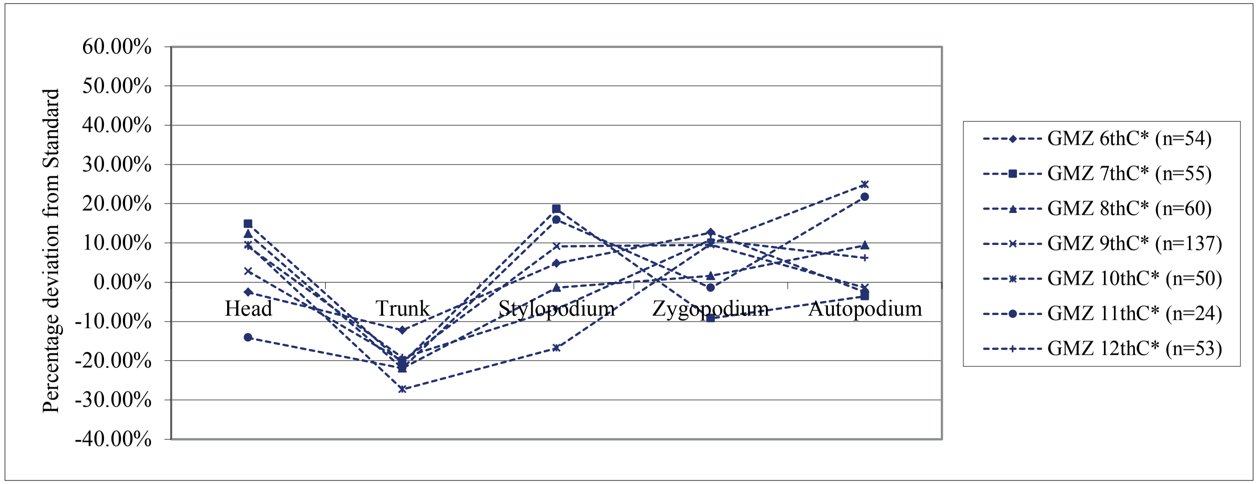


Figure 5.2.1.3-9; Cattle body parts represented from different time periods in the Gemenidezentrum area at Reinach as a deviation from a standard cattle skeleton asterisks and dashed lines represent statistically small samples

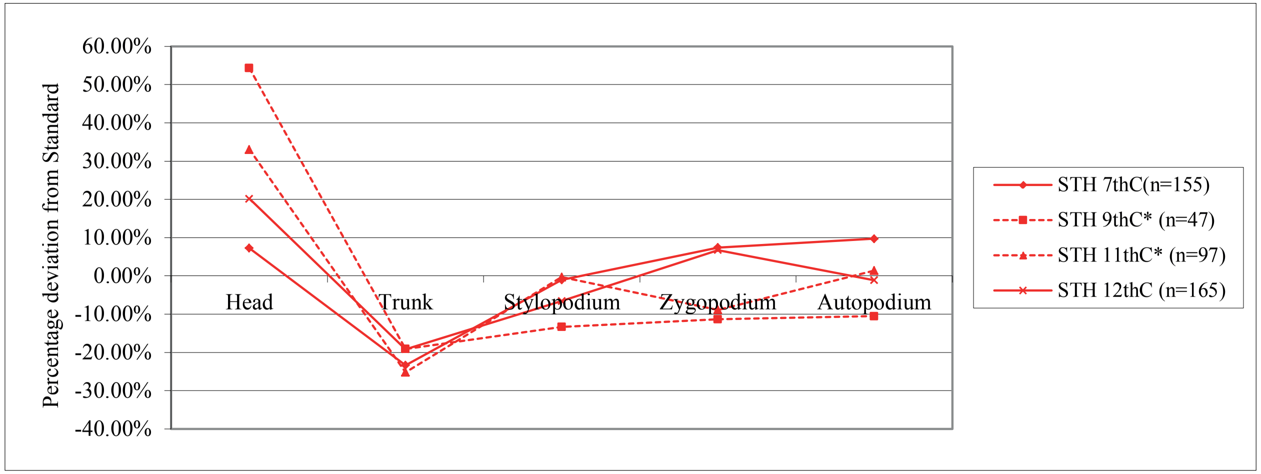


Figure 5.2.1.3-10; Cattle body parts represented from different time periods in the Stadthof area at Reinach as a deviation from a standard cattle skeleton asterisks and dashed lines represent statistically small samples

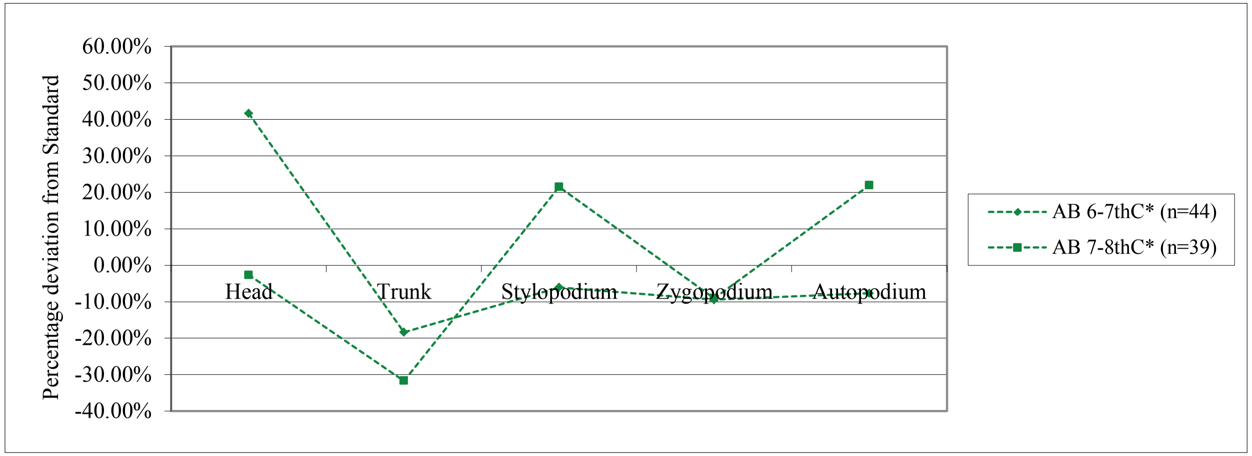


Figure 5.2.1.3-11; Cattle body parts represented from different time periods in the Altebrauerei area at Reinach as a deviation from a standard cattle skeleton asterisks and dashed lines represent statistically small samples

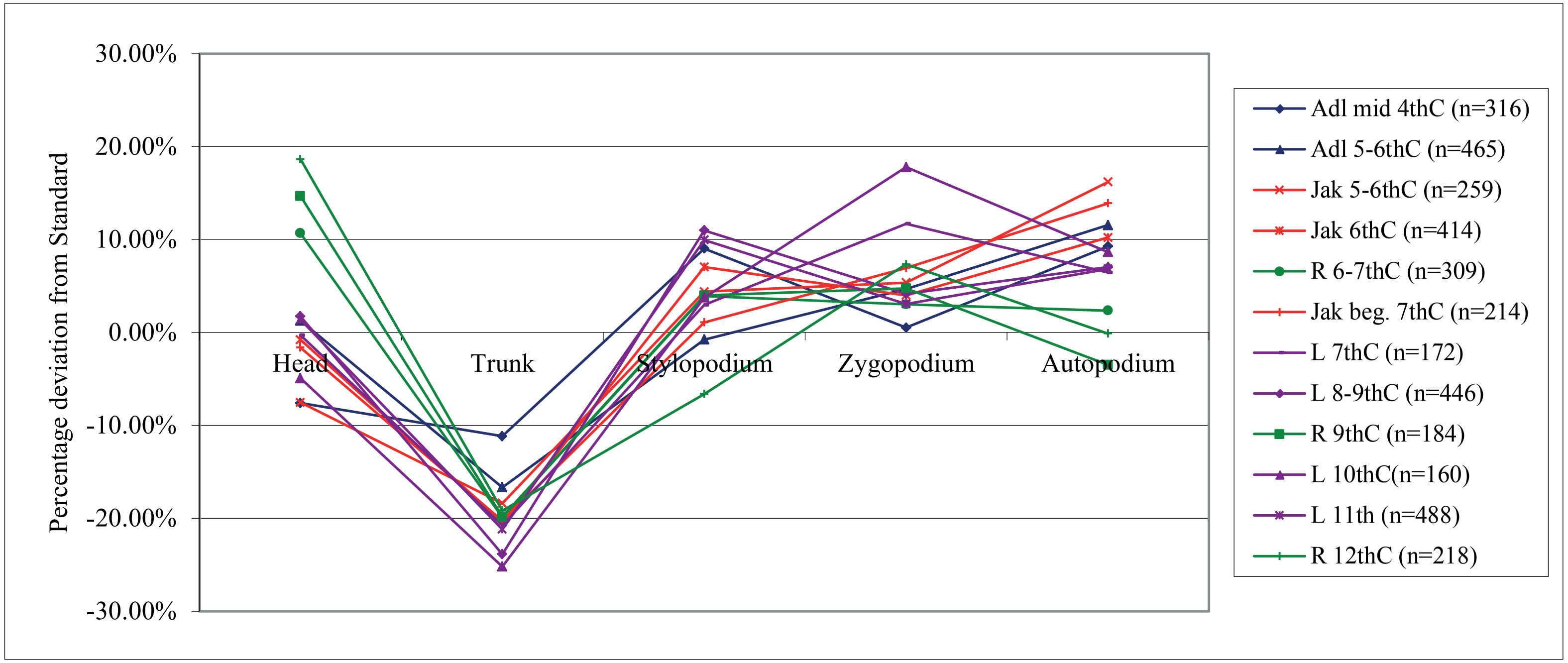


Fig 5.2.1.4-1; Summary of statistically sound data for cattle from the three sites studied here,
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, R- Reinach, L- Lausen

	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Crania	3	2	1	5	13	7	1
Teeth	6	4	1	9	10	9	2
Mandible	10	10	6	26	28	11	0
Scapula	4	6	3	15	8	7	6
Humerus	3	9	0	18	5	8	4
Radius	3	10	6	25	18	11	8
Ulna	4	1	1	3	3	2	1
Metacarpals	1	14	4	31	11	5	4
Vertebra	5	1	2	4	5	2	3
Ribs	8	12	8	32	28	5	5
Pelvis	1	6	1	13	6	2	1
Femur	5	4	2	10	6	6	2
Tibia	6	26	2	52	24	17	5
Astragalus	0	0	0	0	0	0	0
Calcaneus	0	1	0	2	1	0	1
Metatarsals	2	11	7	29	19	2	3
Carpals+Tarsals other	0	0	0	0	0	0	0
Phalanges	0	2	0	4	1	1	0
Total	61	119	44	278	186	95	46

Table 5.2.2.1-1; The total fragment count of each element by period from ovicaprids at Kaiseraugst, Adl- Gasthof Adler, Jak- Jakobli-Haus, Fbk- Fabrikstrasse

	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Crania	16.90	84.90	31.10	116.00	209.10	124.30	2.20
Teeth	17.40	5.90	4.70	10.60	47.30	37.00	7.50
Mandible	177.50	233.50	123.30	356.80	461.40	257.80	0.00
Scapula	48.20	50.60	35.20	85.80	71.20	55.30	58.90
Humerus	30.70	116.90	0.00	116.90	86.80	71.30	37.90
Radius	25.20	126.20	86.20	212.40	282.40	139.60	64.10
Ulna	19.30	7.90	2.20	10.10	8.40	4.70	0.80
Metacarpals	4.80	169.70	57.20	226.90	102.60	55.00	31.80
Vertebra	55.60	6.80	19.80	26.60	50.40	23.80	21.50
Ribs	22.00	27.20	24.60	51.80	92.20	13.30	16.30
Pelvis	8.70	64.30	11.30	75.60	72.00	12.00	26.30
Femur	52.60	29.10	16.70	45.80	89.80	56.30	10.30
Tibia	65.30	268.20	30.30	298.50	447.20	228.60	62.20
Astragalus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcaneus	0.00	8.30	0.00	8.30	8.80	0.00	3.50
Metatarsals	15.10	158.60	76.50	235.10	170.60	8.80	11.80
Carpals+Tarsals other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phalanges	0.00	5.20	0.00	5.20	2.60	2.60	0.00
Total	559.30	1363.30	519.10	1882.40	2202.80	1090.40	355.10

Table 5.2.2.1-2; The total weight of fragments (in g.) of each element from ovicaprid at Kaiseraugst, abbreviations as in table 5.2.2.1-1

	Adl Mid 4thC	Adl mid5th-late 6thC	Jak 5th-late 6thC	All 5-6thC	Jak 6thC	Jak beg, 7thC	Adl+Fbk 12thC
Skull + Hc	507.40	1180.50	193.50	1374.00	1247.00	623.40	9.70
Stylopodium	140.20	260.90	63.20	324.10	319.80	194.90	133.40
Trunk	77.60	34.00	44.40	78.40	142.60	37.10	37.80
Zygopodium	109.80	402.30	118.70	521.00	738.00	372.90	127.10
Autopodium	19.90	341.80	133.70	475.50	284.60	66.40	47.10
Total	854.90	2219.50	553.50	2773.00	2732.00	1294.70	355.10

Table 5.2.2.1-2; The total weight of fragments (in g.) by body region from ovicaprid at Kaiseraugst, abbreviations as in table 5.2.2.1-1

KA Adl.	Std.	%Std.	mid 4thC* (n=68)	%diff from std.	5-6thC* (n=125)	%diff from std.	12thC* (n=12)	%diff from std.
Head	651.2	25.57%	507.4	33.79%	1001.8	25.07%	0	-25.57%
Trunk	812.4	31.89%	77.6	-22.82%	34	-30.18%	0	-31.89%
Stylopodium	529.2	20.78%	140.2	-4.38%	260.9	-7.59%	33.5	3.07%
Zygopodium	285.3	11.20%	109.8	1.64%	368.4	7.42%	80	45.74%
Autopodium	269.0	10.56%	19.9	-8.23%	313.4	5.28%	27	8.66%
Total	2547.2		854.9		1978.5		140.5	

KA Jak.	Std.	%Std.	4-6thC* (n=5)	%diff from std.	5-6thC* (n=45)	%diff from std.	6thC (n=202)	%diff from std.	beg. 7thC* (n=101)	%diff from std.
Head	651.2	25.57%	20.6	29.37%	193.5	9.39%	1247	20.08%	623.4	22.58%
Trunk	812.4	31.89%	6.5	-14.56%	44.4	-23.87%	142.6	-26.67%	37.1	-29.03%
Stylopodium	529.2	20.78%	0	-20.78%	63.2	-9.36%	319.8	-9.07%	194.9	-5.72%
Zygopodium	285.3	11.20%	6.7	6.66%	118.7	10.24%	738	15.81%	372.9	17.60%
Autopodium	269.0	10.56%	3.7	-0.70%	133.7	13.59%	284.6	-0.14%	66.4	-5.43%
Total	2547.2		37.5		553.5		2732.0		1294.7	

Table 5.2.2.1-4; Comparison of ovicaprid body part proportions from Kaiseraugst using a standard ovicaprid skeleton
std- standard, KA- Kaiseraugst, Adl, Gasthof Adler, Jak- Jakobli-Haus

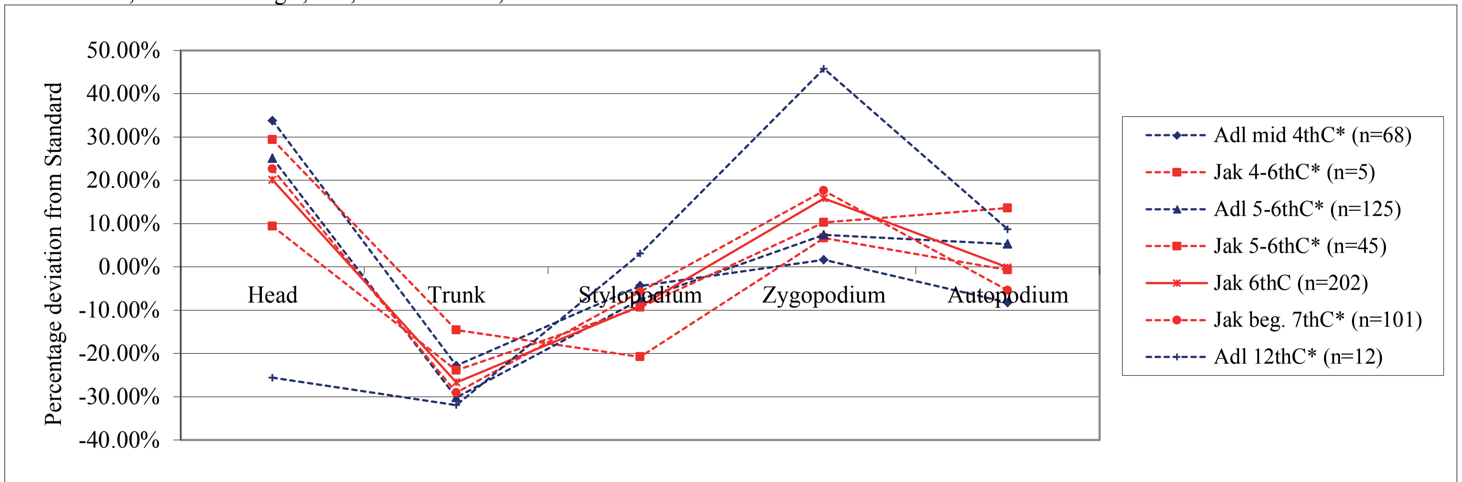


Fig. 5.2.2.1-5; Graphical illustration of table 5.2.2.1-4, abbreviations as in table, dotted lines and asterisks show samples that are considered statistically small

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Crania	13	32	8	36	2
Teeth	30	66	53	88	7
Mandible	13	34	10	29	7
Scapula	1	38	9	20	1
Humerus	9	38	10	29	3
Radius	10	53	10	41	7
Ulna	1	14	4	8	0
Metacarpals	7	24	7	6	1
Vertebra	5	31	16	36	4
Ribs	6	27	18	85	1
Pelvis	1	28	4	9	4
Femur	5	28	14	28	1
Tibia	8	78	23	53	2
Astragalus	1	2	0	1	0
Calcaneus	0	2	0	2	0
Metatarsals	6	20	9	19	1
Carpals+Tarsals other	0	0	1	3	0
Phalanges	0	5	1	8	2
	116	520	197	501	43

Table 5.2.2.2-1; The total fragment count of each element by period from ovicaprid at Lausen,

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Crania	143.70	118.30	16.20	240.70	1.00
Teeth	104.30	186.70	143.10	175.20	10.00
Mandible	212.80	320.10	112.40	183.90	18.30
Scapula	3.20	210.40	23.50	75.90	12.30
Humerus	72.20	315.40	71.20	158.70	10.80
Radius	82.10	379.90	41.00	322.70	47.90
Ulna	37.90	42.30	4.40	9.30	0.00
Metacarpals	16.50	141.10	28.10	40.70	1.80
Vertebra	14.10	181.40	26.90	83.20	19.40
Ribs	6.50	52.70	26.30	151.20	2.30
Pelvis	4.70	173.80	15.60	35.60	11.10
Femur	20.50	141.70	32.40	104.90	2.80
Tibia	35.30	619.90	133.10	375.10	21.20
Astragalus	4.10	8.60	0.00	3.60	0.00
Calcaneus	0.00	3.10	0.00	13.60	0.00
Metatarsals	20.80	142.90	44.80	60.00	4.60
Carpals+Tarsals other	0.00	0.00	1.20	4.90	0.00
Phalanges	0.00	9.50	1.40	16.90	2.60
	778.70	3047.80	721.60	2056.10	166.10

Table 5.2.2.2-2; The total weight of fragments (in g.) of each element from ovicaprid at Lausen,

	6th-7thC	8th-9thC	10thC	11thC	mid 12thC
Skull + Hc	460.80	625.10	271.70	599.80	29.20
Stylopodium	100.60	862.50	142.70	375.10	37.00
Trunk	20.60	234.10	53.20	234.40	21.70
Zygopodium	117.40	1018.90	178.50	707.10	69.10
Autopodium	41.40	325.00	77.70	139.70	9.00
	740.80	3065.60	723.80	2056.10	166.00

Table 5.2.2.2-3; The total weight of fragments (in g.)by body region from ovicaprid at Lausen,

	Std.	%Std.	6-7thC (n=115)	% diff from std.	8-9thC (n=530)	% diff from std.	10thC (n=199)	%diff from std.	11thC (n=507)	% diff from std.	12thC* (n=43)	% diff from std.
Head	651.23	25.57%	460.80	36.64%	697.30	-3.34%	271.70	11.97%	633.80	4.76%	29.30	-7.73%
Trunk	812.40	31.89%	20.60	-29.11%	234.10	-24.43%	53.20	-24.54%	234.40	-20.68%	21.70	-18.69%
Stylopodium	529.20	20.78%	100.60	-7.20%	862.50	6.71%	142.70	-1.06%	375.10	-2.83%	37.00	1.74%
Zygopodium	285.33	11.20%	117.40	4.65%	1018.90	21.27%	178.50	13.46%	707.10	22.63%	69.10	30.86%
Autopodium	269.03	10.56%	41.40	-4.97%	325.00	-0.20%	77.70	0.17%	139.70	-3.88%	7.20	-6.18%
	2547.20		740.80		3137.80		723.80		2090.10		164.30	

Table 5.2.2.2-4; Comparison of ovicaprid body part proportions from different time periods at Lausen using a standard ovicaprid skeleton astrisks represent statistically small samples

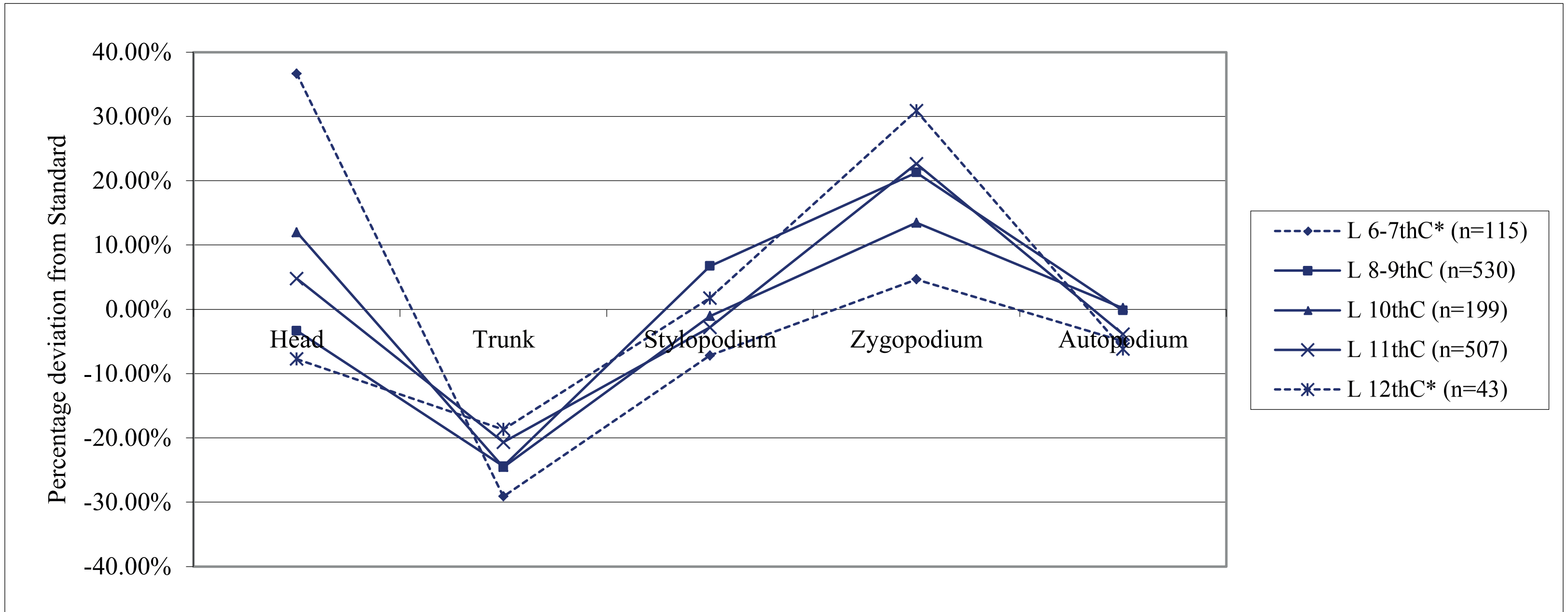


Fig. 5.2.2.2-5; Graphical illustration of table 5.2.2.2-4, dotted lines and asterisks show samples that are considered statistically small

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	4	1	1	6	**12**	1	4	5	3	**13**	3	1	7	**11**	0	13	**13**
Teeth	1	7	2	20	**30**	10	14	13	0	**37**	0	1	1	**2**	1	6	**7**
Mandible	1	3	1	9	**14**	1	5	2	1	**9**	2	0	7	**9**	1	2	**3**
Scapula	0	2	0	0	**2**	0	1	1	3	**5**	1	0	1	**2**	0	3	**3**
Humerus	1	3	0	5	**9**	1	3	6	1	**11**	2	1	3	**6**	1	7	**8**
Radius	0	8	0	10	**18**	6	0	6	5	**17**	0	1	1	**2**	1	10	**11**
Ulna	0	2	3	1	**6**	0	0	1	0	**1**	1	0	0	**1**	0	0	**0**
Metacarpals	0	2	1	7	**10**	4	3	2	0	**9**	0	1	1	**2**	0	7	**7**
Vertebra	1	1	0	2	**4**	0	1	7	3	**11**	1	1	0	**2**	1	5	**6**
Ribs	4	1	2	4	**11**	0	2	6	0	**8**	2	1	0	**3**	2	1	**3**
Pelvis	0	0	1	1	**2**	2	0	1	1	**4**	1	0	1	**2**	1	1	**2**
Femur	2	6	0	5	**13**	0	2	5	1	**8**	2	4	1	**7**	6	2	**8**
Tibia	2	3	1	16	**22**	4	6	6	7	**23**	2	3	4	**9**	1	14	**15**
Astragalus	0	0	0	0	**0**	0	0	1	0	**1**	0	0	0	**0**	0	1	**1**
Calcaneus	0	1	0	0	**1**	0	0	0	0	**0**	0	0	0	**0**	0	0	**0**
Metatarsals	2	7	1	7	**17**	5	3	6	0	**14**	0	0	1	**1**	1	3	**4**
Carpals+Tarsals other	0	0	0	0	**0**	0	1	0	0	**1**	0	0	0	**0**	0	0	**0**
Phalanges	1	0	0	0	**1**	5	0	2	1	**8**	0	1	0	**1**	0	4	**4**
Total	19	47	13	93	**172**	39	45	70	26	**180**	17	15	28	**60**	16	79	**95**

Table 5.2.2.3-1; The total fragment count of each element from ovicaprids by period in all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	10.20	2.80	0.50	11.90	**25.40**	1.30	22.90	7.70	6.30	**38.20**	21.70	2.00	56.90	**80.60**	0.00	45.10	**45.10**
Teeth	0.90	29.90	9.90	83.60	**124.30**	30.10	52.30	47.30	0.00	**129.70**	0.00	3.70	5.50	**9.20**	0.90	15.00	**15.90**
Mandible	3.90	5.80	29.20	104.00	**142.90**	12.70	70.90	4.80	4.70	**93.10**	21.60	0.00	139.20	**160.80**	5.00	8.80	**13.80**
Scapula	0.00	15.30	0.00	0.00	**15.30**	0.00	10.10	8.10	17.30	**35.50**	14.60	0.00	3.50	**18.10**	0.00	27.40	**27.40**
Humerus	24.70	9.70	0.00	13.70	**48.10**	3.20	16.40	72.50	1.50	**93.60**	19.10	3.20	9.60	**31.90**	1.40	36.00	**37.40**
Radius	0.00	34.40	0.00	52.60	**87.00**	25.60	0.00	45.10	27.40	**98.10**	0.00	2.00	3.70	**5.70**	4.10	57.00	**61.10**
Ulna	0.00	2.40	4.30	0.90	**7.60**	0.00	0.00	17.20	0.00	**17.20**	2.80	0.00	0.00	**2.80**	0.00	0.00	**0.00**
Metacarpals	0.00	6.50	6.80	31.80	**45.10**	11.20	17.40	9.30	0.00	**37.90**	0.00	4.30	6.70	**11.00**	0.00	28.90	**28.90**
Vertebra	2.20	0.30	0.00	9.30	**11.80**	0.00	10.50	48.50	4.90	**63.90**	12.60	0.50	0.00	**13.10**	4.10	19.50	**23.60**
Ribs	21.60	0.50	14.20	9.90	**46.20**	0.00	6.40	16.60	0.00	**23.00**	9.40	2.90	0.00	**12.30**	8.00	0.30	**8.30**
Pelvis	0.00	0.00	2.30	14.60	**16.90**	8.60	0.00	7.20	4.20	**20.00**	16.00	0.00	1.50	**17.50**	1.70	10.00	**11.70**
Femur	10.50	17.20	0.00	13.10	**40.80**	0.00	5.90	26.80	5.20	**37.90**	8.20	13.50	4.70	**26.40**	13.60	22.00	**35.60**
Tibia	22.30	9.50	16.10	119.70	**167.60**	21.20	45.80	49.80	63.70	**180.50**	10.50	13.30	38.80	**62.60**	3.50	121.60	**125.10**
Astragalus	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	6.10	0.00	**6.10**	0.00	0.00	0.00	**0.00**	0.00	6.90	**6.90**
Calcaneus	0.00	2.10	0.00	0.00	**2.10**	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.00	**0.00**
Metatarsals	11.90	12.80	1.60	32.40	**58.70**	44.20	19.90	32.20	0.00	**96.30**	0.00	0.00	2.30	**2.30**	1.60	14.00	**15.60**
Carpals+Tarsals other	0.00	0.00	0.00	0.00	**0.00**	0.00	0.80	0.00	0.00	**0.80**	0.00	0.00	0.00	**0.00**	0.00	0.00	**0.00**
Phalanges	0.50	0.00	0.00	0.00	**0.50**	6.20	0.00	6.10	2.40	**14.70**	0.00	2.00	0.00	**2.00**	0.00	7.80	**7.80**
Total	108.70	149.20	84.90	497.50	**840.30**	164.30	279.30	405.30	137.60	**986.50**	136.50	47.40	272.40	**456.30**	43.90	420.30	**464.20**

Table 5.2.2.3-2; The total weight of fragments (in g.) of each element from ovicaprids at all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Skull + Hc	14.10	80.80	50.60	200.00	**345.50**	44.10	146.10	59.80	11.00	**261.00**	43.30	5.70	201.60	**250.60**	13.10	70.40	**83.50**
Stylopodium	0.90	42.20	2.30	41.40	**86.80**	11.80	32.40	114.60	28.20	**187.00**	57.90	16.70	19.30	**93.90**	19.30	95.40	**114.70**
Trunk	24.70	0.80	14.20	19.20	**58.90**	0.00	16.90	65.10	4.90	**86.90**	22.00	3.40	0.00	**25.40**	0.00	27.70	**27.70**
Zygopodium	0.00	46.30	20.40	173.20	**239.90**	46.80	45.80	94.90	91.10	**278.60**	13.30	15.30	42.50	**71.10**	11.50	189.90	**201.40**
Autopodium	32.80	21.40	8.40	64.20	**126.80**	61.60	38.10	53.70	2.40	**155.80**	0.00	6.30	9.00	**15.30**	0.00	57.60	**57.60**
Total	72.50	191.50	95.90	498.00	**857.90**	164.30	279.30	388.10	137.60	**969.30**	136.50	47.40	272.40	**456.30**	43.90	441.00	**484.90**

Table 5.2.2.3-3; The total weight of fragments (in g.) by body area from ovicaprids at all areas of the Reinach excavation

	Std.	%Std.	6/7thC (n=157)	%diff from std.	7/8thC* (n=84)	%diff from std.	9thC* (n=95)	%diff from std.	10thC* (n=17)	%diff from std.	11thC* (n=43)	%diff from std.	12thC* (n=98)	%diff from std.
Head	651.23	25.57%	346.40	13.18%	190.20	0.21%	70.80	-12.10%	43.30	6.15%	207.30	39.26%	76.30	-9.83%
Trunk	812.40	31.89%	58.00	-25.41%	58.00	-24.03%	70.00	-18.58%	22.00	-15.78%	3.40	-30.83%	39.80	-23.69%
Stylopodium	529.20	20.78%	121.10	-7.23%	121.10	-4.36%	142.80	6.39%	57.90	21.64%	36.00	-9.52%	112.10	2.34%
Zygopodium	285.33	11.20%	262.20	18.12%	262.20	24.33%	186.00	24.18%	13.30	-1.46%	57.80	6.87%	197.50	29.53%
Autopodium	269.03	10.56%	106.40	1.34%	106.40	3.86%	56.10	0.11%	0.00	-10.56%	15.30	-5.78%	59.20	1.65%
	2547.20		894.10		737.90		525.70		136.50		319.80		484.90	

Table 5.2.2.3-4; Comparison of ovicaprid body part proportions from different time periods at Reinach using a standard ovicaprid skeleton

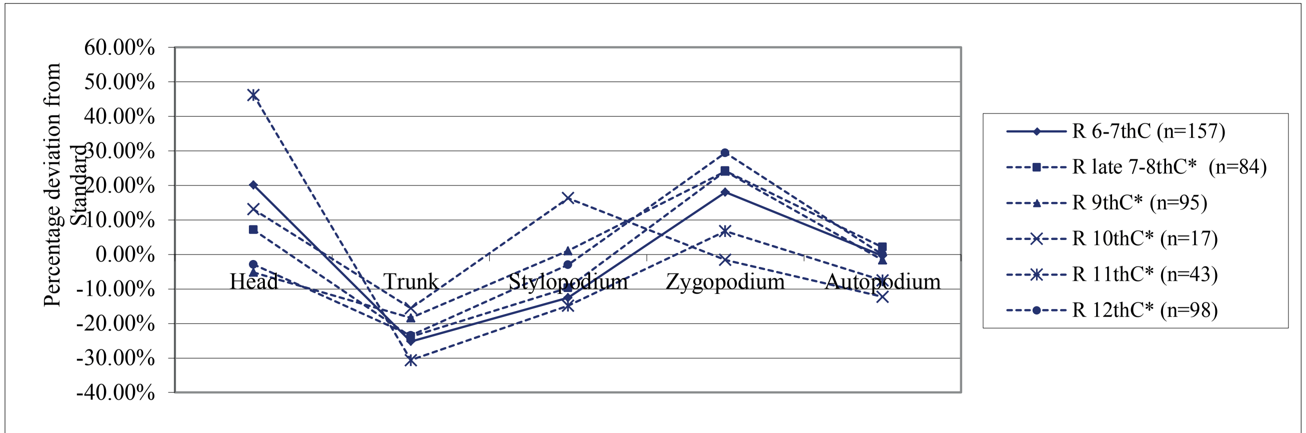


Figure 5.2.2.3-5; Ovicaprid body parts represented from different time periods at Reinach as a deviation from a standard ovicaprid skeleton

Reinach GMZ	Std	%Std.	6thC* (n=19)	%diff from std.	7thC* (n=15)	%diff from std.	8thC* (n=45)	%diff from std.	9thC* (n=69)	%diff from std.	10thC* (n=17)	%diff from std.	11thC* (n=15)	%diff from std.	12thC* (n=16)	%diff from std.
Head	651.23	25.57%	15.00	-11.77%	50.60	27.20%	146.10	26.74%	59.80	-10.16%	43.30	6.15%	5.70	-13.54%	5.90	-12.13%
Trunk	812.40	31.89%	23.80	-10.00%	14.20	-17.09%	16.90	-25.84%	65.10	-15.12%	22.00	-15.78%	3.40	-24.72%	12.10	-4.33%
Stylopodium	529.20	20.78%	35.20	11.61%	2.30	-18.38%	32.40	-9.18%	114.60	8.75%	57.90	21.64%	16.70	14.46%	16.70	17.27%
Zygopodium	285.33	11.20%	22.30	9.31%	20.40	10.07%	45.80	5.20%	94.90	13.25%	13.30	-1.46%	15.30	21.08%	7.60	6.11%
Autopodium	269.03	10.56%	12.40	0.85%	8.40	-1.80%	38.10	3.08%	53.70	3.27%	0.00	-10.56%	6.30	2.73%	1.60	-6.92%
Total	2547.20		108.70		95.90		279.30		388.10		136.50		47.40		43.90	

Table 5.2.2.3-6; Comparison of ovicaprid body part proportions from different time periods in the Gemeindezentrum area using a standard ovicarid skeleton

Reinach Sth	Std	%Std.	7thC (n=94)	%diff from std.	9thC* (n=26)	%diff from std.	11thC* (n=28)	%diff from std.	12thC* (n=82)	%diff from std.
Head	651.23	25.57%	200.00	14.59%	11.00	-17.57%	201.60	48.44%	70.40	-9.60%
Trunk	812.40	31.89%	19.20	-28.04%	4.90	-28.33%	0.00	-31.89%	27.70	-25.61%
Stylopodium	529.20	20.78%	41.40	-12.46%	28.20	-0.28%	19.30	-13.69%	95.40	0.86%
Zygopodium	285.33	11.20%	173.20	23.58%	91.10	55.00%	42.50	4.40%	189.90	31.86%
Autopodium	269.03	10.56%	64.20	2.33%	2.40	-8.82%	9.00	-7.26%	57.60	2.50%
Total	2547.20		498.00		137.60		272.40		441.00	

Table 5.2.2.3-7; Comparison of ovicaprid body part proportions from different time periods in the Stadthof area of reinach using a standard ovicaprid skeleton

Reinach AB	Std.	%Std.	6-7thC* (n=49)	%diff from std.	7-8thC* (n=39)	%diff from std.
Head	651.23	25.57%	80.80	16.63%	44.10	1.27%
Trunk	812.40	31.89%	0.80	-31.48%	0.00	-31.89%
Stylopodium	529.20	20.78%	42.20	1.26%	11.80	-13.59%
Zygopodium	285.33	11.20%	46.30	12.98%	46.80	17.28%
Autopodium	269.03	10.56%	21.40	0.61%	61.60	26.93%
Total	2547.20		191.50		164.30	

Table 5.2.2.3-8; Comparison of ovicaprid body part proportions from different time periods in the Altebrauerei area at Reinach using a standard ovicaprid skeleton

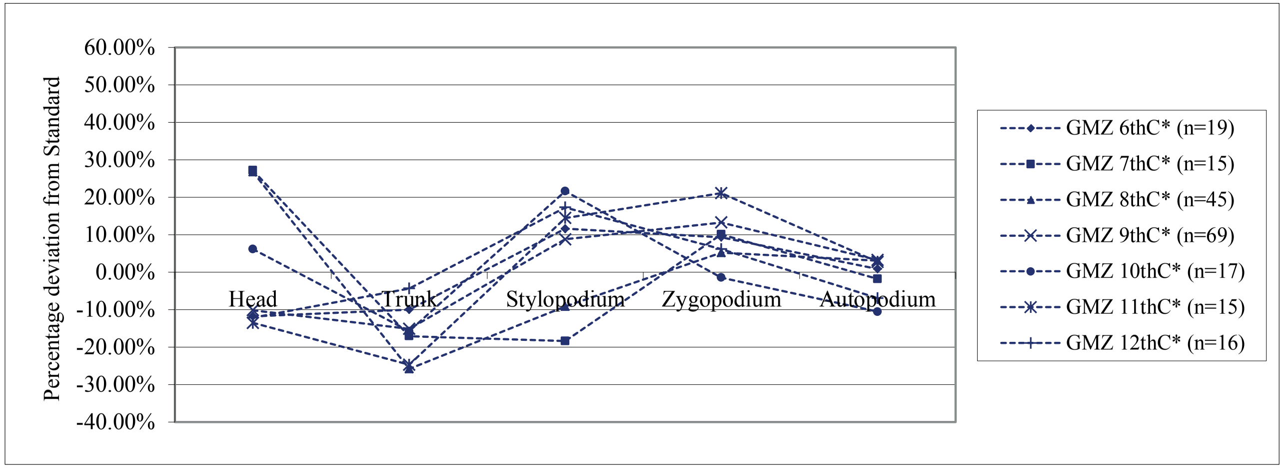


Figure 5.2.2.3-9; Ovicaprid body parts represented from different time periods in the Gemenidezentrum area at Reinach as a deviation from a standard ovicaprid skeleton

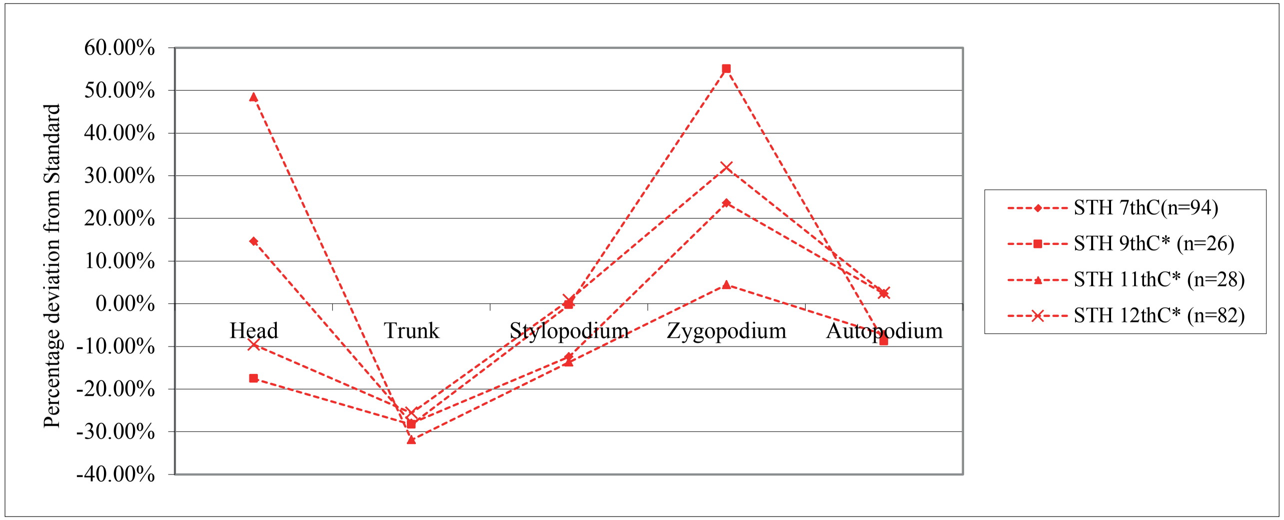


Figure 5.2.2.3-10; Ovicaprid body parts represented from different time periods in the Stadthof area at Reinach as a deviation from a standard ovicaprid skeleton

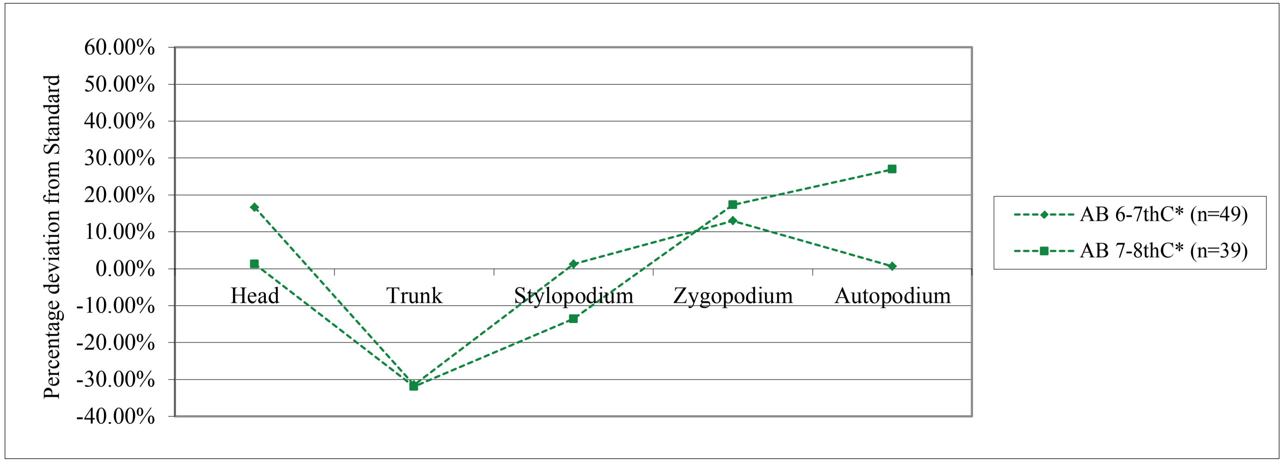


Figure 5.2.2.3-11; Ovicaprid body parts represented from different time periods in the Altebrauerei area at Reinach as a deviation from a standard ovicaprid skeleton

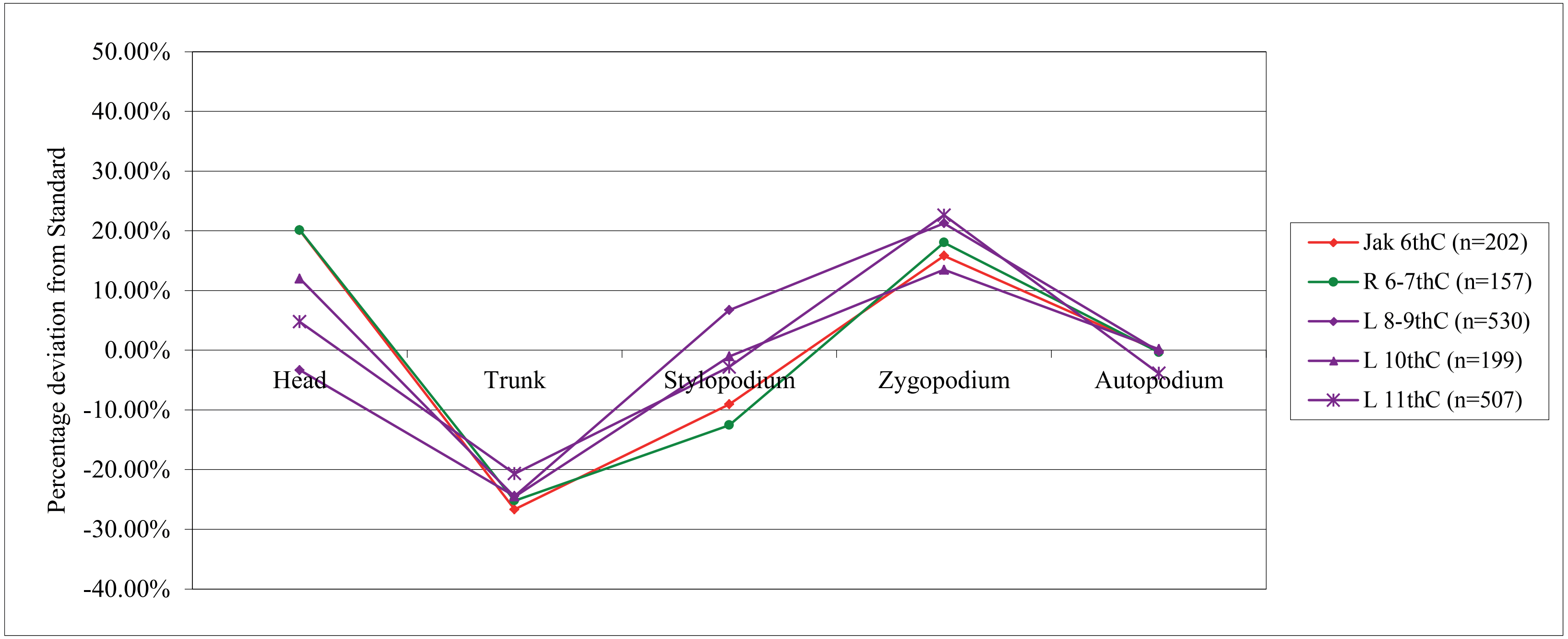


Fig 5.2.2.4-1; Summary of statistically sound data for ovicaprids from the three sites studied here, Jak- Kaiseraugst Jakobli-Haus, R- Reinach, L- Lausen

	Adl Mid 4th C	Adl mid 5 - late6th C	Jak 5 - late6th C	Jak+Adl 5-6th C	Jak Jak 6thC	Jak beg 7th C	Adl+Fbk 12th C
Crania	28	31	21	81	47	18	2
Teeth	13	32	18	77	18	15	6
Mandible	14	61	22	136	52	18	7
Scapula	19	36	16	85	55	16	5
Humerus	24	45	12	101	49	20	9
Radius	8	21	13	54	21	8	4
Ulna	6	23	4	49	29	8	0
Metacarpals	1	15	8	37	9	4	1
Vertebra	18	37	14	85	20	4	5
Ribs	29	98	89	277	84	32	7
Pelvis	9	30	12	68	10	10	2
Femur	22	45	30	117	44	21	5
Tibia	20	39	31	108	39	14	2
Fibula	4	11	9	31	6	6	2
Astragalus	0	1	1	3	2	1	0
Calcaneus	4	4	4	12	3	2	0
Metatarsals	6	15	8	38	18	1	2
Carpals+Tarsals other	1	0	0	0	0	0	0
Phalanges	0	4	3	11	4	0	0
Total	226	548	315	1370	510	198	59

Table 5.2.3.1-1; The total fragment count of each element by period from pig at the Kaiseraugst site,
Adl- Gasthof Adler, Jak- Jakobli-Haus, Fbk- Fabrikstrasse

	Adl Mid 4th C	Adl mid 5 - late6th C	Jak 5 - late6th C	Jak+Adl 5-6th C	Jak Jak 6thC	Jak beg 7th C	Adl+Fbk 12th C
Crania	407.10	538.10	313.20	851.30	1021.20	286.60	8.20
Teeth	58.00	196.10	79.70	275.80	104.80	79.30	17.60
Mandible	353.70	1761.20	529.50	2290.70	1658.90	367.70	138.00
Scapula	332.00	484.00	161.60	645.60	1453.10	375.80	53.10
Humerus	386.40	1111.10	310.80	1421.90	1341.00	519.00	156.60
Radius	144.90	360.30	218.90	579.20	439.20	124.90	54.80
Ulna	127.00	358.50	55.50	414.00	620.00	164.50	0.00
Metacarpals	3.20	119.20	71.00	190.20	75.60	18.20	7.70
Vertebra	208.20	389.70	98.10	487.80	302.40	64.00	58.30
Ribs	157.30	523.50	453.40	976.90	415.50	162.00	42.70
Pelvis	190.50	929.30	230.40	1159.70	210.20	205.80	12.60
Femur	236.10	634.00	562.30	1196.30	597.40	313.60	132.20
Tibia	349.20	750.90	533.90	1284.80	848.30	260.50	37.40
Fibula	12.40	27.40	28.50	55.90	23.10	10.10	7.10
Astragalus	0.00	17.70	15.20	32.90	29.30	11.60	0.00
Calcaneus	45.20	53.50	61.20	114.70	37.90	29.40	0.00
Metatarsals	28.40	112.60	63.30	175.90	145.80	1.90	21.00
Carpals+Tarsals other	3.90	0.00	0.00	0.00	0.00	0.00	0.00
Phalanges	0.00	21.10	22.60	43.70	22.10	0.00	0.00
Total	3043.50	8388.20	3809.10	12197.30	9345.80	2994.90	747.30

Table 5.2.3.1-2; The total weight of fragments (in g.) of each element from pig at the Kaiseraugst site,
abbreviations as in table 5.2.3.1-1

	Adl Mid 4th C	Adl mid 5 - late6th C	Jak 5 - late6th C	Jak+Adl 5-6th C	Jak Jak 6thC	Jak beg 7th C	Adl+Fbk 12th C
Skull + Hc	818.8	2495.4	922.4	3417.8	2784.9	733.6	163.8
Stylopodium	1145	3158.4	1265.1	4423.5	3601.7	1414.2	354.5
Trunk	365.5	913.2	551.5	1464.7	717.9	226	101
Zygopodium	633.5	1497.1	836.8	2333.9	1930.6	560	99.3
Autopodium	80.7	324.1	233.3	557.4	310.7	61.1	28.7
Total	3043.5	8388.2	3809.1	12197.3	9345.8	2994.9	747.3

Table 5.2.3.1-3; The total weight of fragments (in g.) by body region from pig at the Kaiseraugst site,
abbreviations as in table 5.2.3.1-1

KA Adl.	Std.	%Std.	mid 4thC (n=226)	%diff from std.	5-6thC (n=548)	%diff from std.	12thC* (n=43)	%diff from std.
Head	1266.6	24.96%	1454.5	-13.95%	2495.4	4.78%	160.5	0.13%
Trunk	1438.9	28.36%	2708.2	-7.84%	913.2	-17.47%	64	-18.35%
Stylopodium	1267.5	24.98%	4636.3	10.14%	3158.4	12.67%	313.2	23.99%
Zygopodium	579.1	11.41%	1560.4	0.41%	1497.1	6.43%	73.1	0.02%
Autopodium	521.6	10.28%	2840.8	11.24%	324.1	-6.42%	28.7	-5.79%
Total	5073.7		13200.2		8388.2		639.5	

KA Jak.	Std.	%Std.	4-6thC* (n=90)	%diff from std.	5-6thC (n=315)	%diff from std.	6thC (n=510)	%diff from std.	beg. 7thC (n=214)	%diff from std.
Head	1266.6	24.96%	205.9	-3.81%	922.4	-0.75%	2784.9	4.83%	733.6	-0.47%
Trunk	1438.9	28.36%	126.9	-15.32%	551.5	-13.88%	717.9	83.90%	226	-20.81%
Stylopodium	1267.5	24.98%	496.3	26.00%	1265.1	8.23%	3601.7	538.22%	1414.2	22.24%
Zygopodium	579.1	11.41%	107.9	-0.33%	836.8	10.55%	1930.6	290.48%	560	7.28%
Autopodium	521.6	10.28%	36.5	-6.53%	233.3	-4.16%	310.7	38.31%	61.1	-8.24%
Total	5073.7		973.5		3809.1		9345.8		2994.9	

Table 5.2.3.1-4; Comparison of pig body part proportions from Kaiseraugst using a standard pig skeleton
std- standard, KA- Kaiseraugst, Adl, Gasthof Adler, Jak- Jakobli-Haus

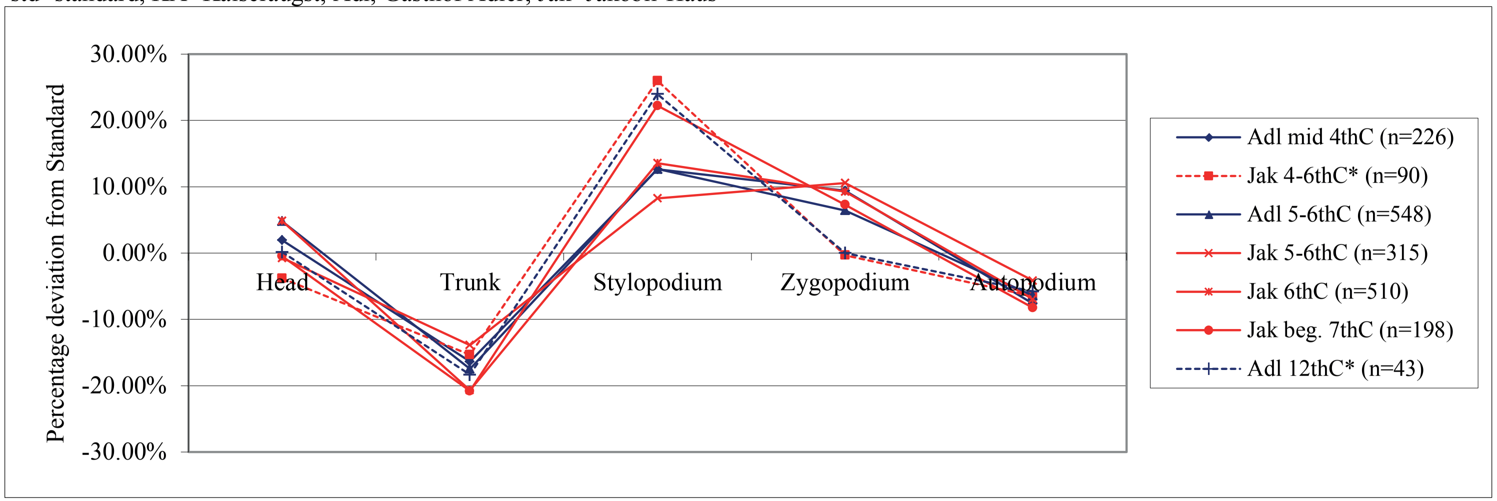


Fig. 5.2.3.1-5; Graphical illustration of table 5.2.3.1-4, abbreviations as in table, dotted lines and asterisks show samples that are considered statistically small

	Late6th-7thC	8th-9thC	10thC	11thC	12thC
Crania	14	126	106	114	5
Teeth	41	137	73	137	4
Mandible	12	117	70	54	5
Scapula	6	83	23	53	4
Humerus	20	65	34	49	4
Radius	3	26	13	15	3
Ulna	3	24	7	16	0
Metacarpals	3	12	7	16	0
Vertebra	7	66	18	156	1
Ribs	8	67	54	136	2
Pelvis	2	46	9	27	0
Femur	8	86	34	90	4
Tibia	14	60	31	49	3
Fibula	3	27	20	22	0
Astragalus	0	4	4	4	0
Calcaneus	1	17	3	3	0
Metatarsals	3	14	7	14	1
Carpals+Tarsals other	0	7	7	6	0
Phalanges	6	22	8	25	2
Total	154	1006	528	986	38

Table 5.2.3.2-1; The total fragment count of each element by period from pig at Lausen.

	Late6th-7thC	8th-9thC	10thC	11thC	12thC
Crania	62.60	829.00	620.40	718.90	45.00
Teeth	76.00	268.10	145.50	198.40	10.60
Mandible	145.70	1962.10	942.90	664.30	93.60
Scapula	101.40	804.40	209.70	323.00	45.20
Humerus	458.70	848.00	534.20	488.10	64.60
Radius	28.30	198.00	64.20	86.00	8.00
Ulna	52.70	319.80	51.90	193.30	0.00
Metacarpals	5.00	46.20	19.70	38.10	0.00
Vertebra	54.30	377.30	93.10	1174.70	1.60
Ribs	23.00	262.10	183.10	382.60	4.40
Pelvis	33.30	709.20	97.90	258.80	0.00
Femur	50.30	622.20	197.20	541.70	16.90
Tibia	162.50	626.60	367.80	366.40	19.50
Fibula	3.80	30.10	16.90	29.60	0.00
Astragalus	0.00	41.60	39.90	30.00	0.00
Calcaneus	14.30	122.80	18.40	16.70	0.00
Metatarsals	14.20	65.40	16.80	47.40	6.90
Carpals+Tarsals other	0.00	15.80	10.30	8.00	0.00
Phalanges	11.10	50.60	12.70	55.80	4.20
Total	1297.20	8199.30	3642.60	5621.80	320.50

Table 5.2.3.2-2; The total weight of fragments (in g.) of each element from pig at Lausen.

	Late6th-7thC	8th-9thC	10thC	11thC	12thC
Skull + Hc	284.30	3059.20	1708.80	1581.60	149.20
Stylopodium	643.70	3010.00	1039.00	1611.60	126.70
Trunk	77.30	646.10	276.20	1560.90	6.00
Zygopodium	247.30	1174.50	500.80	675.30	27.50
Autopodium	44.60	353.40	123.40	200.80	11.10
Total	1297.20	8243.20	3648.20	5630.20	320.50

Table 5.2.3.2-2; The total weight of fragments (in g.) by body region from pig at Lausen.

	Std.	%Std.	6-7thC (n=154)	%diff from std.	8-9thC (n=1017)	%diff from std.	10thC (n=532)	%diff from std.	11thC (n=996)	%diff from std.	12thC* (n=38)	%diff from std.
Head	1266.60	24.96%	284.30	-3.05%	3059.20	12.13%	1708.80	21.88%	1581.60	3.11%	149.20	29.23%
Trunk	1438.87	28.36%	77.30	-22.40%	639.40	-20.61%	276.20	-20.79%	1560.90	-0.65%	6.00	-26.18%
Stylopodium	1267.53	24.98%	643.70	24.64%	3013.90	11.56%	1039.00	3.50%	1615.40	3.69%	81.50	4.62%
Zygopodium	579.13	11.41%	247.30	7.65%	1174.50	2.83%	500.80	2.31%	675.30	0.57%	27.50	-1.43%
Autopodium	521.57	10.28%	44.60	-6.84%	360.10	-5.91%	123.40	-6.90%	200.80	-6.72%	11.10	-6.25%
	5073.70		1297.20		8247.10		3648.20		5634.00		275.30	

Table 5.2.3.2-4; Comparison of cattle body part proportions from different time periods at Lausen using a standard pig skeleton

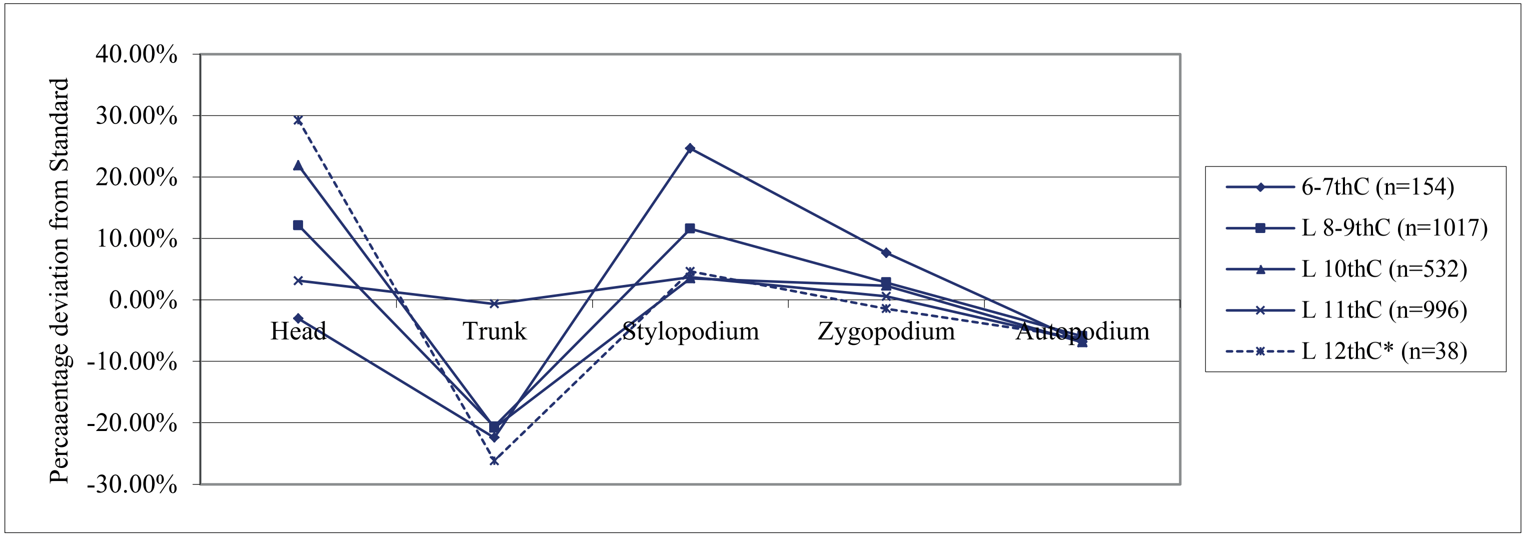


Fig. 5.2.3.2-5; Graphical illustration of table 5.2.2.2-4, dotted lines and asterisks show samples that are considered statistically small

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	41	38	4	10	**93**	5	3	26	13	**47**	2	1	7	**10**	2	8	**10**
Teeth	10	15	3	10	**38**	4	5	25	2	**36**	6	1	7	**14**	4	17	**21**
Mandible	15	22	5	18	**60**	7	5	14	4	**30**	2	1	3	**6**	2	20	**22**
Scapula	6	11	2	8	**27**	2	2	7	4	**15**	1	1	4	**6**	2	3	**5**
Humerus	5	12	5	8	**30**	6	3	6	4	**19**	1	3	5	**9**	1	8	**9**
Radius	3	4	3	2	**12**	3	2	6	1	**12**	0	1	4	**5**	0	1	**1**
Ulna	2	7	0	3	**12**	0	4	1	2	**7**	1	2	5	**8**	3	3	**6**
Metacarpals	11	6	8	4	**29**	4	1	0	1	**6**	0	10	0	**10**	0	1	**1**
Vertebra	6	7	1	10	**24**	6	2	5	1	**14**	4	4	2	**10**	3	3	**6**
Ribs	9	11	4	7	**31**	1	9	3	6	**19**	6	1	1	**8**	2	7	**9**
Pelvis	5	3	4	8	**20**	0	3	0	4	**7**	0	3	4	**7**	1	5	**6**
Femur	2	24	2	5	**33**	3	6	8	1	**18**	2	1	2	**5**	0	3	**3**
Tibia	6	12	4	12	**34**	3	4	3	4	**14**	2	2	5	**9**	5	5	**10**
Fibula	4	8	2	7	**21**	1	0	5	1	**7**	4	10	0	**14**	1	5	**6**
Astragalus	1	0	1	0	**2**	0	0	1	0	**1**	2	1	1	**4**	0	1	**1**
Calcaneus	1	1	1	0	**3**	0	2	0	1	**3**	1	1	1	**3**	0	2	**2**
Metatarsals	3	7	7	4	**21**	4	3	5	1	**13**	0	3	1	**4**	0	3	**3**
Carpals+Tarsals other	0	1	0	0	**1**	0	0	0	0	**0**	1	2	0	**3**	0	0	**0**
Phalanges	3	1	5	0	**9**	0	3	1	0	**4**	2	6	0	**8**	0	3	**3**
Total	133	190	61	116	**500**	49	57	116	50	**272**	37	54	52	**143**	26	98	**124**

Table 5.2.3.3-1; The total weight of fragments (in g.) of each element from pig at all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Crania	139.30	119.80	30.40	125.50	**415.00**	66.70	18.80	231.10	185.90	**502.50**	5.20	1.30	53.70	**60.20**	4.50	54.60	**59.10**
Teeth	19.30	21.10	8.00	38.70	**87.10**	2.40	9.50	34.50	3.10	**49.50**	23.50	0.70	18.30	**42.50**	5.20	42.90	**48.10**
Mandible	357.20	87.30	42.80	526.00	**1013.30**	98.20	85.10	222.30	82.60	**488.20**	59.40	46.90	64.50	**170.80**	86.10	#####	**370.20**
Scapula	57.90	138.50	33.70	80.90	**311.00**	5.50	14.30	123.50	47.90	**191.20**	15.80	5.70	64.10	**85.60**	19.80	34.10	**53.90**
Humerus	96.10	42.20	97.60	92.20	**328.10**	52.40	38.20	69.50	90.50	**250.60**	2.90	19.60	115.30	**137.80**	14.70	#####	**144.90**
Radius	35.50	8.90	47.20	7.90	**99.50**	9.90	14.20	63.80	12.80	**100.70**	0.00	5.70	50.50	**56.20**	0.00	1.00	**1.00**
Ulna	20.50	18.00	0.00	13.00	**51.50**	0.00	47.40	28.20	30.10	**105.70**	27.70	8.00	23.20	**58.90**	13.40	17.70	**31.10**
Metacarpals	37.20	11.20	28.70	12.60	**89.70**	8.40	5.20	0.00	2.10	**15.70**	0.00	52.60	0.00	**52.60**	0.00	3.60	**3.60**
Vertebra	66.20	69.20	10.70	116.00	**262.10**	55.80	5.30	53.40	3.00	**117.50**	47.30	20.10	6.40	**73.80**	3.70	32.20	**35.90**
Ribs	54.00	51.40	21.40	40.30	**167.10**	7.10	26.70	10.80	35.30	**79.90**	27.60	5.70	4.80	**38.10**	12.10	39.00	**51.10**
Pelvis	89.50	53.10	17.40	36.10	**196.10**	0.00	62.50	0.00	119.80	**182.30**	0.00	7.80	60.40	**68.20**	4.50	#####	**115.70**
Femur	3.00	90.20	27.70	54.00	**174.90**	11.80	62.10	47.70	7.80	**129.40**	30.50	5.70	31.60	**67.80**	0.00	35.70	**35.70**
Tibia	82.80	44.20	47.50	132.80	**307.30**	13.00	28.60	67.60	40.60	**149.80**	33.70	15.00	57.80	**106.50**	37.10	#####	**149.60**
Fibula	13.60	8.10	5.10	12.10	**38.90**	2.30	0.00	10.40	0.90	**13.60**	7.20	52.60	0.00	**59.80**	2.10	5.90	**8.00**
Astragalus	17.80	0.00	12.30	0.00	**30.10**	0.00	0.00	9.40	0.00	**9.40**	24.20	5.70	12.30	**42.20**	0.00	8.00	**8.00**
Calcaneus	0.40	0.50	12.50	0.00	**13.40**	0.00	31.20	0.00	20.20	**51.40**	13.80	5.70	16.30	**35.80**	0.00	22.00	**22.00**
Metatarsals	12.30	20.60	48.40	29.20	**110.50**	11.10	18.80	10.80	2.60	**43.30**	0.00	3.20	3.60	**6.80**	0.00	10.90	**10.90**
Carpals+Tarsals other	0.00	5.40	0.00	0.00	**5.40**	0.00	0.00	0.00	0.00	**0.00**	4.10	11.40	0.00	**15.50**	0.00	0.00	**0.00**
Phalanges	14.90	1.10	21.20	0.00	**37.20**	0.00	3.50	1.20	0.00	**4.70**	3.10	17.40	0.00	**20.50**	0.00	5.10	**5.10**
Total	1117.50	790.80	512.60	1317.30	**3738.20**	344.60	471.40	984.20	685.20	**2485.40**	326.00	290.80	582.80	**1199.60**	203.20	#####	**1153.90**

Table 5.2.3.3-1; The total weight of fragments (in g.) of each element from pig at all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Skull + Hc	515.80	228.20	81.20	690.20	**1515.40**	167.30	113.40	487.90	271.60	**1040.20**	88.10	48.90	136.50	**273.50**	95.80	#####	**477.40**
Stylopodium	246.50	324.00	176.40	263.20	**1010.10**	69.70	177.10	240.70	266.00	**753.50**	40.60	75.40	271.40	**387.40**	39.00	#####	**350.20**
Trunk	120.20	124.50	32.10	156.30	**433.10**	62.90	32.00	64.20	38.30	**197.40**	50.60	36.50	11.20	**98.30**	15.80	71.20	**87.00**
Zygopodium	152.40	79.20	99.80	165.80	**497.20**	25.20	90.20	170.00	84.40	**369.80**	77.20	45.20	131.50	**253.90**	52.60	#####	**189.70**
Autopodium	84.60	39.10	123.10	44.20	**291.00**	20.10	58.70	21.40	24.90	**125.10**	70.70	23.10	32.20	**126.00**	0.00	49.60	**49.60**
Total	1119.50	795.00	512.60	1319.70	**3746.80**	345.20	471.40	984.20	685.20	**2486.00**	327.20	229.10	582.80	**1139.10**	203.20	#####	**1153.90**

Table 5.2.3.3-2; The total weight of fragments (in g.) of body area from pig at all areas of the Reinach excavation

	GMZ 6thC	AB 6th-7thC	GMZ 7thC	Sth 7thC	**All 6th-7thC**	AB 7th-8thC	GMZ 8thC	GMZ 9thC	Sth 9thC	**All 8th-9thC**	GMZ 10thC	GMZ 11thC	Sth 11thC	**All 10th-11thC**	GMZ 12thC	Sth 12thC	**All 12thC**
Skull	515.80	228.20	81.20	690.20	**1515.40**	167.30	113.40	487.90	271.60	**1040.20**	88.10	48.90	136.50	**273.50**	95.80	#####	**477.40**
Meat	340.90	424.00	208.50	406.50	**1379.90**	107.20	206.80	275.20	304.30	**893.50**	91.20	98.90	277.80	**467.90**	54.80	#####	**437.20**
Meat lesser	164.20	82.30	99.80	165.80	**512.10**	27.60	90.20	187.70	84.40	**389.90**	404.40	51.50	131.50	**587.40**	52.60	#####	**189.70**
Worked/Tools (Mp)	51.50	32.10	77.10	44.20	**204.90**	20.10	24.00	10.80	4.70	**59.60**	1.80	14.30	3.60	**19.70**	0.00	14.50	**14.50**
Cp & Ts	18.20	5.90	24.80	0.00	**48.90**	0.00	31.20	9.40	20.20	**60.80**	42.10	0.00	28.60	**70.70**	0.00	30.00	**30.00**
Pes	14.90	1.10	21.20	0.00	**37.20**	0.00	3.50	1.20	0.00	**4.70**	26.80	8.80	0.00	**35.60**	0.00	5.10	**5.10**
Other	14.00	21.40	0.00	13.00	**48.40**	23.00	2.30	12.00	0.00	**37.30**	0.00	6.70	9.60	**16.30**	0.00	0.00	**0.00**
Total	1119.50	795.00	512.60	1319.70	**3746.80**	345.20	471.40	984.20	685.20	**2486.00**	654.40	229.10	587.60	**1471.10**	203.20	#####	**1153.90**

Table 5.2.3.3-3; The total weight of fragments (in g.) by use from pig at all areas of the Reinach excavation

	Std	%Std.	6-7thC (n=505)	%diff from std.	late 7-8thC* (n=107)	%diff from std.	9thC (n=166)	%diff from std.	10thC* (n=38)	%diff from std.	11thC* (n=96)	%diff from std.	12thC* (n=124)	%diff from std.
Head	2953.5	18.63%	1515.4	22.07%	280.7	-7.35%	759.5	26.86%	88.1	8.29%	185.4	4.20%	477.4	22.95%
Trunk	5023.3	31.69%	433.1	-20.06%	433.1	-14.29%	102.5	-25.55%	74.9	-8.80%	47.7	-25.81%	87	-24.11%
Stylopodium	4137.7	26.10%	992.7	0.56%	992.7	13.79%	506.7	4.25%	49.2	-11.06%	346.8	16.61%	350.2	4.40%
Zygopodium	1793.4	11.31%	497.2	2.04%	497.2	8.66%	254.4	3.93%	68.6	9.65%	176.7	10.45%	183.8	4.70%
Autopodium	1944.6	12.27%	285.1	-4.61%	285.1	-0.81%	46.3	-9.49%	46.4	1.91%	55.3	-5.46%	49.6	-7.95%
	15852.5		3723.5		2488.8		1669.4		327.2		811.9		1148	

Table 5.2.2.3-4; Comparison of pig body part proportions from different time periods at Reinach using a standard pig skeleton, * denotes small samples

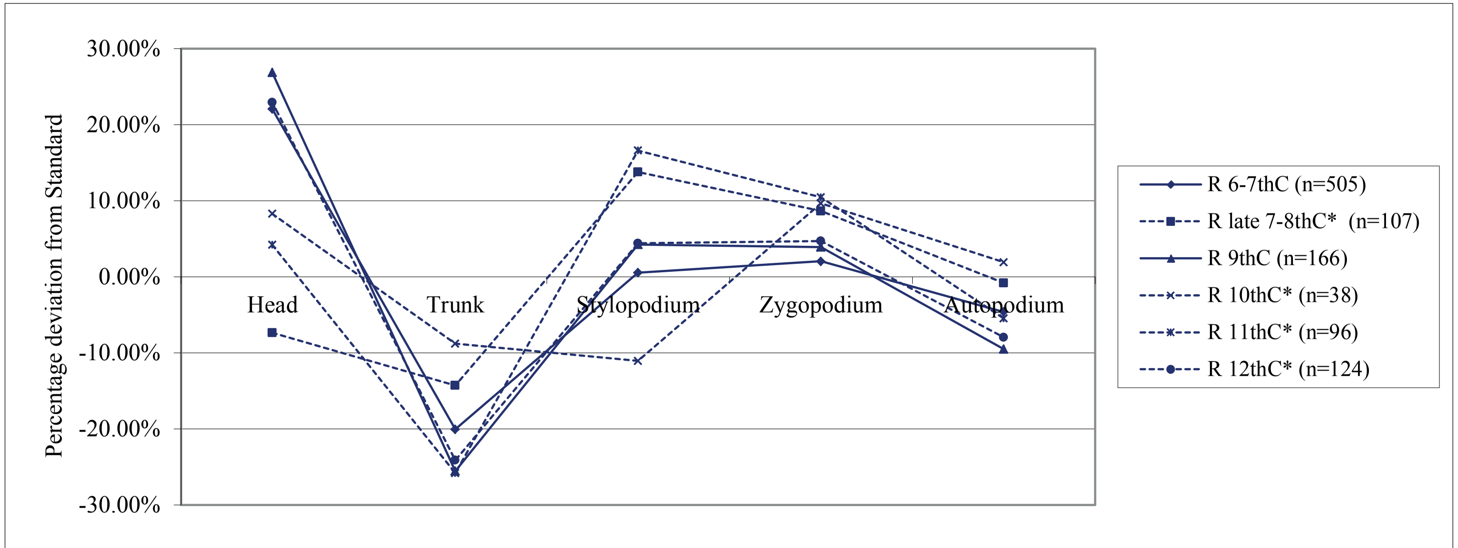


Table 5.2.2.3-5; Pig body parts represented from different time periods at Reinach as a deviation from a standard pig skeleton asterisks and dashed lines represent statistically small samples

Reinach GMZ	Std	%Std.	6thC* (n=135)	%diff from std.	7thC* (n=61)	%diff from std.	8thC* (n=57)	%diff from std.	9thC* (n=116)	%diff from std.	10thC* (n=38)	%diff from std.	11thC* (n=43)	%diff from std.	12thC* (n=26)	%diff from std.
Head	1266.60	24.96%	515.80	21.11%	81.20	-8.57%	113.40	-0.91%	487.90	24.61%	88.10	1.96%	48.90	-3.62%	95.80	22.18%
Trunk	1438.87	28.36%	120.20	-17.62%	32.10	-21.88%	32.00	-21.57%	64.20	-21.84%	74.90	-5.47%	36.50	-12.43%	15.80	-20.58%
Stylopodium	1267.53	24.98%	246.50	-2.96%	159.00	7.13%	177.10	12.59%	240.70	-0.53%	49.20	-9.95%	75.40	7.93%	39.00	-5.79%
Zygopodium	579.13	11.41%	152.40	2.20%	99.80	8.74%	90.20	7.72%	170.00	5.86%	68.60	9.55%	45.20	8.31%	52.60	14.47%
Autopodium	521.57	10.28%	84.60	-2.72%	123.10	14.58%	58.70	2.17%	21.40	-8.11%	46.40	3.90%	23.10	-0.20%	0.00	-10.28%
	5073.70		1119.50		495.20		471.40		984.20		327.20		229.10		203.20	

Table 5.2.2.3-6; Comparison of pig body part proportions from different time periods in the Gemeindezentrum area using a standard pig skeleton, * denotes small samples

Reinach Sth	Std	%Std.	7thC (n=117)	%diff from std.	9thC* (n=50)	%diff from std.	11thC* (n=53)	%diff from std.	12thC* (n=98)	%diff from std.
Head	1266.60	24.96%	690.20	27.34%	271.60	14.67%	136.50	-1.54%	381.60	15.43%
Trunk	1438.87	28.36%	156.30	-16.52%	38.30	-22.77%	11.20	-26.44%	71.20	-20.82%
Stylopodium	1267.53	24.98%	263.20	-5.04%	266.00	13.84%	271.40	21.59%	311.20	7.96%
Zygopodium	579.13	11.41%	165.80	1.15%	84.40	0.90%	131.50	11.15%	131.20	2.47%
Autopodium	521.57	10.28%	44.20	-6.93%	24.90	-6.65%	32.20	-4.75%	49.60	-5.03%
	5073.70		1319.70		685.20		582.80		944.80	

Table 5.2.2.3-7; Comparison of pig body part proportions from different time periods in the Stadthof area using a standard pig skeleton, * denotes small samples

Reinach AB	Std.	%Std.	6-7thC (n=192)	%diff from std.	7-8thC* (n=50)	%diff from std.
Head	1266.60	24.96%	228.20	3.95%	167.30	23.50%
Trunk	1438.87	28.36%	124.50	-12.58%	62.90	-10.14%
Stylopodium	1267.53	24.98%	324.00	16.08%	69.70	-4.79%
Zygopodium	579.13	11.41%	79.20	-1.38%	25.20	-4.11%
Autopodium	521.57	10.28%	33.20	-6.07%	20.10	-4.46%
	5073.70		789.10		345.20	

Table 5.2.2.3-8; Comparison of pig body part proportions from different time periods in the Altebrauerei area using a standard pig skeleton, * denotes small samples

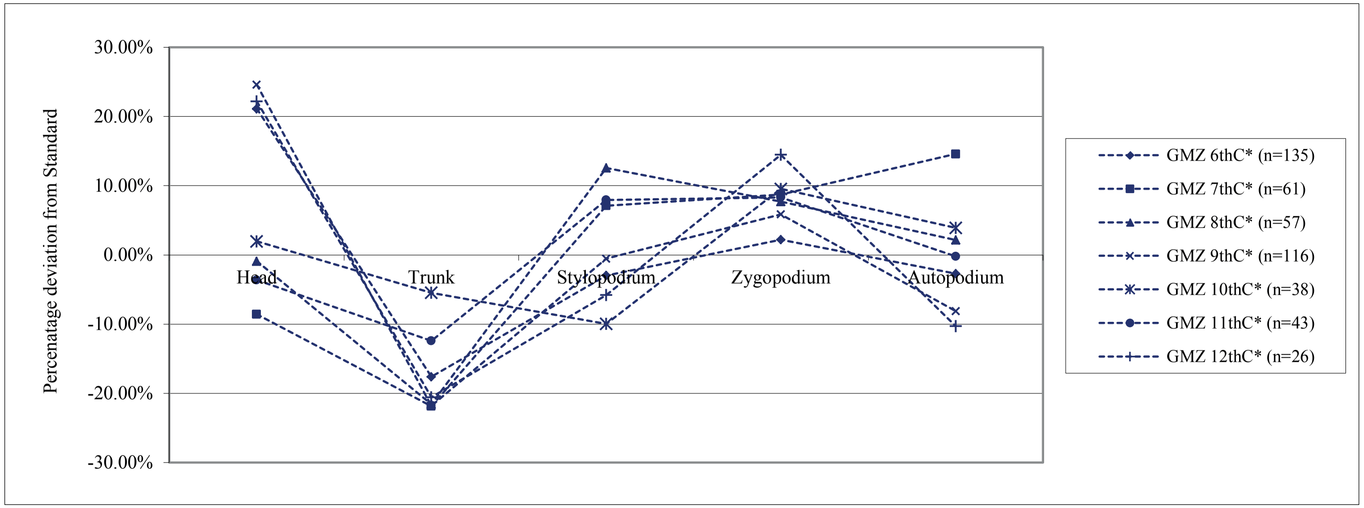


Table 5.2.2.3-9; Pig body parts represented from different time periods in the Gemeindezentrum area at Reinach as a deviation from a standard pig skeleton asterisks and dashed lines represent statistically small samples

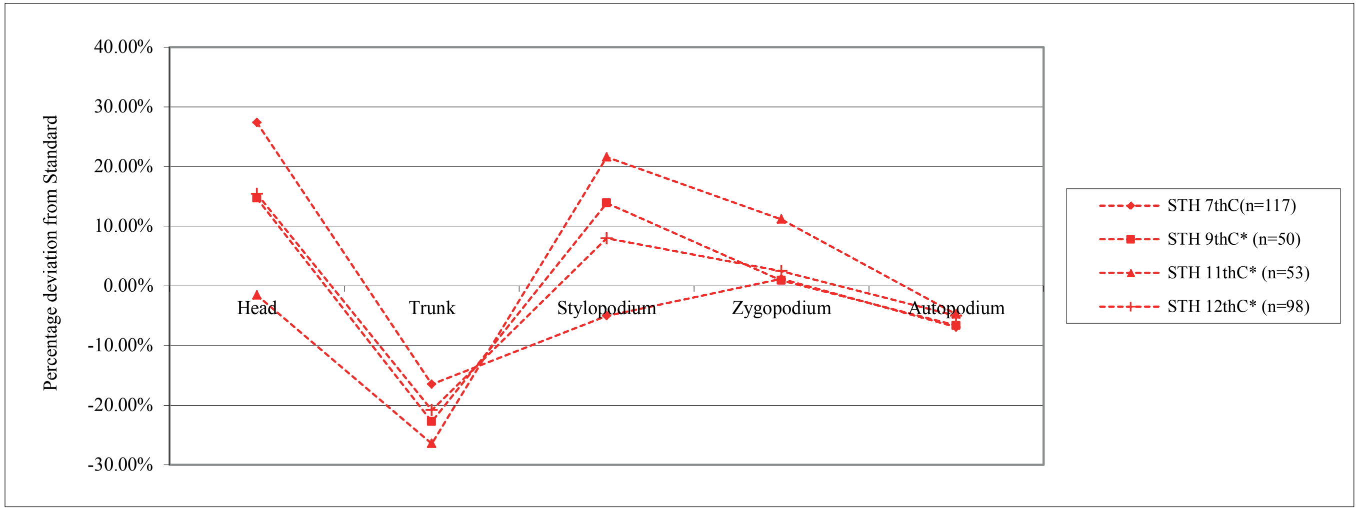


Table 5.2.2.3-10; Pig body parts represented from different time periods in the Stadthof area at Reinach as a deviation from a standard Pig skeleton asterisks and dashed lines represent statistically small samples

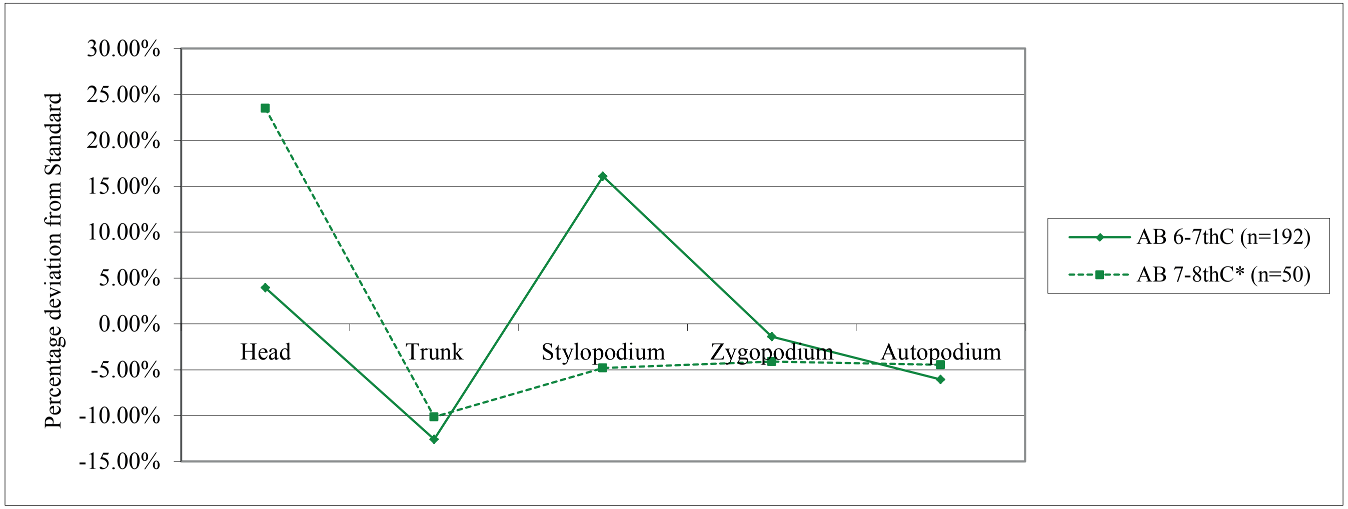


Table 5.2.2.3-11; Pig body parts represented from different time periods in the Altebrauerei area at Reinach as a deviation from a standard pig skeleton asterisks and dashed lines represent statistically small samples

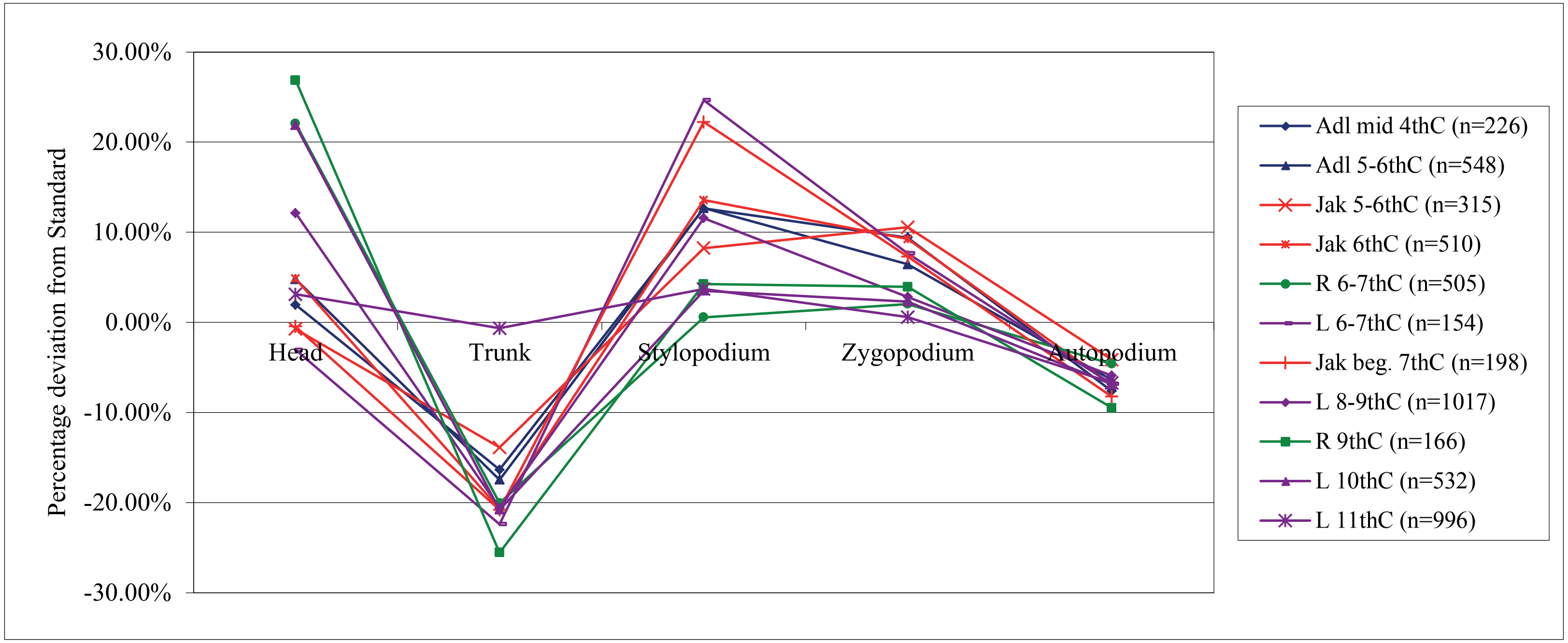


Fig 5.2.3.4-1; Summary of statistically sound data for pigs from the three sites studied here,
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, R- Reinach, L- Lausen

KA	All				Jak*				Adl*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	0	0.0	0.00%	0.00%	0	0.0	0.00%	0.00%	0	0	0.00%	0.00%
G	13	10.0	7.18%	3.27%	11	8.1	7.48%	3.28%	2	1.9	5.88%	3.24%
F	85	122.8	46.96%	40.16%	67	97.0	45.58%	39.26%	18	25.8	52.94%	43.95%
T	7	5.9	3.87%	1.93%	5	3.8	3.40%	1.54%	2	2.1	5.88%	3.58%
H	55	125.3	30.39%	40.97%	45	98.8	30.61%	39.98%	10	26.5	29.41%	45.14%
P	21	41.8	11.60%	13.67%	19	39.4	12.93%	15.94%	2	2.4	5.88%	4.09%
Total	181	305.8			147	247.1			34	58.7		

Table 5.2.4-1; Body part distribution of Gallus bones at Kaiseraugst, Jak- Jakobli-Haus, Adl- Gasthof Adler, *denotes small samples
n.- number, g.- grammes, C- Cranial, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones

Lausen	All*				9thC*				10thC*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	0	0.0	0.00%	0.00%	0	0.0	0.00%	0.00%	0	0	0.00%	0.00%
G	7	4.8	6.03%	4.50%	3	1.8	6.82%	3.87%	3	1.6	8.57%	6.04%
F	48	36.8	41.38%	34.49%	18	15.4	40.91%	33.12%	12	5.3	34.29%	20.00%
T	10	4.3	8.62%	4.03%	2	0.4	4.55%	0.86%	2	1.2	5.71%	4.53%
H	38	52.8	32.76%	49.48%	15	24.0	34.09%	51.61%	15	17	42.86%	64.15%
P	13	8.0	11.21%	7.50%	6	4.9	13.64%	10.54%	3	1.4	8.57%	5.28%
Total	116	106.7			44	46.5			35	26.5		

Table 5.2.4-2; Body part distrubution of Gallus bones at Lausen, split by date, *denotes small samples
n.- number, g.- grammes, C- Cranial, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones

Reinach	All*				STH*				GMZ*				AB*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	2	0.9	1.87%	0.83%	1	0.6	3.03%	1.73%	1	0.3	1.52%	0.42%	0	0.0	0.00%	0.00%
G	15	8.3	14.02%	7.65%	9	5.6	27.27%	16.18%	6	2.7	9.09%	3.82%	0	0.0	0.00%	0.00%
F	37	30.8	34.58%	28.39%	10	9.2	30.30%	26.59%	22	20.0	33.33%	28.33%	5	1.6	62.50%	48.48%
T	5	1.5	4.67%	1.38%	1	0.7	3.03%	2.02%	3	0.7	4.55%	0.99%	1	0.1	12.50%	3.03%
H	31	47.5	28.97%	43.78%	7	8.6	21.21%	24.86%	22	37.3	33.33%	52.83%	2	1.6	25.00%	48.48%
P	17	19.5	15.89%	17.97%	5	9.9	15.15%	28.61%	12	9.6	18.18%	13.60%	0	0.0	0.00%	0.00%
Total	107	108.5			33	34.6			66	70.6			8	3.3		

Table 5.2.4-3; Body part distribution of Gallus bones at Reinach, split by excavation area, Sth- Stadthof, GMZ- Gemeindezentrum, AB- Altebrauerei
n.- number, g.- grammes, C- Cranial, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones, * denotes small samples

Lausen	All				9thC*				10thC*				11thC*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	34	4336.1	17.26%	29.20%	7	72.1	25.00%	4.86%	13	1500.8	18.57%	19.07%	13	2760.3	19.70%	64.56%
D	36	830.5	18.27%	5.59%	6	154.5	21.43%	10.42%	8	110.7	11.43%	1.41%	15	283.3	22.73%	6.63%
G	15	2709.8	7.61%	18.25%	0	0.0	0.00%	0.00%	8	2133.2	11.43%	27.10%	2	205.6	3.03%	4.81%
F	24	2423.0	12.18%	16.32%	6	473.2	21.43%	31.91%	7	1359.3	10.00%	17.27%	8	347.6	12.12%	8.13%
T	14	772.5	7.11%	5.20%	1	21.3	3.57%	1.44%	7	577.6	10.00%	7.34%	4	145.2	6.06%	3.40%
H	24	2331.5	12.18%	15.70%	4	653.9	14.29%	44.10%	3	1101.3	4.29%	13.99%	10	375.3	15.15%	8.78%
P	50	1447.3	25.38%	9.75%	4	107.7	14.29%	7.26%	24	1087.6	34.29%	13.82%	14	158.2	21.21%	3.70%
Total	197	14850.7			28	1482.7			70	7870.5			66	4275.5		

Table 5.2.5-1; Body part distrubution of equid bones at Lausen, split by date, * denotes small samples
n.- number, g.- grammes, C- Cranial, D- teeth, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones

Reinach	All*				STH*				GMZ*				AB*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	7	107.8	12.50%	3.78%	1	19.2	6.25%	1.22%	6	88.6	15.79%	7.19%	0	0.0	0.00%	0.00%
D	11	363.5	19.64%	12.75%	0	0.0	0.00%	0.00%	11	363.5	28.95%	29.48%	0	0.0	0.00%	0.00%
G	4	495.0	7.14%	17.36%	2	399.1	12.50%	25.39%	2	95.9	5.26%	7.78%	0	0.0	0.00%	0.00%
F	4	222.2	7.14%	7.79%	1	50.8	6.25%	3.23%	3	171.4	7.89%	13.90%	0	0.0	0.00%	0.00%
T	4	85.7	7.14%	3.01%	0	0.0	0.00%	0.00%	3	82.4	7.89%	6.68%	1	3.3	50.00%	7.19%
H	7	644.6	12.50%	22.61%	3	466.7	18.75%	29.69%	4	177.9	10.53%	14.43%	0	0.0	0.00%	0.00%
P	19	932.0	33.93%	32.69%	9	636.2	56.25%	40.47%	9	253.2	23.68%	20.54%	1	42.6	50.00%	92.81%
Total	56	2850.8			16	1572.0			38	1232.9			2	45.9		

Table 5.2.5-2; Body part distribution of Equid bones at Reinach, split by excavation area, Sth- Stadthof, GMZ- Gemeindezentrum, AB- Altebrauerei
n.- number, g.- grammes, C- Cranial, D- teeth, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones, * denotes small samples

KA	All*				Jak*				Adl*			
Body Area	n.	g.	n%	g%	n.	g.	n%	g%	n.	g.	n%	g%
C	6	407.6	11.54%	10.82%	3	145.1	10.71%	4.14%	3	262.5	12.50%	16.45%
D	3	73.3	5.77%	1.95%	2	73.3	7.14%	2.09%	1	49.0	4.17%	3.07%
G	2	478.9	3.85%	12.72%	1	478.9	3.57%	13.67%	1	284.8	4.17%	17.85%
F	5	342.5	9.62%	9.09%	1	342.5	3.57%	9.77%	4	290.4	16.67%	18.20%
T	12	473.7	23.08%	12.58%	6	473.7	21.43%	13.52%	6	194.5	25.00%	12.19%
H	9	769.8	17.31%	20.44%	8	769.8	28.57%	21.97%	1	33.6	4.17%	2.11%
P	15	1220.6	28.85%	32.41%	7	1220.6	25.00%	34.84%	8	481.0	33.33%	30.14%
Total	52	3766.4			28	3503.9			24	1595.8		

Table 5.2.5-3; Body part distribution of Equid bones at Kaiseraugst, Jak- Jakobli-Haus, Adl- Gasthof Adler, *denotes small samples
n.- number, g.- grammes, C- Cranial, D- teeth, G- Girdle, F- Forelimb, T- Trunk, H- Hindlimb, P- Foot bones

Area	KA undated	KA Mid 4thC	KA 5 - late 6thC	KA 6thC	KA beg. 7thC	Reinach 7-8thC	Lausen 7-10thC	Reinach 9-11thC	Lausen c. 11thC	KA 12thC	Reinach 12thC	Total
indet	0	0	0	5	0	0	0	0	6	0	0	11
Base	0	0	0	0	2*	0	0	1*	0	0	0	3
Beam	0	0	0	3	1	0	0	0	5	0	0	9
Tine (inc crown)	1	0	3	4	2	0	0	1	0	0	0	11
Base and Beam	0	0	0	0	0	0	0	0	0	0	0	0
Beam and Tine	0	0	0	3	0	0	0	0	0	0	0	3
Near complete	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	0	3	15	5	0	0	2	11	0	0	37

Table 5.3-1; The number of antler fragments found at the three sites for the given time periods KA- Kaiseraugst
*1 fragment of antler in each group with the portion of skull still attached

Area	KA undated	KA Mid 4thC	KA 5 - late 6thC	KA 6thC	KA beg. 7thC	Reinach 7-8thC	Lausen 7-10thC	Reinach 9-11thC	Lausen c. 11thC	KA 12thC	Reinach 12thC	Total
indet	0.0	0.0	0.0	41.9	0.0	0.0	0.0	0.0	2.8	0.0	0.0	44.7
Base	0.0	0.0	0.0	0.0	200.6	0.0	0.0	7.1	0.0	0.0	0.0	207.7
Beam	0.0	0.0	0.0	270.5	6.8	0.0	0.0	0.0	20.6	0.0	0.0	297.9
Tine (inc crown)	35.3	0.0	439.3	329.3	125.1	0.0	0.0	50.5	0.0	0.0	0.0	979.5
Base and Beam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beam and Tine	0.0	0.0	0.0	415.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	415.6
Near complete	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Complete	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	35.3	0.0	439.3	1057.3	332.5	0.0	0.0	57.6	23.4	0.0	0.0	1945.4

Table 5.3-2; The weight of antler fragments (in g.) found at the three sites for the given time periods KA- Kaiseraugst

Marks	KA undated	KA Mid 4thC	KA 5 - late 6thC	KA 6thC	KA beg. 7thC	Reinach 7-8thC	Lausen 7-10thC	Reinach 9-11thC	Lausen c. 11thC	KA 12thC	Reinach 12thC	Total
chp	0	0	1	3	2	0	0	0	0	0	0	6
chp ser	1	0	0	4	0	0	0	1	0	0	0	6
clv	0	0	2	5	3	0	0	0	0	0	0	10
clv ser	0	0	0	1	0	0	0	0	0	0	0	1
knf ser	0	0	0	0	2	0	0	0	0	0	0	2
none	0	0	1	5	1	0	0	1	11	0	0	19
Total	1	0	4	18	8	0	0	2	11	0	0	44

5.3-3; Implement marks observed on the antler fragments found at the three sites for given time periods

Fig 5.4-1; Pig fibula with a hole punched on the right most end (broken), one of two items of worked bone from all three sites, Scale: 1 major division = 1 cm.

Area	KA undated	KA Mid 4thC	KA 4-6thC	KA 5 - late 6th	KA 6thC	Lausen Late 6th- late 8thC	KA beg. 7thC	Reinach 7-8thC	Lausen 8-9thC	Reinach 9thC	Lausen 10thC	Lausen c. 11thC	Reinach c. 11thC	KA 12thC	Lausen 12thC	Reinach 12thC	Total
indet	0	0	0	7	5	2	2	1	1	0	0	4	0	0	2	1	25
Base	2	2	1	7	9	1	6	3	3	0	2	7	0	0	0	0	43
Body	3	7	0	4	6	1	4	3	0	1	0	4	0	0	0	2	35
Tip	0	1	0	1	1	0	1	1	0	1	1	0	0	0	0	0	7
Base and Body	0	3	1	2	3	0	4	0	0	0	1	2	2	0	0	0	18
Body and Tip	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2
Near complete	0	1	0	8	7	0	1	1	1	0	0	0	0	0	0	0	19
Complete	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	4
Total	5	14	2	30	32	5	18	9	5	3	4	18	2	1	2	3	153

Table 5.5-1; The number of horncore fragments found at the three sites for the given time periods KA- Kaiseraugst

Fig 5.3-4; Double row composite comb fragments from the mid-fifth to late sixth Century levels in 'Jakoblihaus' area of the Kaiseraugst excavation. The diagonal patterning on the left fragment is clearly visible; scale: 1 major division on the scale = 1cm.

a)

b)

Figs 5.3-5; Antler knife handle or comb fragment from the Jakoblihaus area of the Kaiseraugst excavation and dated to the beginning of the seventh Century. a) The outer surface of the artefact with the iron rivet in place, scale: 1 major division on the scale = 1cm. b) the reverse side of the same fragment scale: as fig 5.3-5a.

Fig 5.3-6; Antler tine knife handle with blade attachment point from the Jakoblihaus area of the Kaiseraugst excavation in an undated pit; scale: 1 major division on the scale = 1cm.

a)

b)

Figs 5.3-7; Antler waste from the Kaiseraugst site a) whole tines from the current study found in the 'Jakoblihaus' area from the fifth to sixth Century, scale: rule divisions = 1cm; b) Tine tips from the castrum at Kaiseraugst from the fourth Century as reported by Deschler-Erb (1998), scale: one large square = 1cm^2

Area	KA undated	KA Mid 4thC	KA 4-6thC	KA 5 - late 6thC	KA 6thC	Lausen Late 6th- late 8thC	KA beg. 7thC	Reinach 7-8thC	Lausen 8-9thC	Reinach 9thC	Lausen 10thC	Lausen c. 11thC	Reinach c. 11thC	KA 12thC	Lausen 12thC	Reinach 12thC	Total
indet	0.0	0.0	0.0	27.4	11.1	2.0	2.1	0.3	0.3	0.0	0.0	4.7	0.0	0.0	1.8	1.5	51.2
Base	42.2	53.0	20.6	300.4	273.3	50.5	199.0	8.2	9.1	0.0	25.3	75.7	0.0	0.0	0.0	0.0	#####
Body	84.4	170.4	0.0	347.2	299.8	68.9	140.1	50.3	0.0	10.1	0.0	59.7	0.0	0.0	0.0	44.3	#####
Tip	0.0	102.7	0.0	169.4	10.8	0.0	28.7	12.0	0.0	92.2	11.1	0.0	0.0	0.0	0.0	0.0	426.9
Base and Body	0.0	186.5	0.0	730.2	405.5	0.0	236.5	0.0	0.0	0.0	37.9	148.4	257.1	0.0	0.0	0.0	#####
Body and Tip	0.0	0.0	0.0	0.0	135.3	0.0	0.0	0.0	0.0	0.0	0.0	40.6	0.0	0.0	0.0	0.0	175.9
Near complete	0.0	58.8	0.0	879.6	598.4	0.0	113.1	68.3	27.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	#####
Complete	0.0	0.0	0.0	57.9	0.0	69.4	0.0	0.0	0.0	3.8	0.0	0.0	0.0	72.6	0.0	0.0	203.7
Total	126.6	571.4	20.6	2512.1	#####	190.8	719.5	139.1	37.0	106.1	74.3	329.1	257.1	72.6	1.8	45.8	#####

Table 5.5-2; The weight of horncore fragments (in g.) found at the three sites for the given time periods KA- Kaiseraugst

Marks	KA undated	KA Mid 4thC	KA 4-6thC	KA 5 - late 6thC	KA 6thC	Lausen Late 6th- late 8thC	KA beg. 7thC	Reinach 7-8thC	Lausen 8-9thC	Reinach 9thC	Lausen 10thC	Lausen c. 11thC	Reinach c. 11thC	KA 12thC	Lausen 12thC	Reinach 12thC	Total
chp	1	4	2	5	5	2	2	0	1	0	0	1	0	0	0	0	23
chp ser	1	1	1	3	3	0	0	1	0	0	0	1	1	0	0	0	12
clv	0	1	0	0	10	0	1	0	0	0	0	0	0	0	0	0	12
clv ser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
knf ser	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
none	3	8	0	22	18	3	16	10	4	3	4	16	1	1	2	3	114
Total	5	14	3	30	36	5	19	11	5	3	4	19	2	1	2	3	162

5.5-3; Implement marks observed on the horncore fragments found at the three sites for given time periods

	Lausen				Kaiseraugst				Reinach			
	Marks	Marks excl HC	Marks %	Marks excl HC%	Marks	Marks excl HC	Marks %	Marks excl HC%	Marks	Marks excl HC	Marks %	Marks excl HC%
knf	24	23	11.21%	10.80%	13	13	4.10%	4.35%	11	11	8.73%	8.80%
knf ser	48	48	22.43%	22.54%	41	41	12.93%	13.71%	15	15	11.90%	12.00%
chp	72	72	33.64%	33.80%	139	132	43.85%	44.15%	52	52	41.27%	41.60%
chp ser	52	52	24.30%	24.41%	81	71	25.55%	23.75%	32	31	25.40%	24.80%
scp	1	1	0.47%	0.47%	12	12	3.79%	4.01%	2	2	1.59%	1.60%
scp ser	2	2	0.93%	0.94%	8	8	2.52%	2.68%	0	0	0.00%	0.00%
clv	15	15	7.01%	7.04%	20	19	6.31%	6.35%	14	14	11.11%	11.20%
clv ser	0	0	0.00%	0.00%	0	0	0.00%	0.00%	0	0	0.00%	0.00%
saw	0	0	0.00%	0.00%	3	3	0.95%	1.00%	0	0	0.00%	0.00%
Total	214	213			317	299			126	125		
None	892	892	80.65%	80.72%	1582	1582	83.31%	84.10%	873	873	87.39%	87.47%
Light	72	71	6.51%	6.43%	54	54	2.84%	2.87%	26	26	2.60%	2.61%
Intermediate	127	127	11.48%	11.49%	240	223	12.64%	11.86%	86	85	8.61%	8.52%
Heavy	15	15	1.36%	1.36%	23	22	1.21%	1.17%	14	14	1.40%	1.40%
Single	112	111	52.34%	52.11%	187	179	58.99%	59.87%	79	79	62.70%	63.20%
>1 mark	102	102	47.66%	47.89%	130	120	41.01%	40.13%	47	46	37.30%	36.80%
Total assemblage	1106	1105			1899	1881			999	998		

Table 5.8.1-1; Cattle butchery marks according to type at the three sties studied here;

knf- knife, chp- chop, scp- scrape, clv- cleave, ser- series (i.e. more than one mark), HC- horncores

Reinach	6thC*	6thC*%	7-8thC	7-8thC%	9thC	9thC*%	10-12thC	10-12thC%
knf	0	0.00%	4	8.16%	3	14.29%	3	7.50%
knf ser	3	21.43%	4	8.16%	3	14.29%	5	12.50%
chp	6	42.86%	20	40.82%	9	42.86%	17	42.50%
chp ser	2	14.29%	15	30.61%	4	19.05%	11	27.50%
scp	0	0.00%	0	0.00%	0	0.00%	1	2.50%
scp ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	3	21.43%	6	12.24%	2	9.52%	3	7.50%
clv ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
saw	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	14		49		21		40	
None	40	74.07%	303	86.08%	163	88.59%	349	89.72%
Light	3	5.56%	8	2.27%	6	3.26%	8	2.06%
Intermediate	8	14.81%	35	9.94%	13	7.07%	29	7.46%
Heavy	3	5.56%	6	1.70%	2	1.09%	3	0.77%
Single	9	64.29%	30	61.22%	14	66.67%	24	60.00%
>1 mk	5	35.71%	19	38.78%	7	33.33%	16	40.00%
Total assemblage	54		352		184		389	

Table 5.8.1-2; Cattle butchery marks according to type at the Reinach site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	6thC*	6thC%	7-8thC	7-8thC%	9thC*	9thC%	10-12thC	10-12thC%	All	All%
HC	0	0.00%	0	0.00%	0	0.00%	1	2.50%	1	0.79%
Cranial	2	14.29%	7	13.73%	7	33.33%	4	10.00%	20	15.87%
Forelimb	2	14.29%	8	15.69%	3	14.29%	10	25.00%	23	18.25%
Girdle	0	0.00%	10	19.61%	4	19.05%	10	25.00%	24	19.05%
Hindlimb	0	0.00%	4	7.84%	3	14.29%	1	2.50%	8	6.35%
Foot	2	14.29%	3	5.88%	2	9.52%	4	10.00%	11	8.73%
Trunk	8	57.14%	19	37.25%	2	9.52%	10	25.00%	39	30.95%
Total	14		51		21		40		126	

Table 5.8.1-3; Cattle butchery marks according to body area at the Reinach site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

Lausen	Late 6th-late 7th*	6th-late 7th%	8 -9thC	8-9thC%	c. 10th	c. 10th%	11- 12th	11- 12thC%
knf	5	14.29%	10	12.20%	4	19.05%	5	6.58%
knf ser	8	22.86%	19	23.17%	2	9.52%	19	25.00%
chp	9	25.71%	23	28.05%	8	38.10%	32	42.11%
chp ser	7	20.00%	22	26.83%	7	33.33%	16	21.05%
scp	0	0.00%	0	0.00%	0	0.00%	1	1.32%
scp ser	1	2.86%	1	1.22%	0	0.00%	0	0.00%
clv	5	14.29%	7	8.54%	0	0.00%	3	3.95%
Total	35		82		21		76	
None	112	76.19%	364	81.61%	139	86.88%	473	86.16%
Light	13	8.84%	29	6.50%	6	3.75%	24	4.37%
Intermediate	17	11.56%	46	10.31%	15	9.38%	49	8.93%
Heavy	5	3.40%	7	1.57%	0	0.00%	3	0.55%
Single	19	54.29%	40	48.78%	12	57.14%	41	53.95%
>1 mk	16	45.71%	42	51.22%	9	42.86%	35	46.05%
Total assemblage	147		446		160		549	

Table 5.8.1-4; Cattle butchery marks according to type at Lausen through all periods; abbreviations as table 5.8.1-1

	Late 6th-late 7th	6th-late 7th%	8 -9thC	8-9thC%	c. 10th*	c. 10th%	11- 12th	11- 12thC%	All	All%
HC	0	0.00%	0	0.00%	0	0.00%	1	1.32%	1	0.47%
Cranial	7	20.00%	8	9.76%	0	0.00%	8	10.53%	23	10.75%
Forelimb	4	11.43%	9	10.98%	1	4.76%	7	9.21%	21	9.81%
Girdle	2	5.71%	22	26.83%	0	0.00%	25	32.89%	49	22.90%
Hindlimb	4	11.43%	8	9.76%	4	19.05%	12	15.79%	28	13.08%
Foot	4	11.43%	6	7.32%	3	14.29%	4	5.26%	17	7.94%
Trunk	14	40.00%	29	35.37%	13	61.90%	19	25.00%	75	35.05%
Total	35		82		21		76		214	

Table 5.8.1-5; Cattle butchery marks according to body area at Lausen through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

KA	Mid 4thC	Mid 4thC%	5- late 6thC	5- late 6thC%	6thC	6thC%	beg. 7thC	beg. 7thC%	12thC*	12thC%
knf	3	8.82%	5	3.03%	3	4.84%	2	10.00%	0	0.00%
knf ser	5	14.71%	24	14.55%	5	8.06%	4	20.00%	0	0.00%
chp	13	38.24%	65	39.39%	34	54.84%	5	25.00%	0	0.00%
chp ser	7	20.59%	45	27.27%	15	24.19%	5	25.00%	2	100.00%
scp	3	8.82%	8	4.85%	0	0.00%	0	0.00%	0	0.00%
scp ser	0	0.00%	7	4.24%	1	1.61%	0	0.00%	0	0.00%
clv	2	5.88%	9	5.45%	4	6.45%	4	20.00%	0	0.00%
clv ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
saw	1	2.94%	2	1.21%	0	0.00%	0	0.00%	0	0.00%
Total	34		165		62		20		2	
None	282	89.24%	535	76.43%	352	85.02%	194	90.65%	35	94.59%
Light	8	2.53%	29	4.14%	8	1.93%	6	2.80%	0	0.00%
Intermediate	23	7.28%	125	17.86%	50	12.08%	10	4.67%	2	5.41%
Heavy	3	0.95%	11	1.57%	4	0.97%	4	1.87%	0	0.00%
Single	22	64.71%	89	53.94%	41	66.13%	11	55.00%	0	0.00%
>1 mk	12	35.29%	76	46.06%	21	33.87%	9	45.00%	2	100.00%
Total assemblage	316		700		414		214		37	

Table 5.8.1-6; Cattle butchery marks according to type at Kaiseraugst through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	Mid 4thC	Mid 4thC%	5- late 6thC	5- late 6thC%	6thC	6thC%	beg. 7thC*	beg. 7thC%	12thC*	12thC%	All	All%
HC	0	0.00%	2	1.21%	10	19.23%	0	0.00%	0	0.00%	12	4.24%
Cranial[1]	2	5.88%	13	7.88%	3	5.77%	5	25.00%	0	0.00%	23	8.13%
Forelimb	5	14.71%	26	15.76%	7	13.46%	2	10.00%	0	0.00%	40	14.13%
Girdle	6	17.65%	31	18.79%	6	11.54%	2	10.00%	1	50.00%	46	16.25%
Hindlimb	4	11.76%	19	11.52%	6	11.54%	3	15.00%	0	0.00%	32	11.31%
Foot	4	11.76%	24	14.55%	7	13.46%	2	10.00%	1	50.00%	38	13.43%
Trunk	13	38.24%	50	30.30%	23	44.23%	6	30.00%	0	0.00%	92	32.51%
Total	34		165		52		20		2		283	

Table 5.8.1-7; Cattle butchery marks according to body area at Kaiseraugst through all periods; * denotes small sample sizes

[1] Five cranial elements with horncore attached; abbreviations as table 5.8.1-1

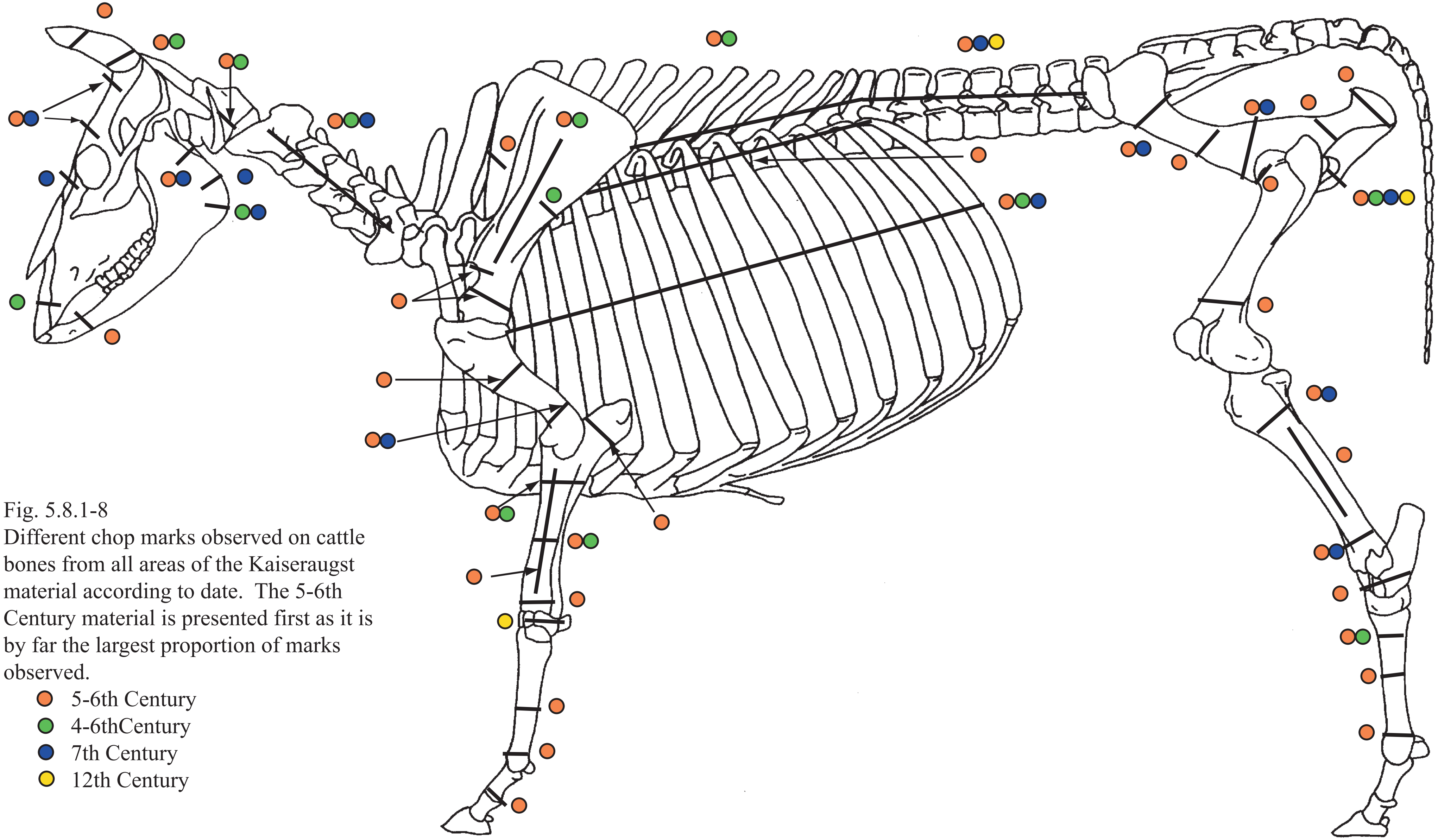


Fig. 5.8.1-8
Different chop marks observed on cattle bones from all areas of the Kaiseraugst material according to date. The 5-6th Century material is presented first as it is by far the largest proportion of marks observed.

- 5-6th Century
- 4-6thCentury
- 7th Century
- 12th Century

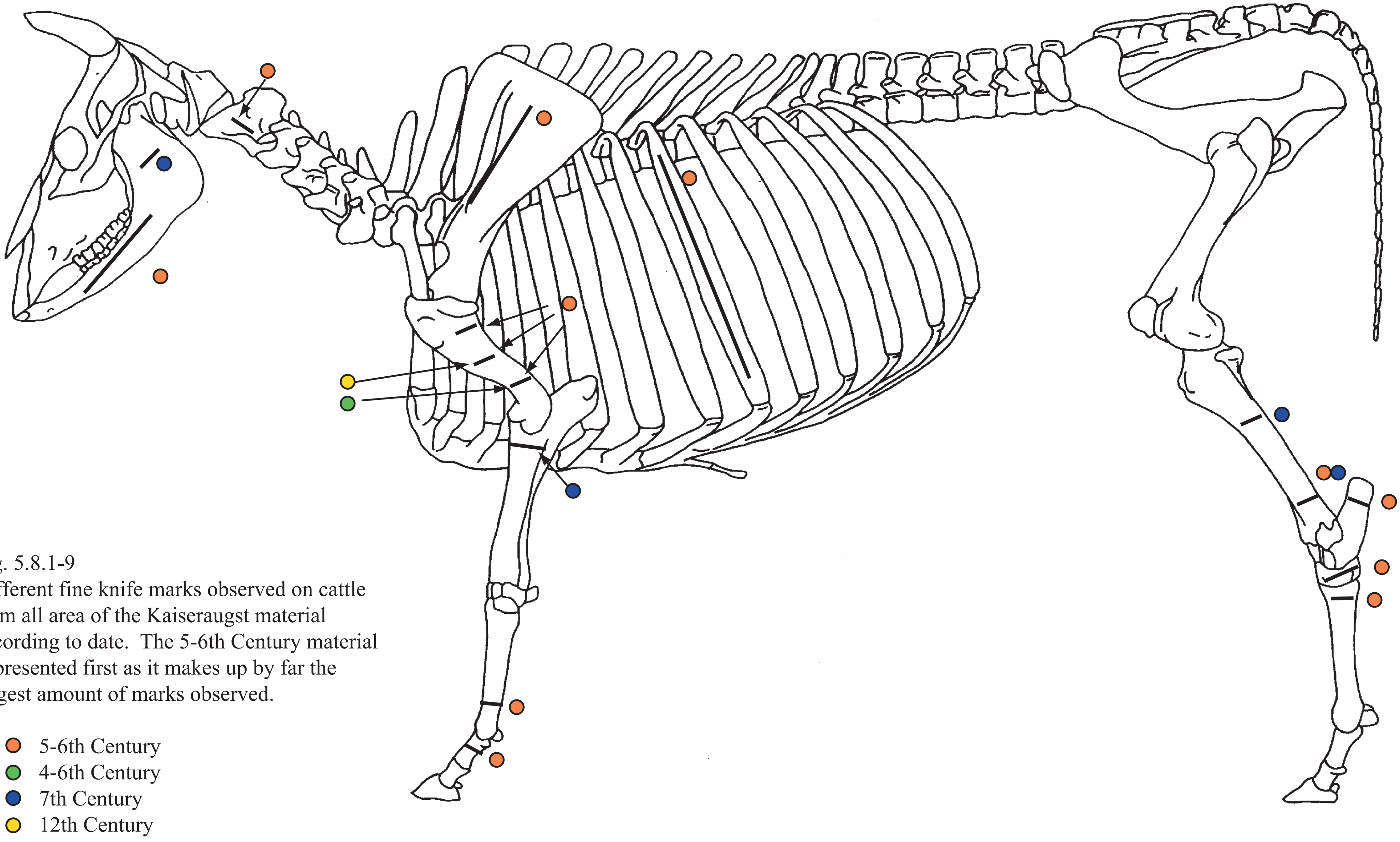


Fig. 5.8.1-9
Different fine knife marks observed on cattle from all area of the Kaiseraugst material according to date. The 5-6th Century material is presented first as it makes up by far the largest amount of marks observed.

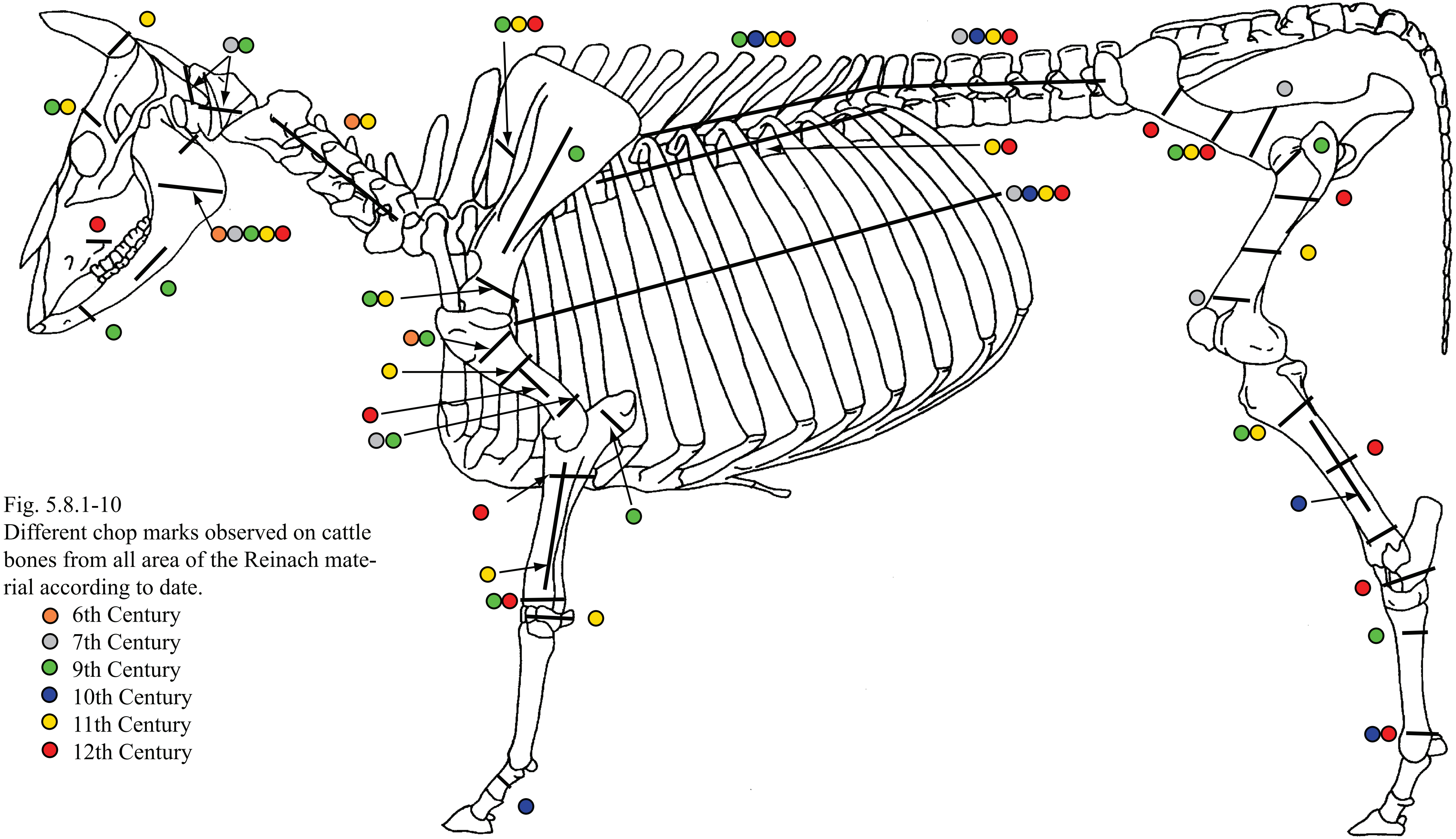


Fig. 5.8.1-10
Different chop marks observed on cattle bones from all area of the Reinach material according to date.

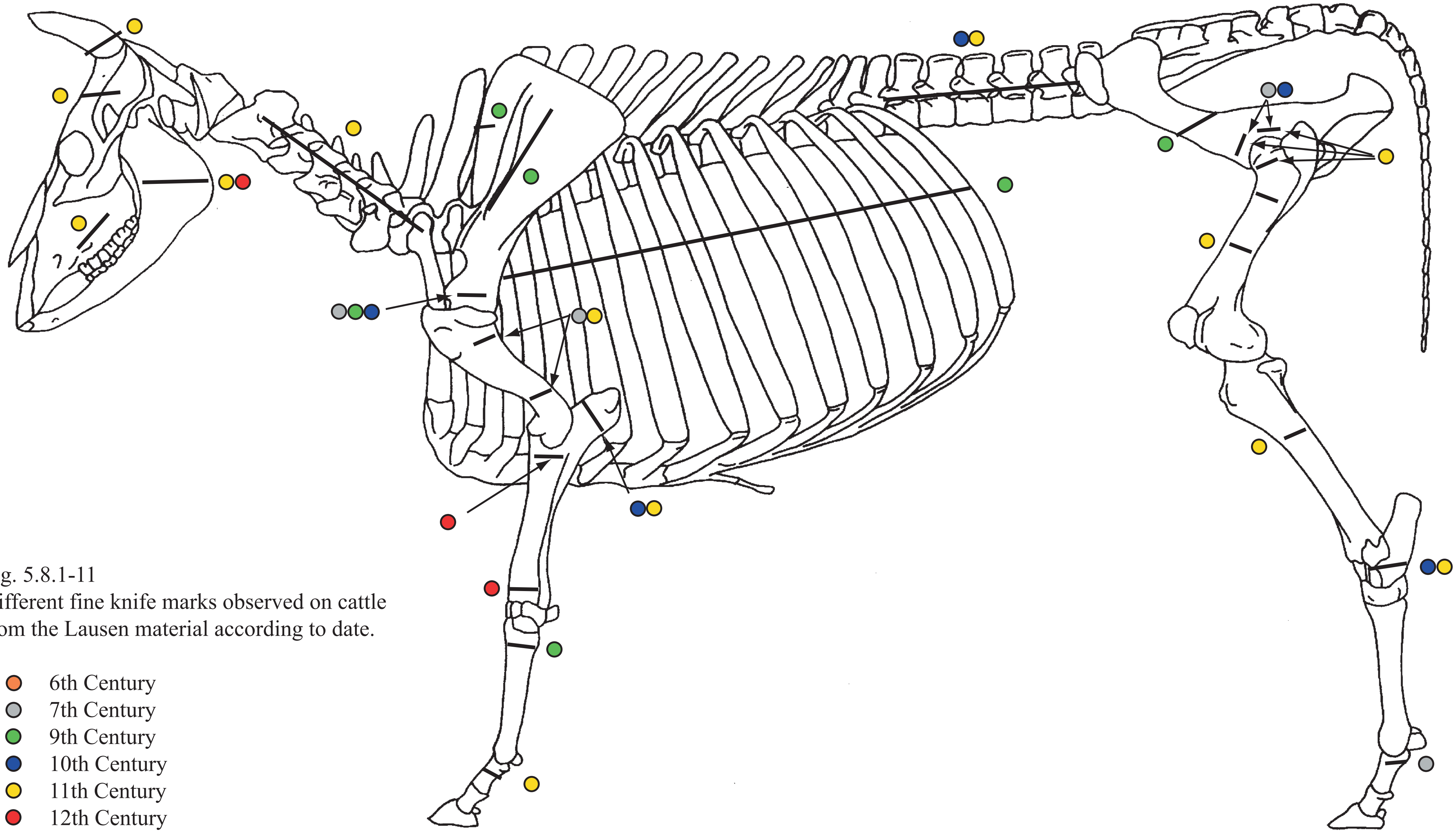


Fig. 5.8.1-11
Different fine knife marks observed on cattle from the Lausen material according to date.

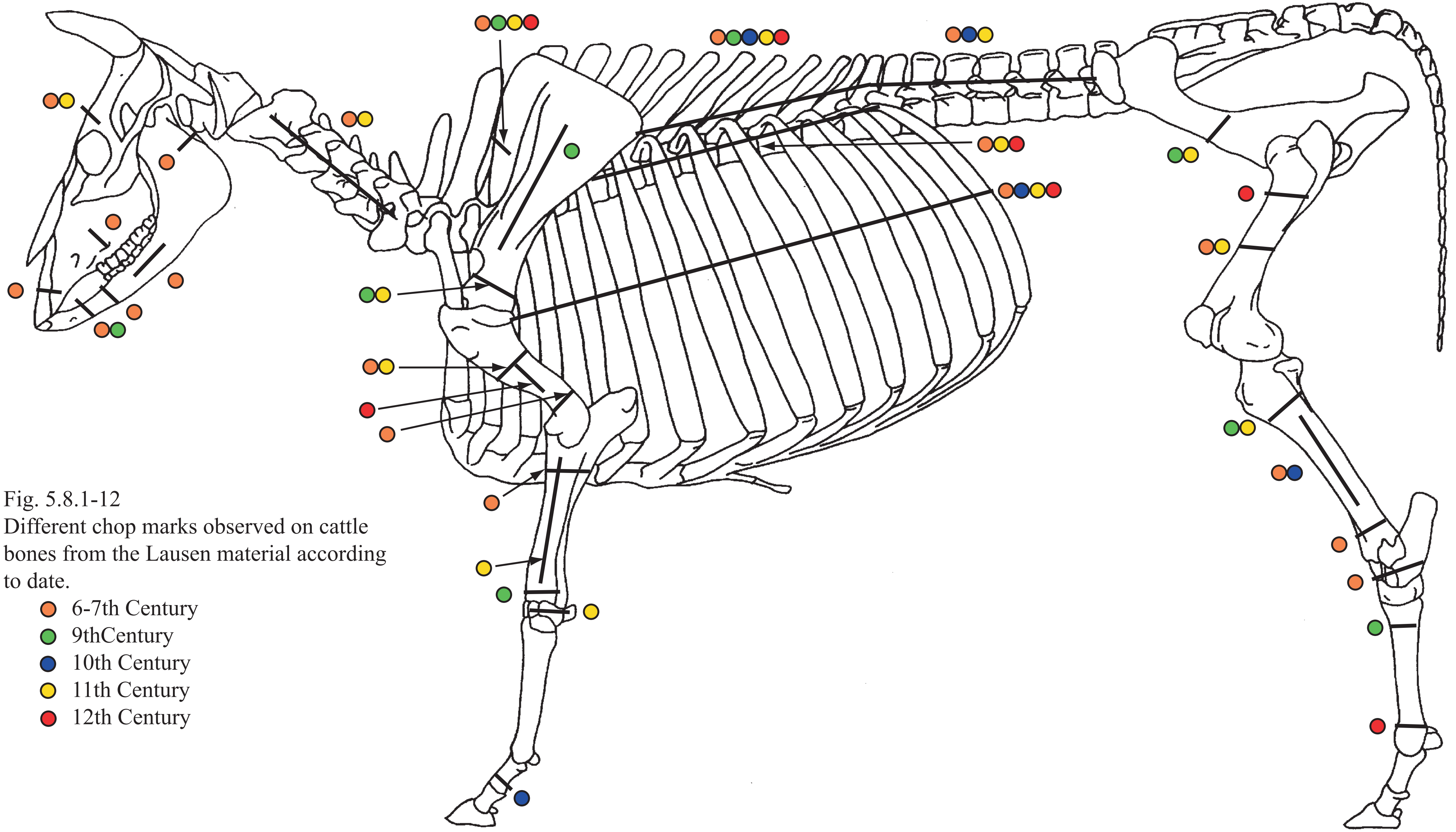


Fig. 5.8.1-12
Different chop marks observed on cattle bones from the Lausen material according to date.

- 6-7th Century
- 9thCentury
- 10th Century
- 11th Century
- 12th Century

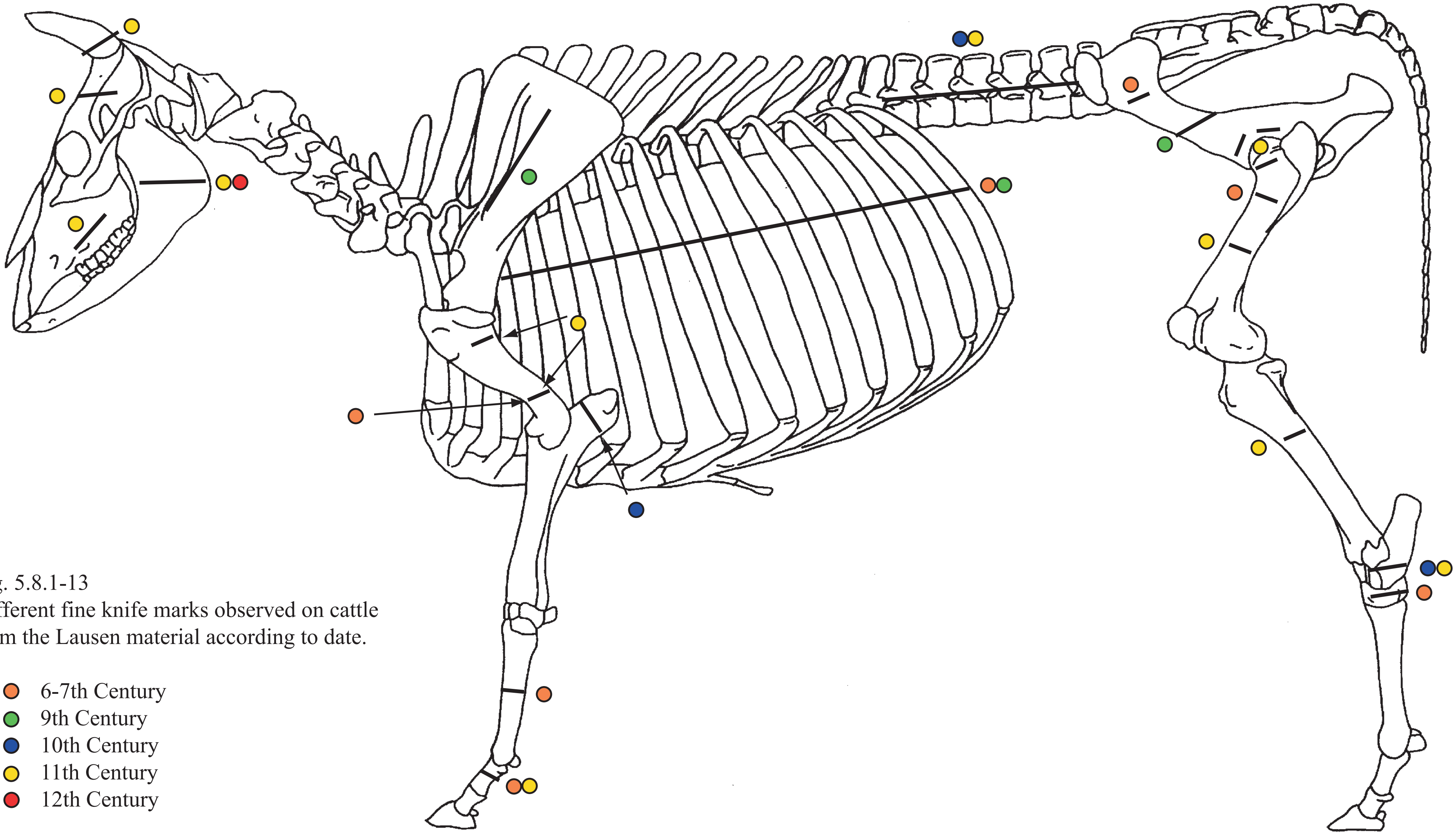


Fig. 5.8.1-13
Different fine knife marks observed on cattle from the Lausen material according to date.

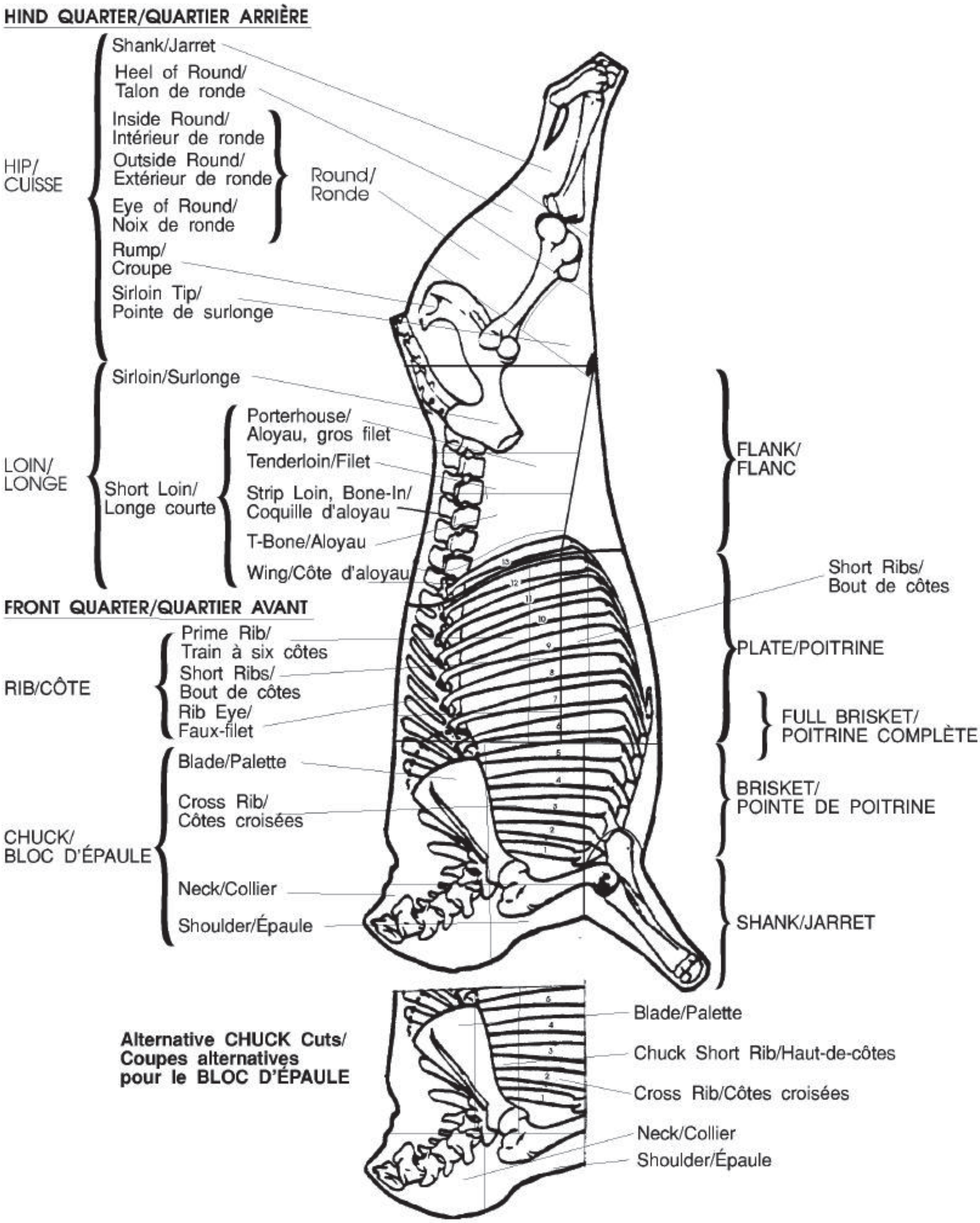


Fig. 5.8.1.4-1; Modern Beef cuts including alternative chuck cuts, modified from website 9

	Lausen				Kaiseraugst				Reinach			
	Marks	Marks excl HC	Marks %	Marks excl HC%	Marks	Marks excl HC	Marks %	Marks excl HC%	Marks	Marks excl HC	Marks %	Marks excl HC%
knf	16	16	11.27%	11.51%	5	5	7.04%	10.00%	6	6	12.50%	12.77%
knf ser	30	30	21.13%	21.58%	10	10	14.08%	20.00%	10	10	20.83%	21.28%
chp	70	68	49.30%	48.92%	36	24	50.70%	48.00%	14	14	29.17%	29.79%
chp ser	20	19	14.08%	13.67%	10	5	14.08%	10.00%	8	7	16.67%	14.89%
scp	1	1	0.70%	0.72%	2	2	2.82%	4.00%	0	0	0.00%	0.00%
scp ser	1	1	0.70%	0.72%	0	0	0.00%	0.00%	0	0	0.00%	0.00%
clv	4	4	2.82%	2.88%	8	4	11.27%	8.00%	10	10	20.83%	21.28%
clv ser	0	0	0.00%	0.00%	0	0	0.00%	0.00%	0	0	0.00%	0.00%
saw	0	0	0.00%	0.00%	0	0	0.00%	0.00%	0	0	0.00%	0.00%
Total	142	139			71	50			48	47		
None	1245	1245	89.76%	89.96%	526	526	88.11%	91.32%	466	466	90.66%	90.84%
Light	46	46	3.32%	3.32%	15	15	2.51%	2.60%	16	16	3.11%	3.12%
Intermediate	92	89	6.63%	6.43%	48	31	8.04%	5.38%	22	21	4.28%	4.09%
Heavy	4	4	0.29%	0.29%	8	4	1.34%	0.69%	10	10	1.95%	1.95%
Single	91	89	64.08%	64.03%	51	35	71.83%	70.00%	30	30	62.50%	63.83%
>1 mark	51	50	35.92%	35.97%	20	15	28.17%	30.00%	18	17	37.50%	36.17%
Total assemblage	1387	1384			597	576			514	513		

Table 5.8.2-1; Ovicaprid butchery marks according to type at the three sties studied here; * denotes small sample sizes
abbreviations as table 5.8.1-1

Lausen	Late 6th-late 7th*	6th-late 7th%	8-9thC	8-9thC%	c. 10th	c. 10th%	11- 12th	11- 12thC%
knf	0	0.00%	7	20.00%	3	16.67%	6	7.32%
knf ser	3	42.86%	5	14.29%	4	22.22%	18	21.95%
chp	4	57.14%	13	37.14%	9	50.00%	44	53.66%
chp ser	0	0.00%	8	22.86%	1	5.56%	11	13.41%
scp	0	0.00%	0	0.00%	1	5.56%	0	0.00%
scp ser	0	0.00%	1	2.86%	0	0.00%	0	0.00%
clv	0	0.00%	1	2.86%	0	0.00%	3	3.66%
Total	7		35		18		82	
None	80	91.95%	494	93.38%	181	90.95%	462	84.93%
Light	3	3.45%	12	2.27%	7	3.52%	24	4.41%
Intermediate	4	4.60%	22	4.16%	11	5.53%	55	10.11%
Heavy	0	0.00%	1	0.19%	0	0.00%	3	0.55%
Single	4	57.14%	21	60.00%	13	72.22%	53	64.63%
>1 mk	3	42.86%	14	40.00%	5	27.78%	29	35.37%
Total assemblage	87		529		199		544	

Table 5.8.2-2; Ovicaprid butchery marks according to type at the Lausen site through all periods; abbreviations as table 5.8.1-1

	Late 6th-late 7th*	6th-late 7th%	8-9thC	8-9thC%	c. 10th*	c. 10th%	11- 12th	11- 12thC%
HC	1	14.29%	1	2.86%	0	0.00%	1	1.22%
Cranial	0	0.00%	2	5.71%	0	0.00%	2	2.44%
Forelimb	3	42.86%	5	14.29%	1	5.56%	16	19.51%
Girdle	0	0.00%	5	14.29%	2	11.11%	6	7.32%
Hindlimb	1	14.29%	6	17.14%	4	22.22%	7	8.54%
Pes	0	0.00%	1	2.86%	1	5.56%	1	1.22%
Trunk	2	28.57%	15	42.86%	10	55.56%	49	59.76%
Total	7		35		18		82	

Table 5.8.2-3; Ovicaprid butchery marks according to body area at the Lausen site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

Reinach	6thC*	6thC*%	7-8thC	7-8thC%	9thC*	9thC*%	10-12thC	10-12thC%
knf	0	0.00%	3	13.64%	2	20.00%	1	10.00%
knf ser	2	33.33%	6	27.27%	1	10.00%	1	10.00%
chp	3	50.00%	4	18.18%	2	20.00%	5	50.00%
chp ser	1	16.67%	3	13.64%	3	30.00%	1	10.00%
scp	0	0.00%	0	0.00%	0	0.00%	0	0.00%
scp ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	0	0.00%	6	27.27%	2	20.00%	2	20.00%
clv ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
saw	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	6		22		10		10	
None	13	68.42%	220	90.91%	85	89.47%	148	93.67%
Light	2	10.53%	9	3.72%	3	3.16%	2	1.27%
Intermediate	4	21.05%	7	2.89%	5	5.26%	6	3.80%
Heavy	0	0.00%	6	2.48%	2	2.11%	2	1.27%
Single	3	50.00%	13	59.09%	6	60.00%	8	80.00%
>1 mk	3	50.00%	9	40.91%	4	40.00%	2	20.00%
Total assemblage	19		242		95		158	

Table 5.8.2-4; Ovicaprid butchery marks according to type at the Reinach site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	6thC*	6thC%	7-8thC*	7-8thC%	9thC*	9thC%	10-12thC*	10-12thC%
HC	0	0.00%	1	4.55%	0	0.00%	0	0.00%
Cranial	0	0.00%	1	4.55%	0	0.00%	1	10.00%
Forelimb	2	33.33%	2	9.09%	5	50.00%	1	10.00%
Girdle	1	16.67%	0	0.00%	1	10.00%	0	0.00%
Hindlimb	2	33.33%	2	9.09%	3	30.00%	3	30.00%
Foot	1	16.67%	4	18.18%	0	0.00%	0	0.00%
Trunk	0	0.00%	12	54.55%	1	10.00%	5	50.00%
Total	6		22		10		10	

Table 5.8.2-5; Ovicaprid butchery marks according to body area at the Reinach site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

KA	Mid 4thC*	Mid 4thC%	5- late 6thC	5- late 6thC%	6thC	6thC%	beg. 7thC*	beg. 7thC%	12thC*	12thC%
knf	0	0.00%	1	5.26%	2	9.09%	0	0.00%	1	100.00%
knf ser	2	16.67%	1	5.26%	6	27.27%	1	10.00%	0	0.00%
chp	8	66.67%	11	57.89%	7	31.82%	4	40.00%	0	0.00%
chp ser	1	8.33%	2	10.53%	5	22.73%	2	20.00%	0	0.00%
scp	0	0.00%	2	10.53%	0	0.00%	0	0.00%	0	0.00%
scp ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	1	8.33%	2	10.53%	2	9.09%	3	30.00%	0	0.00%
clv ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
saw	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	12		19		22		10		1	
None	55	82.09%	151	88.82%	186	89.42%	91	90.10%	45	97.83%
Light	2	2.99%	2	1.18%	8	3.85%	1	0.99%	1	2.17%
Intermediate	9	13.43%	15	8.82%	12	5.77%	6	5.94%	0	0.00%
Heavy	1	1.49%	2	1.18%	2	0.96%	3	2.97%	0	0.00%
Single	9	75.00%	16	84.21%	11	50.00%	7	70.00%	1	100.00%
>1 mk	3	25.00%	3	15.79%	11	50.00%	3	30.00%	0	0.00%
Total assemblage	67		170		208		101		46	

Table 5.8.2-6; Ovicaprid butchery marks according to type at the Kaiseraugst site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	Mid 4thC*	Mid 4thC%	5- late 6thC*	5- late 6thC%	6thC*	6thC%	beg. 7thC*	beg. 7thC%	12thC*	12thC%
HC	6	50.00%	3	15.79%	7	31.82%	3	30.00%	0	0.00%
Cranial	0	0.00%	1	5.26%	1	4.55%	3	30.00%	0	0.00%
Forelimb	0	0.00%	3	15.79%	2	9.09%	1	10.00%	0	0.00%
Girdle	0	0.00%	5	26.32%	0	0.00%	1	10.00%	1	100.00%
Hindlimb	2	16.67%	2	10.53%	5	22.73%	1	10.00%	0	0.00%
Pes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Trunk	4	33.33%	5	26.32%	7	31.82%	1	10.00%	0	0.00%
Total	12		19		22		10		1	

Table 5.8.2-7; Ovicaprid butchery marks according to body area at the Kaiseraugst site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

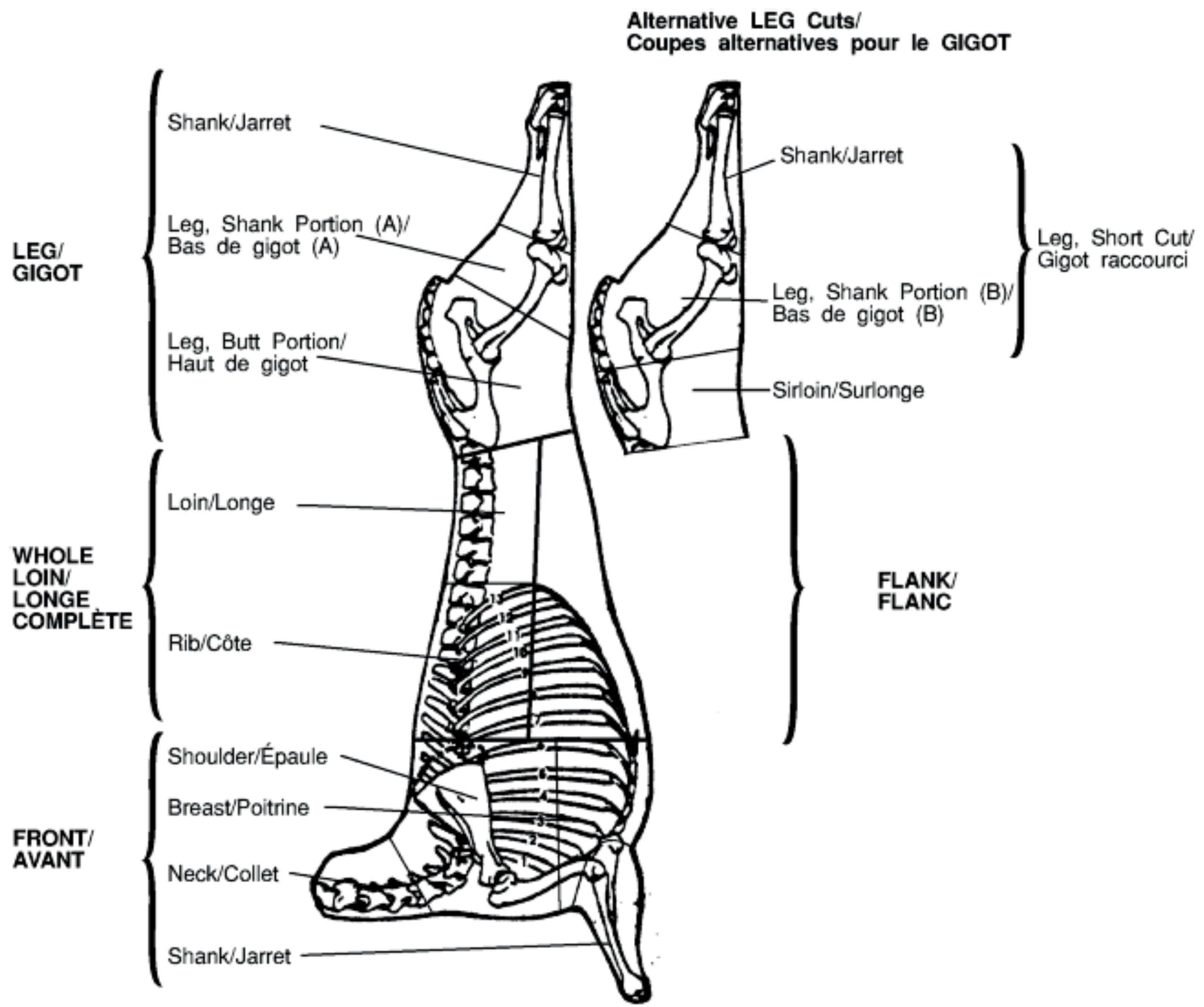


Fig. 5.8.2-8; Modern cuts of lamb or mutton, also included is an alternative for cuts from the leg, image taken from WEBSITE 7. ©Copyright 1996, 1997, 1998, 1999, 2000, 2001 E.Techie. All Rights Reserved.

	Lausen		Kaiseraugst		Reinach	
	Marks	Marks %	Marks	Marks %	Marks	Marks %
knf	49	13.32%	10	3.64%	14	13.33%
knf ser	86	23.37%	30	10.91%	19	18.10%
chp	130	35.33%	135	49.09%	39	37.14%
chp ser	69	18.75%	77	28.00%	17	16.19%
scp	5	1.36%	5	1.82%	2	1.90%
scp ser	0	0.00%	2	0.73%	0	0.00%
clv	29	7.88%	12	4.36%	12	11.43%
clv ser	0	0.00%	0	0.00%	1	0.95%
saw	0	0.00%	4	1.45%	1	0.95%
Total	368		275		105	
None	2366	86.54%	1629	85.56%	931	89.86%
Light	49	1.79%	40	2.10%	33	3.19%
Intermediate	290	10.61%	219	11.50%	58	5.60%
Heavy	29	1.06%	16	0.84%	14	1.35%
Single	213	57.88%	166	60.36%	68	64.76%
>1 mark	155	42.12%	109	39.64%	37	35.24%
Total assemblage	2734		1904		1036	

Table 5.8.3-1; Pig butchery marks according to type at the three sties studied here; abbreviations as table 5.8.1-1, * denotes small sample sizes

Reinach	6thC*	6thC%	7-8thC	7-8thC%	9thC	9thC%	10-12thC	10-12thC%
knf	2	6.25%	8	19.51%	0	0.00%	3	17.65%
knf ser	6	18.75%	6	14.63%	4	28.57%	3	17.65%
chp	16	50.00%	12	29.27%	5	35.71%	6	35.29%
chp ser	4	12.50%	7	17.07%	4	28.57%	2	11.76%
scp	0	0.00%	0	0.00%	1	7.14%	1	5.88%
scp ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	4	12.50%	6	14.63%	0	0.00%	2	11.76%
clv ser	0	0.00%	1	2.44%	0	0.00%	0	0.00%
saw	0	0.00%	1	2.44%	0	0.00%	0	0.00%
Total	32		41		14		17	
None	103	76.30%	436	91.40%	152	91.57%	241	93.41%
Light	8	5.93%	14	2.94%	4	2.41%	6	2.33%
Intermediate	20	14.81%	19	3.98%	10	6.02%	9	3.49%
Heavy	4	2.96%	8	1.68%	0	0.00%	2	0.78%
Single	22	68.75%	26	63.41%	6	42.86%	12	70.59%
>1 mk	10	31.25%	14	34.15%	8	57.14%	5	29.41%
Total assemblage	135		477		166		258	

Table 5.8.3-2; Pig butchery marks according to type at the Reinach site through all periods; abbreviations as table 5.8.1-1

	6thC	6thC%	7-8thC	7-8thC%	9thC*	9thC%	10-12thC*	10-12thC%
Cranial	8	25.00%	5	12.20%	4	28.57%	2	11.76%
Forelimb	4	12.50%	8	19.51%	1	7.14%	4	23.53%
Girdle	5	15.63%	5	12.20%	2	14.29%	3	17.65%
Hindlimb	1	3.13%	6	14.63%	2	14.29%	3	17.65%
Pes	2	6.25%	3	7.32%	0	0.00%	0	0.00%
Trunk	12	37.50%	14	34.15%	5	35.71%	5	29.41%
Total	32		41		14		17	

Table 5.8.3-3; Pig butchery marks by body area at the Reinach site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

Lausen	Late 6th-late 7th*	Late 6th-late 7th%	8 -9thC	8 -9thC%	c. 10th	c. 10th%	11- 12th	11- 12thC%
knf	4	44.44%	11	10.78%	10	15.15%	24	12.57%
knf ser	2	22.22%	26	25.49%	15	22.73%	43	22.51%
chp	0	0.00%	37	36.27%	30	45.45%	63	32.98%
chp ser	2	22.22%	16	15.69%	9	13.64%	42	21.99%
scp	0	0.00%	4	3.92%	0	0.00%	1	0.52%
scp ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	1	11.11%	8	7.84%	2	3.03%	18	9.42%
Total	9		102		66		191	
None	126	93.33%	931	90.13%	466	87.59%	843	81.53%
Light	6	4.44%	37	3.58%	25	4.70%	67	6.48%
Intermediate	2	1.48%	57	5.52%	39	7.33%	106	10.25%
Heavy	1	0.74%	8	0.77%	2	0.38%	18	1.74%
Single	5	55.56%	60	58.82%	42	63.64%	106	55.50%
>1 mk	4	44.44%	42	41.18%	24	36.36%	85	44.50%
Total assemblage	135		1033		532		1034	

Table 5.8.3-4; Pig butchery marks according to body area at the Lausen site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	Late 6th-late 7th*	Late 6th-late 7th%	8 -9thC	8 -9thC%	c. 10th	c. 10th%	11- 12th	11- 12thC%
Cranial	1	11.11%	9	8.82%	14	21.21%	18	9.42%
Forelimb	4	44.44%	17	16.67%	7	10.61%	10	5.24%
Girdle	2	22.22%	17	16.67%	3	4.55%	21	10.99%
Hindlimb	0	0.00%	15	14.71%	2	3.03%	11	5.76%
Pes	1	11.11%	1	0.98%	0	0.00%	2	1.05%
Trunk	1	11.11%	43	42.16%	40	60.61%	129	67.54%
Total	9		102		66		191	

Table 5.8.3-5; Pig butchery marks according to body area at the Lausen site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

KA	Mid 4thC	Mid 4thC%	5- late 6thC	5- late 6thC%	6thC	6thC%	beg. 7thC	beg. 7thC%	12thC*	12thC%
knf	0	0.00%	5	3.60%	1	2.00%	1	4.55%	0	0.00%
knf ser	1	5.00%	14	10.07%	6	12.00%	8	36.36%	0	0.00%
chp	7	35.00%	72	51.80%	24	48.00%	9	40.91%	2	33.33%
chp ser	10	50.00%	37	26.62%	14	28.00%	4	18.18%	1	16.67%
scp	0	0.00%	3	2.16%	1	2.00%	0	0.00%	0	0.00%
scp ser	2	10.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
clv	0	0.00%	4	2.88%	4	8.00%	0	0.00%	3	50.00%
clv ser	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
saw	0	0.00%	4	2.88%	0	0.00%	0	0.00%	0	0.00%
Total	20		139		50		22		6	
None	205	91.11%	683	83.09%	460	90.20%	176	88.89%	53	89.83%
Light	1	0.44%	19	2.31%	7	1.37%	9	4.55%	0	0.00%
Intermediate	19	8.44%	112	13.63%	39	7.65%	13	6.57%	3	5.08%
Heavy	0	0.00%	8	0.97%	4	0.78%	0	0.00%	3	5.08%
Single	7	35.00%	88	63.31%	30	60.00%	10	45.45%	5	83.33%
>1 mk	13	65.00%	51	36.69%	20	40.00%	12	54.55%	1	16.67%
Total assemblage	225		822		510		198		59	

Table 5.8.3-6; Pig butchery marks according to type at the Kaiseraugst site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

	Mid 4thC*	Mid 4thC%	5- late 6thC	5- late 6thC%	6thC	6thC%	beg. 7thC*	beg. 7thC%	12thC*	12thC%
Cranial	2	10.00%	6	4.32%	3	6.00%	0	0.00%	0	0.00%
Forelimb	4	20.00%	18	12.95%	6	12.00%	9	40.91%	1	16.67%
Girdle	3	15.00%	25	17.99%	3	6.00%	3	13.64%	0	0.00%
Hindlimb	4	20.00%	15	10.79%	3	6.00%	6	27.27%	3	50.00%
Pes	0	0.00%	1	0.72%	1	2.00%	1	4.55%	0	0.00%
Trunk	7	35.00%	74	53.24%	34	68.00%	3	13.64%	2	33.33%
Total	20		139		50		22		6	

Table 5.8.3-7; Pig butchery marks according to body area at the Kaiseraugst site through all periods; abbreviations as table 5.8.1-1, * denotes small sample sizes

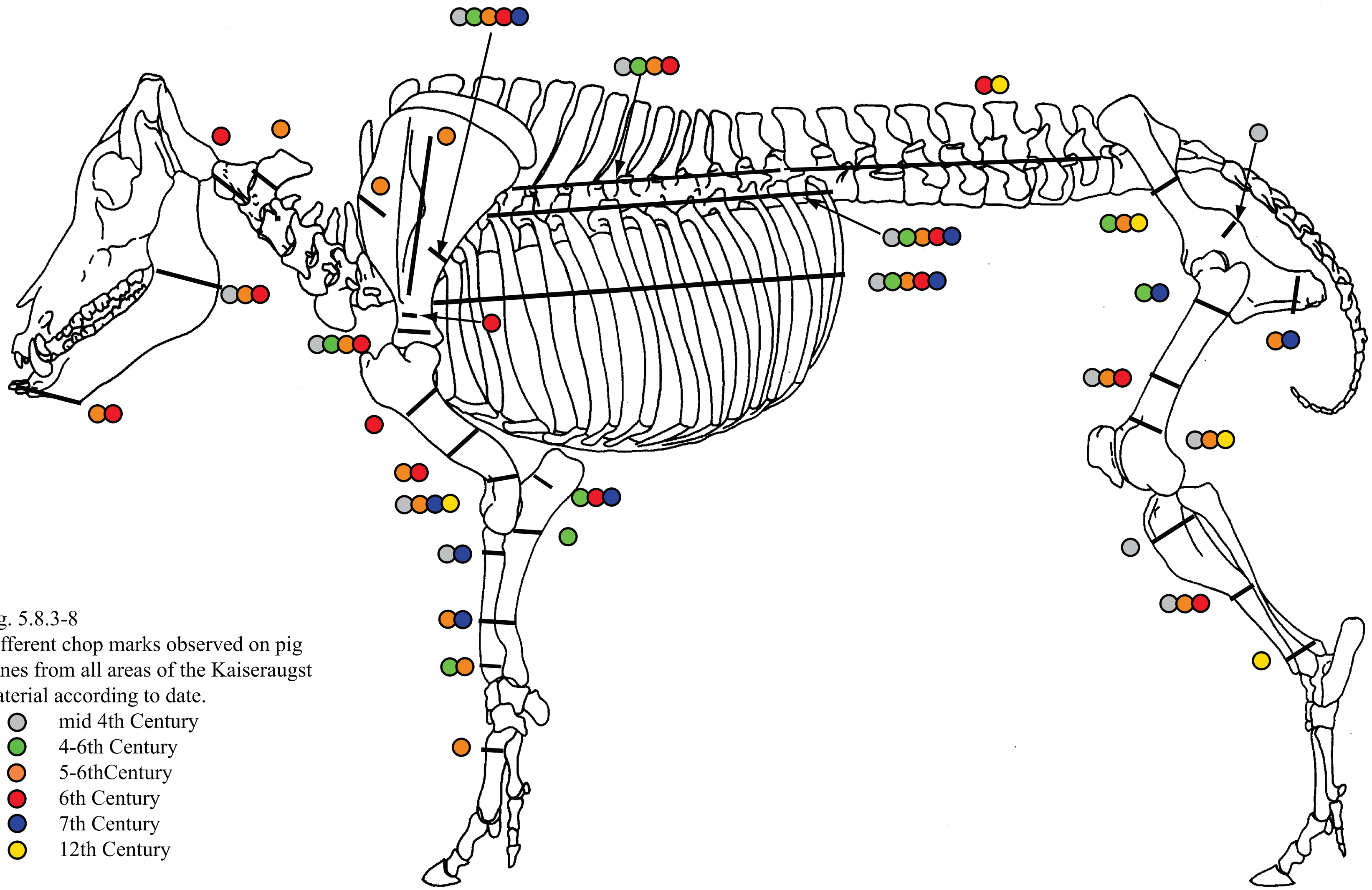


Fig. 5.8.3-8
Different chop marks observed on pig bones from all areas of the Kaiseraugst material according to date.

- mid 4th Century
- 4-6th Century
- 5-6thCentury
- 6th Century
- 7th Century
- 12th Century

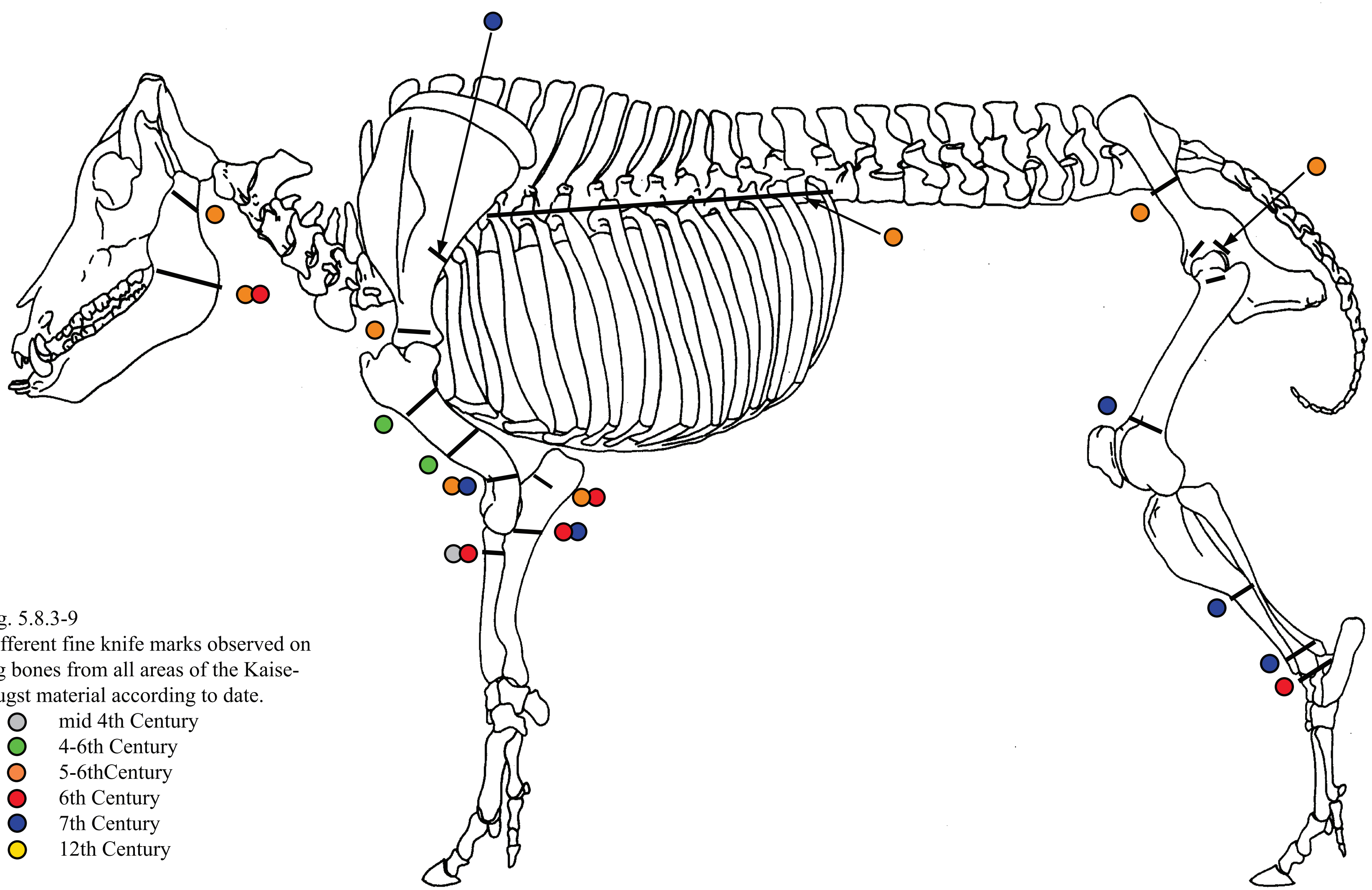


Fig. 5.8.3-9
Different fine knife marks observed on pig bones from all areas of the Kaiseraugst material according to date.

- mid 4th Century
- 4-6th Century
- 5-6thCentury
- 6th Century
- 7th Century
- 12th Century

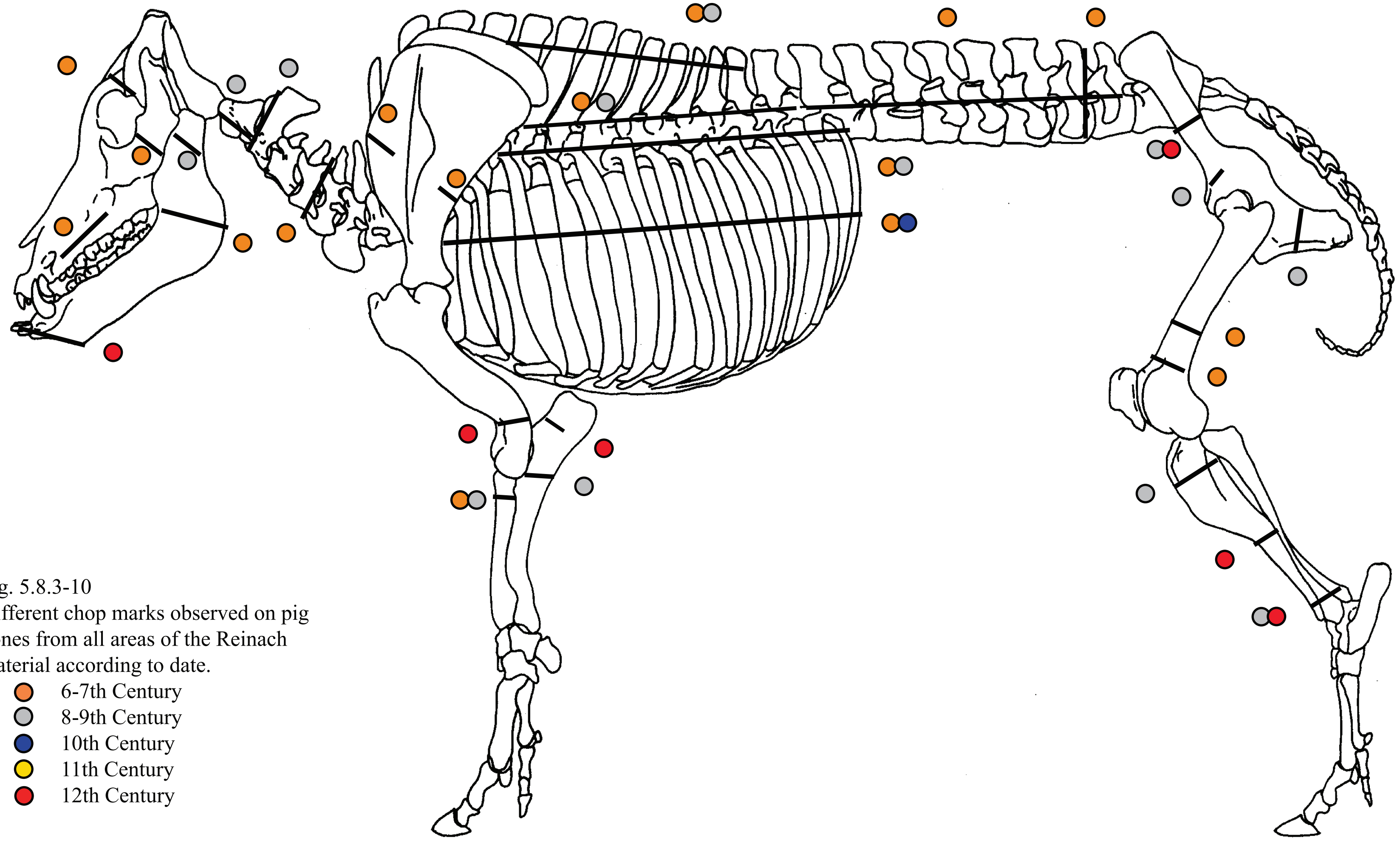


Fig. 5.8.3-10
Different chop marks observed on pig bones from all areas of the Reinach material according to date.

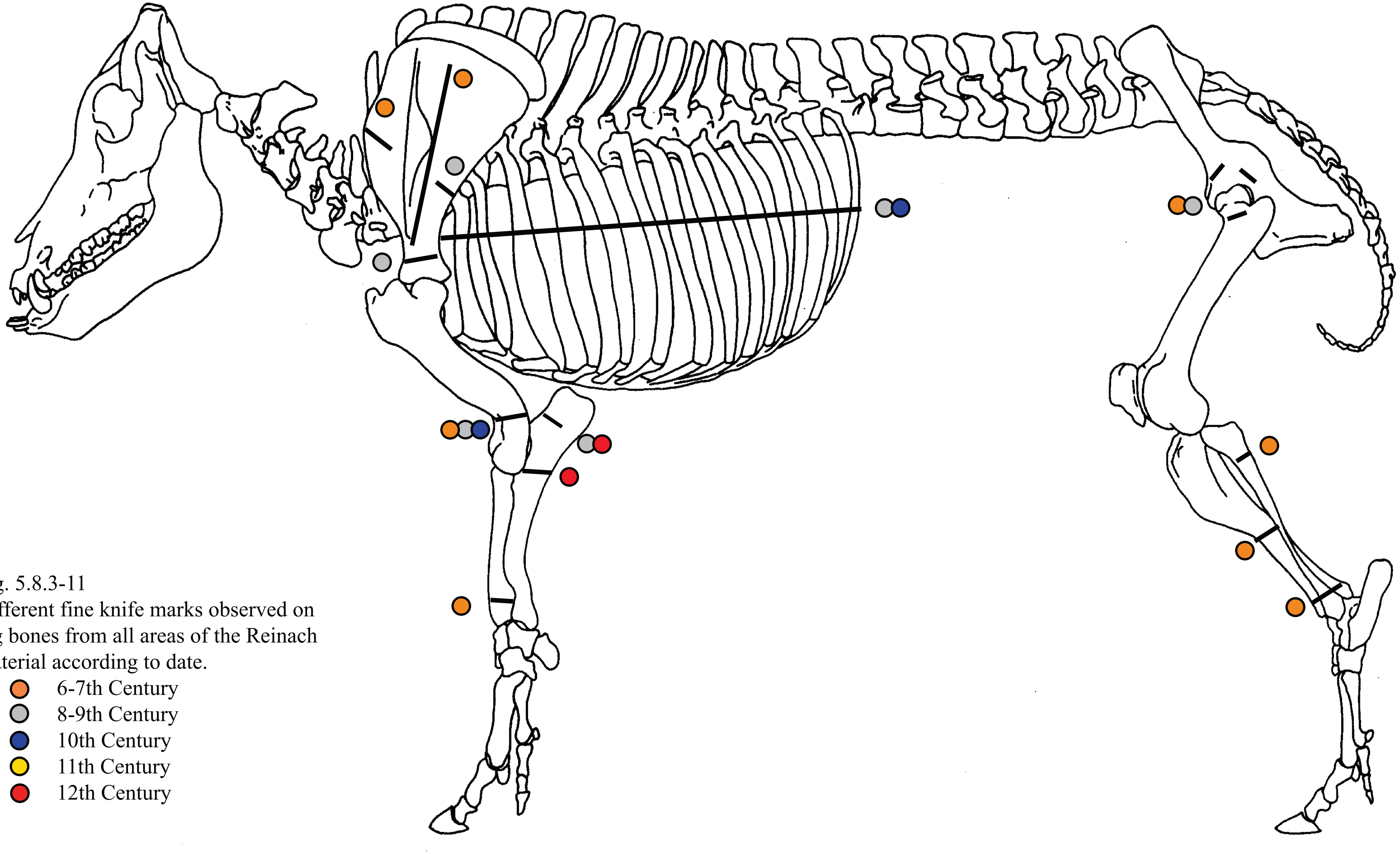


Fig. 5.8.3-11
Different fine knife marks observed on pig bones from all areas of the Reinach material according to date.

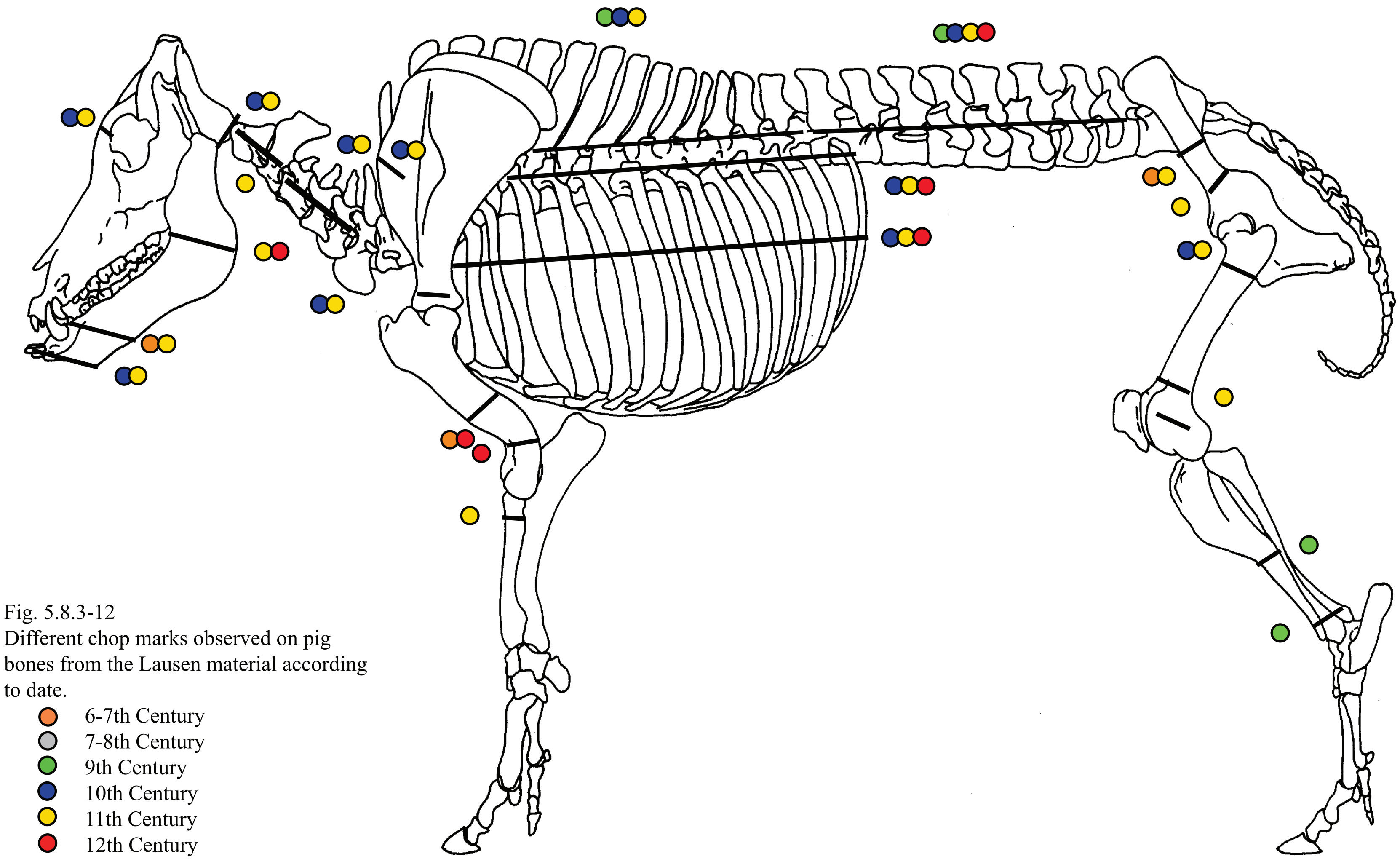


Fig. 5.8.3-12
Different chop marks observed on pig bones from the Lausen material according to date.

- 6-7th Century
- 7-8th Century
- 9th Century
- 10th Century
- 11th Century
- 12th Century

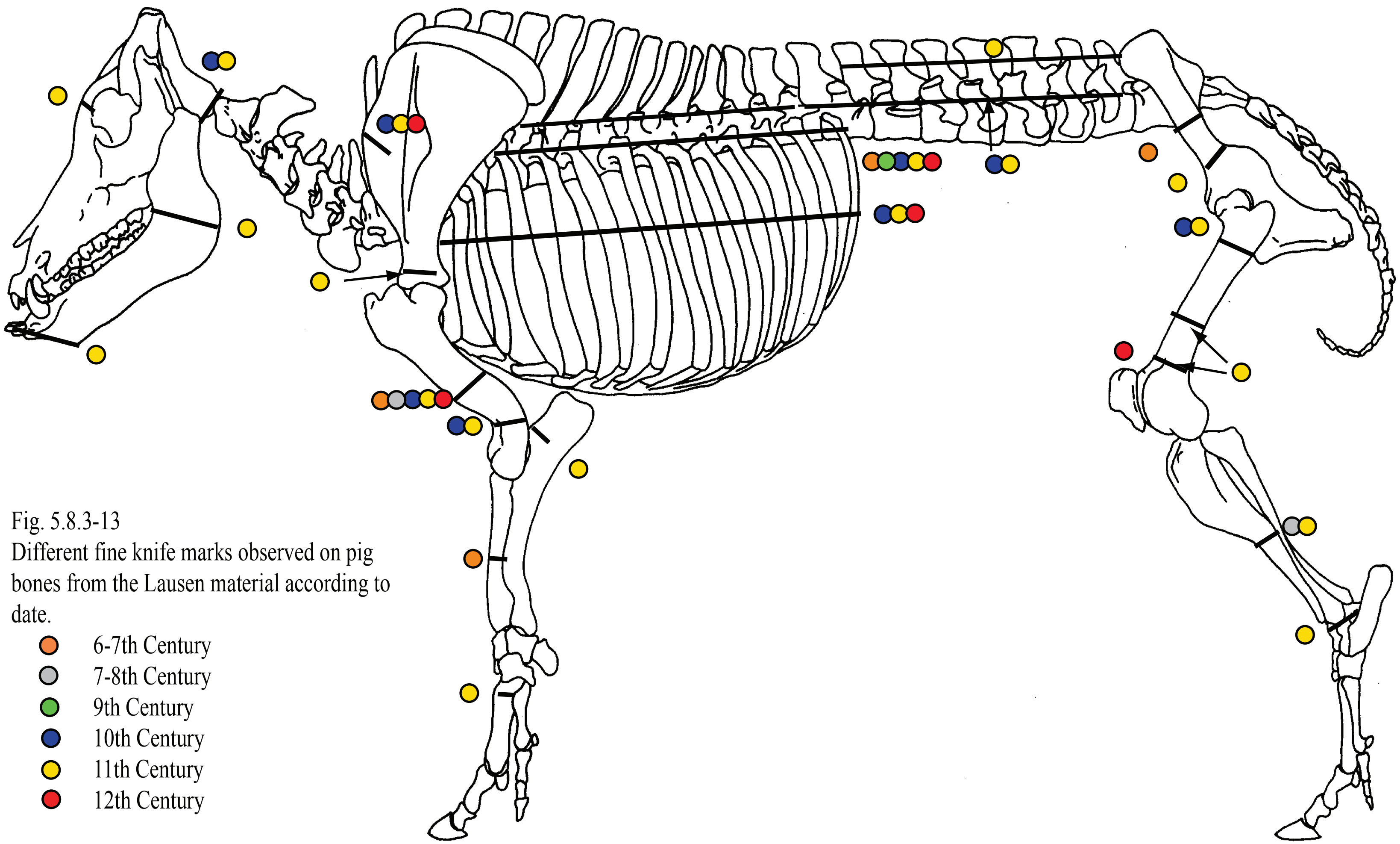


Fig. 5.8.3-13
Different fine knife marks observed on pig bones from the Lausen material according to date.

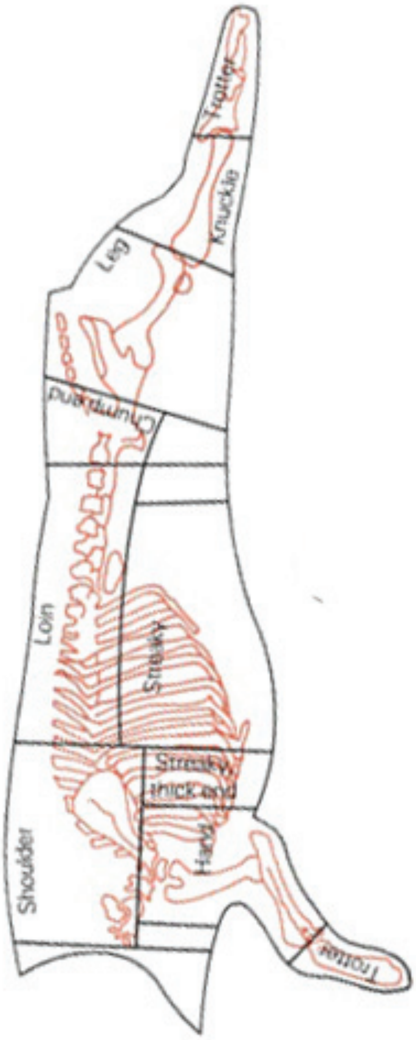


Fig. 5.8.3-14; Modern pork cuts, modifed from website 8.

Site/Area	Dating	Element	Mark	Body Area
KA-Adler	Mid 4thC	carpal	knf ser	P
KA-Adler	Mid 4thC	scapula	knf ser	G
KA-Adler	Mid 4thC	scapula	chp ser	G
R-GMZ	700/beg. 8thC	hyoid	chp ser	C
R-Sth	Mid to late 9thC	metatarsal 3	chp	P
R-GMZ	Mid to late 10thC	femur	knf ser	H
Lausen G10	c. 11th	tibia	chp	H
Lausen G45	c. 11th	rib	chp	T

Table 5.8.4.1-1; Data of equid butchery from all three sites; KA-Adler - Kaiseraugst Gasthof Adler, R-GMZ-Reinach Gemeindezentrum, R-Sth-Reinach Stadthof
knf- knife, chp- chop, scp- scrape, clv- cleave, ser- series (i.e. more than one mark).

Site/Area	Dating	Element	Mark	Body Area
R-GMZ	late 6thC	femur	knf	H
Lausen G50	Late 6th-late 7th	humerus	knf ser	F
R-Sth	c. 600	scapula	knf	G
Lausen G65	Late 7th-late 8th	radius	chp	F
R-GMZ	c. 7/8thC	humerus	knf ser	F
R-GMZ	Beg. 9thC	coracoid	knf ser	F
R-GMZ	Beg. 9thC	coracoid	knf	F
Lausen G28	c. 9thC	femur	knf ser	H
Lausen G28	c. 9thC	humerus	knf ser	F
Lausen G28	c. 9thC	tibia	clv	H
Lausen G54	c. 10thC	femur	knf ser	H
Lausen G36	c. 11thC	humerus	chp	F
R-GMZ	late 11thC/c.1100	femur	knf ser	H
R-Sth	early to mid 12thC	scapula	knf ser	G
R-Sth	early to mid 12thC	scapula	knf ser	G

Table 5.8.4.2-1; Data of chicken butchery from all three sites; abbreviations as table 5.8.4.1-1

Site/Area	Dating	Species	Element	Mark	Body Area
KA-Jakobli	n.d.	Cervus elaphus	axis	chp ser	T
KA-Jakobli	n.d.	Cervus elaphus	skull	clv	C
KA-Jakobli	n.d.	Cervus elaphus	skull	chp	C
KA-Jakobli	n.d.	Cervus elaphus	skull	chp	C
KA-Jakobli	5th-late 6thC	Cervus elaphus	humerus	chp ser	F
KA-Adler	mid 5 - late 6thC	Cervus elaphus	pelvis	chp ser	G
KA-Adler	mid 5 - late 6thC	Cervus elaphus	skull	chp ser	C
KA-Adler	mid 5 - late 6thC	Cervus elaphus	cevical	chp	T
KA-Jakobli	6thC	Cervus elaphus	pelvis	chp ser	G
KA-Jakobli	6thC	Cervus elaphus	pelvis	clv	G
KA-Jakobli	6thC	Cervus elaphus	atlas	chp	T
KA-Jakobli	beg. 7thC	Cervus elaphus	rib	chp ser	T
Lausen G28	c. 9thC	Cervus elaphus	pelvis	chp	G
R-Sth	Early 11thC	Cervus elaphus	tibia	chp ser	H
Lausen G45	c. 11thC	Cervus elaphus	cevical	chp	T
Lausen G46	c. 11thC	Cervus elaphus	humerus	knf ser	F
KA-Jakobli	5th-late 6thC	Lepus europaeus	tibia	knf ser	H
KA-Jakobli	5th-late 6thC	Lepus europaeus	tibia	knf ser	H
KA-Adler	mid 5 - late 6thC	Sus scrofa	radius	clv	F
Lausen G28	c. 9thC	Vulpes vulpes	mandible	knf	C
Lausen G54	c. 10thC	Anser domesticus	coracoid	knf ser	F
Lausen G54	c. 10thC	Anser domesticus	coracoid	knf ser	F
Lausen G54	c. 10thC	Anser domesticus	humerus	knf ser	F
Lausen G54	c. 10thC	Anser domesticus	tibiotarsus	knf ser	H

Table 5.8.5-1; Data of butchery on wild mammals and birds from all three sites; abbreviations as table 5.8.4.1-1

	Mid 4thC					4-6thC*					450-500*					5-6thC				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	0	0	0	0	0.00%	0	0	0	0	0.00%	0	0	0	0	0.00%	0	0	0	0	0.00%
< subadult	0	9	0	9	18.75%	0	1	0	1	14.29%	0	1	0	1	14.29%	4	15	0	19	14.07%
Subadult	0	5	0	5	10.42%	1	0	0	1	14.29%	0	0	0	0	0.00%	1	16	0	17	12.59%
Adult/Senile	0	34	0	34	70.83%	5	0	0	5	71.43%	0	6	0	6	85.71%	41	58	0	99	73.33%
Total	0	48	0	48		6	1	0	7		0	7	0	7		46	89	0	135	

Table 6.2.1.1-1; Age distribution of cattle using combined dental and epiphyseal data from the three areas at Kaiseraugst split by period, Jak - Jakobli-Haus, Adl - Gasthof Adler, Fstr - Fabrikstrasse; * - denotes statistically small samples

	6thC					beg. 7thC					12thC*				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	1	0	0	1	1.32%	0	0	0	0	0.00%	0	0	0	0	0.00%
< subadult	8	0	0	8	10.53%	3	0	0	3	7.32%	0	2	2	4	25.00%
Subadult	14	0	0	14	18.42%	10	0	0	10	24.39%	0	2	0	2	12.50%
Adult/Senile	53	0	0	53	69.74%	28	0	0	28	68.29%	0	2	8	10	62.50%
Total	76	0	0	76		41	0	0	41		0	6	10	16	

Table 6.2.1.1-1; contd

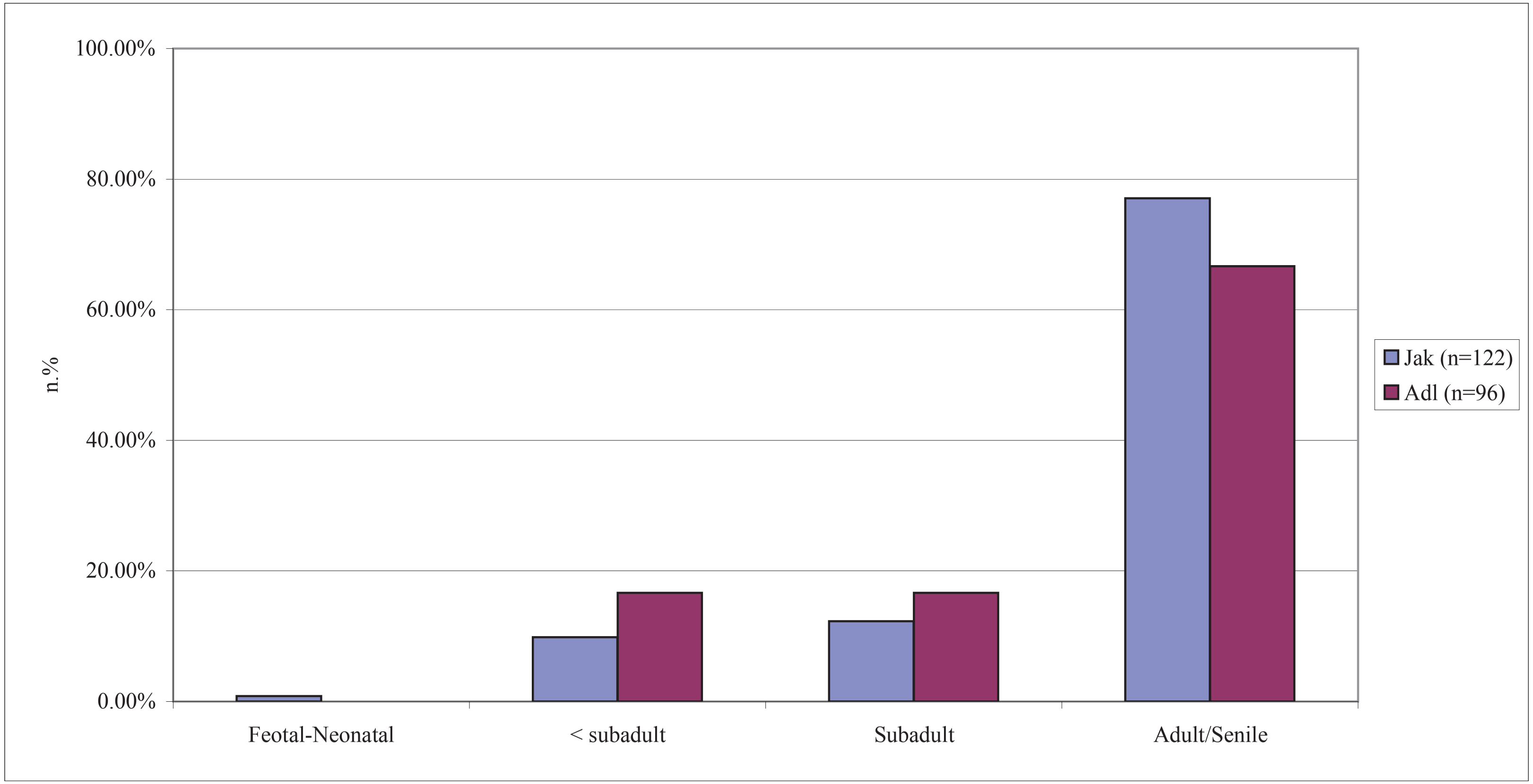


Fig. 6.2.1.1-2; Age distribution of cattle using combined dental and epiphyseal data from the fifth to sixth and sixth Century periods at Kaiseraugst split by area; Jak - Jakobli-Haus, Adl - Gasthof Adler

	6-7thC*		8thC*		9thC		10thC*		11thC		12thC*	
Feotal-Neonatal	0	0.00%	0	0.00%	1	1.69%	0	0.00%	0	0.00%	0	0.00%
< subadult	2	12.50%	0	0.00%	15	25.42%	1	16.67%	11	24.44%	0	0.00%
Subadult	1	6.25%	1	33.33%	26	44.07%	1	16.67%	18	40.00%	0	0.00%
Adult/Senile	13	81.25%	2	66.67%	17	28.81%	4	66.67%	16	35.56%	6	100.00%
Total	16		3		59		6		45		6	

Fig. 6.2.1.2-1; Proportion of age groups in cattle using combined dental and epiphyseal data from Lausen split by date

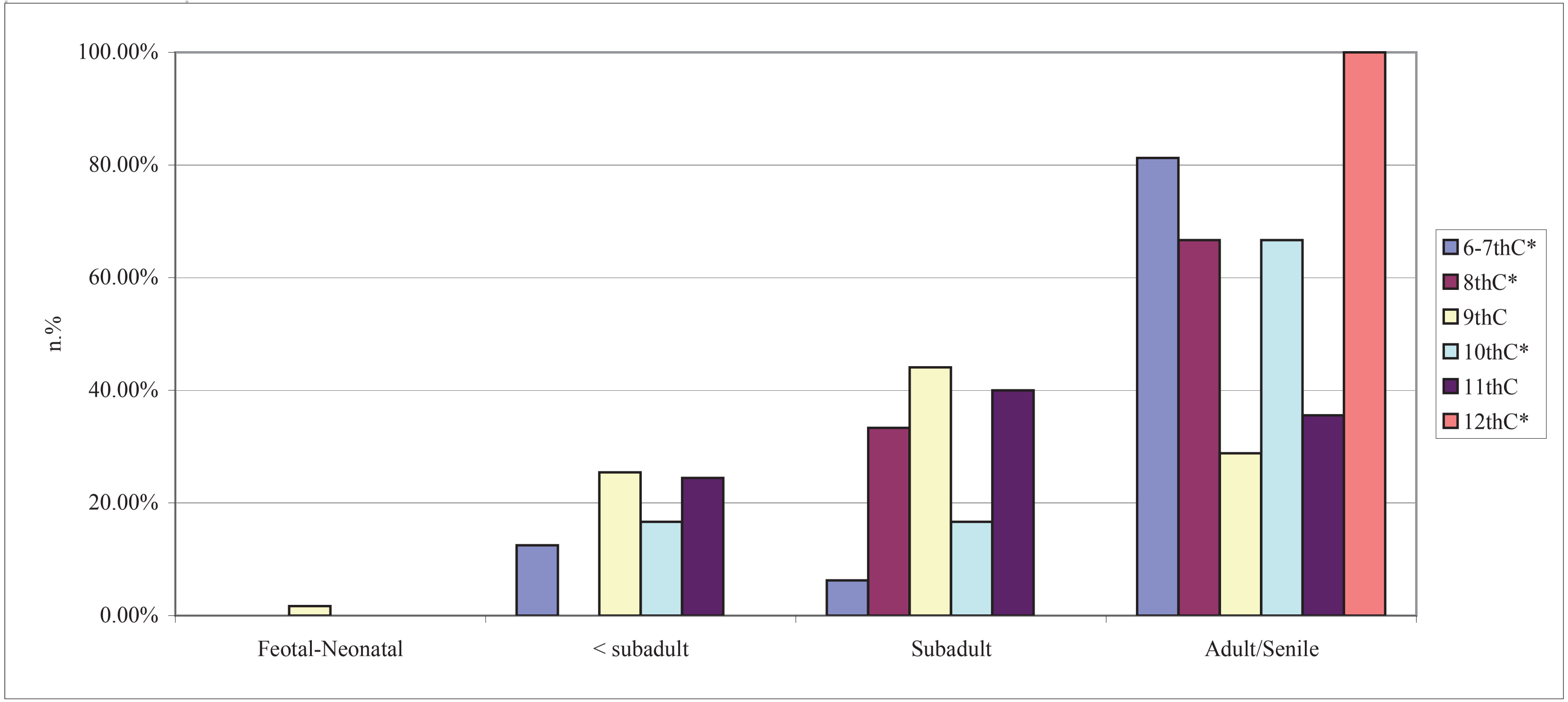


Fig. 6.2.1.2-2; Age distribution of cattle using combined dental and epiphyseal data from Lausen split by date
* - denotes statistically small samples

Age Group	9thC (n=59)	Grouped data	9thC (n=59)
feotal-neonatal	1	feotal-neonatal	1
foetal or infantile	0	less than subadult	15
infantile	3		
less than subadult	11		
infantile oder juvenile	1		
juvenile	0		
juvenile or subadult	0	subadult	26
subadult	3		
subadult or adult	1		
not adult	22		
young adult	0	adult/senile	17
adult	11		
adult or senile	6		

Fig. 6.2.1.2-3; A detailed age distribution of cattle using combined dental and epiphyseal data from the Lausen site showing the high proportion of not adult individuals

	6thC*		7thC		8thC*		9thC*		10thC*		11thC*		12thC	
Feotal-Neonatal	0	0.00%	0	0.00%	2	18.18%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
< subadult	0	0.00%	6	18.18%	2	18.18%	2	25.00%	4	50.00%	3	25.00%	13	34.21%
Subadult	3	75.00%	11	33.33%	2	18.18%	1	12.50%	1	12.50%	4	33.33%	21	55.26%
Adult/Senile	1	25.00%	16	48.48%	5	45.45%	5	62.50%	3	37.50%	5	41.67%	4	10.53%
Total	4		33		11		8		8		12		38	

Table 6.2.1.3-1; Age distribution of cattle using combined dental and epiphyseal data from the Reinach site split by period
* - denotes statistically small samples

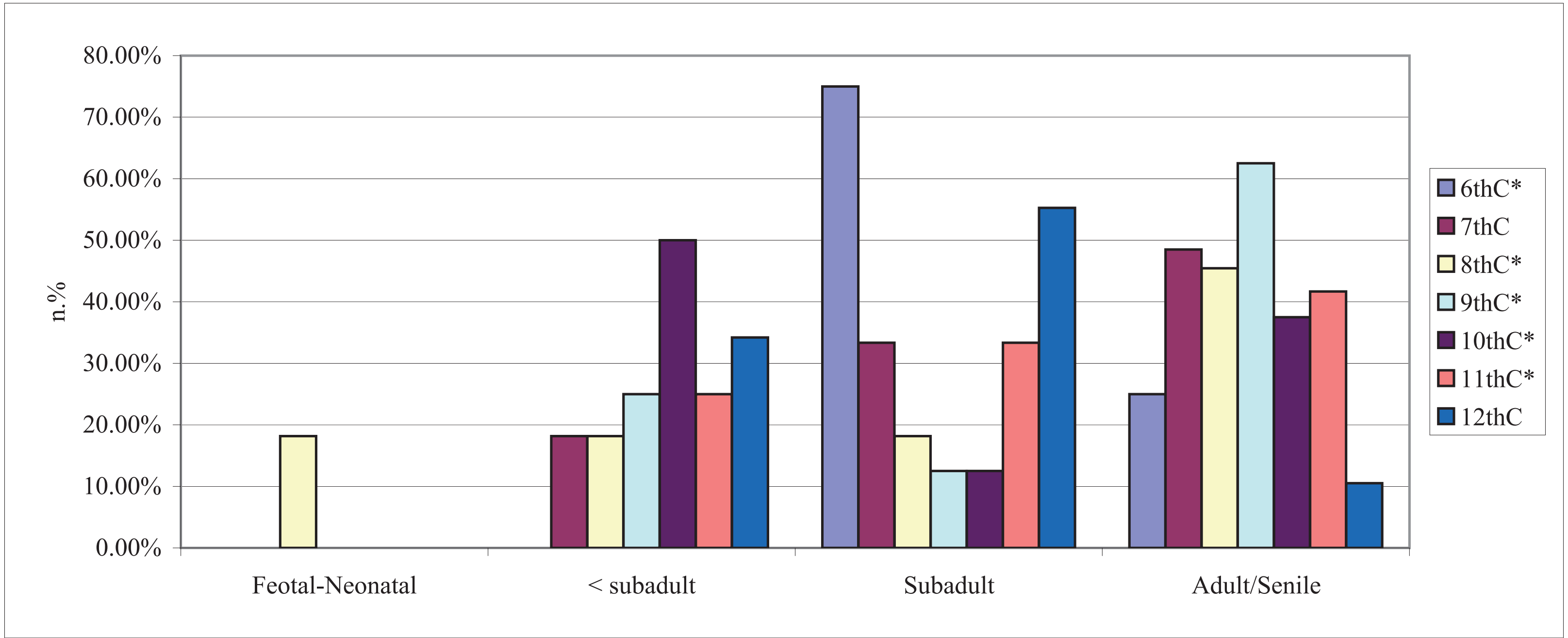


Fig. 6.2.1.3-2; Age distribution of cattle using combined dental and epiphyseal data from the Reinach site split by period
* - denotes statistically small samples

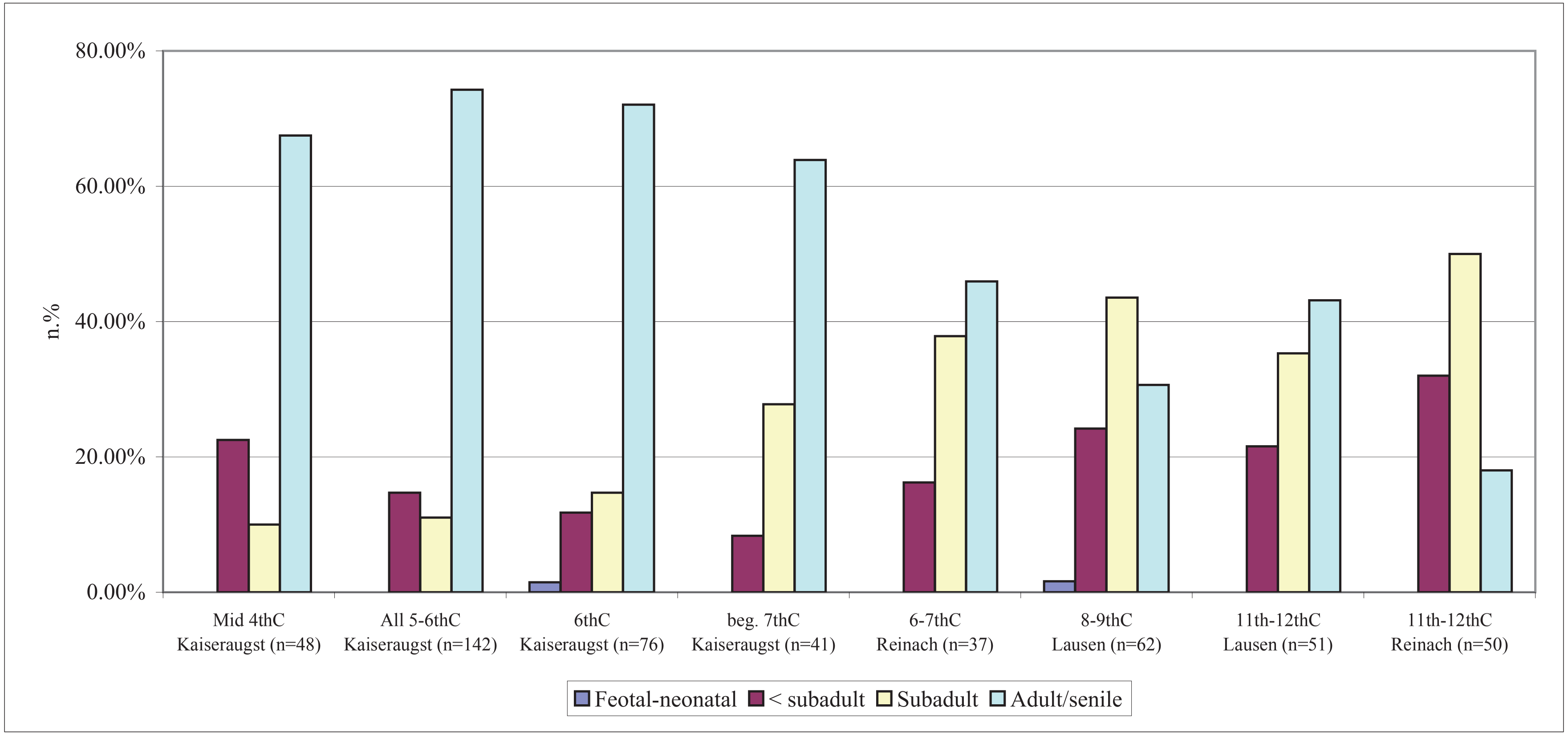


Fig. 6.2.1.4-1; Age distribution of cattle using combined dental and epiphyseal data from all sites by period

Excavation	Area	Date	Element	Sex
KA	Adler	Mid 4thC	skull and horncore	female
KA	Adler	Mid 4thC	pelvis	female
KA	Adler	mid 5 - late 6thC	horncore	poss male
KA	Adler	mid 5 - late 6thC	skull and horncore	poss female
KA	Adler	12thC	horncore	poss female
KA	Jakobli	5th-late 6thC	horncore	poss male
KA	Jakobli	6thC	horncore	male
KA	Jakobli	6thC	horncore	poss female
KA	Jakobli	6thC	horncore	poss female
KA	Jakobli	6thC	horncore	poss male
KA	Jakobli	beg. 7thC	skull and horncore	poss female
KA	Jakobli	beg. 7thC	horncore	male
Reinach	GMZ	8thC	pelvis	female
Reinach	Altebrauerei	8thC	pelvis	female
Reinach	Altebrauerei	8thC	horncore	poss male
Reinach	Stadthof	12thC	pelvis	poss male
Lausen	Grube 28	c. 9thC	pelvis	male
Lausen	Grube 28	c. 9thC	pelvis	male
Lausen	Grube 28	c. 9thC	pelvis	male
Lausen	Grube 28	c. 9thC	pelvis	male
Lausen	Grube 28	c. 9thC	pelvis	poss female
Lausen	Grube 28	c. 9thC	pelvis	poss female
Lausen	Grube 28	c. 9thC	pelvis	poss female
Lausen	Grube 28	c. 9thC	pelvis	poss female
Lausen	Grube 28	c. 9thC	horncore	poss female
Lausen	Grube 28	c. 9thC	pelvis	poss male
Lausen	Grube 28	c. 9thC	pelvis	poss male
Lausen	Grube 54	c. 10thC	pelvis	poss male
Lausen	Grube 45	c. 11thC	pelvis	poss male

	n.	%
male	5	41.67%
female	7	58.33%
n.	12	

	n.	%
male	2	50.00%
female	2	50.00%
n.	4	

	n.	%
male	8	61.54%
female	5	38.46%
n.	13	

Table 6.2.2-1; Sex determintion of cattle through all sites using both horncores and pelvis possible assignations are counted within the determined sex for the analsis here.
KA - Kaiseraugst, Adler - Kaiseraugst Gasthof Adler, Jakobli - Kaiseraugst Jakobli-Haus, GMZ - Reinach Gemeindezentrum, n. - number

Area	Date	Element	SLC	GLP	LG	BG
Jak	6th	Scapula	51.21		51.49	46.65
Jak	6th	Scapula	60.34	77.75	62.8	56.75
Jak	6th	Scapula	40.73	61.92		40.38
Jak	beg. 7th	Scapula		53.55	46.62	39.69
Jak	beg. 7th	Scapula				39.9
Jak	6th	Scapula	47.5	65.58	55.87	47.78
Jak	n.d.	Scapula	44.67			
Jak	5th-late 6th	Scapula	64.43			
Jak	6th	Scapula		81.94	67.15	54.68
Jak	6th	Scapula	66.19	85.13	69.36	61.59
Jak	6th	Scapula	48.8	63.04	56.16	
Adl	mid 5 - late 6th	Scapula				48.03
Adl	mid 5 - late 6th	Scapula		60.38	51.75	42.23
Adl	mid 5 - late 6th	Scapula	50.57			
Adl	Mid 4th	Scapula	61.96		64.67	58.57
		count	10	8	9	11
		min	40.73	53.55	46.62	39.69
		mean	53.64	68.66	58.43	48.75
		max	66.19	85.13	69.36	61.59
		sd	8.89	11.42	7.89	8.00
		CoV	16.58%	16.64%	13.50%	16.40%

Area	Date	Element	Bd	BT	HT	HTC	Dp
Jak	n.d.	Humerus		90.06	52.47	42.63	
Jak	6thC	Humerus	70	58.41	38.18		
Jak	6thC	Humerus	94.38	79.43	49.77		
Jak	6thC	Humerus	85.94	76.87	47.51		
Jak	6thC	Humerus	86.62	74.75	43.8		
Jak	6thC	Humerus	95.41	83.53			
Jak	4-6thC	Humerus		61.84	38.04		
Jak	6thC	Humerus				40.11	
Jak	6thC	Humerus			31.9		
Adl	12thC	Humerus	98.47	90.78			
Adl	Mid 4thC	Humerus		66.02	42.72	31.42	
Adl	Mid 4thC	Humerus		68.47	40.59	32.25	
Adl	Mid 4thC	Humerus	75.79	63.89	42.28	30.82	
Adl	Mid 4thC	Humerus	56.9	48.95	39.74	28.82	
Adl	mid 5 - late 6thC	Humerus	82.8	78.26	46.65		111.9
Adl	mid 5 - late 6thC	Humerus			38.8		
		count	9	13	13	6	1
		min	56.90	48.95	31.90	28.82	111.90
		mean	82.92	72.40	42.50	34.34	111.90
		max	98.47	90.78	52.47	42.63	111.90
		sd	13.45	12.48	5.57	5.62	
		CoV	16.22%	17.23%	13.11%	16.36%	

Area	Date	Element	SD	Bd	GL	Dd
Jak	beg. 7th	Tibia		59.84		42.56
Jak	5th-late 6th	Tibia		66.3		
Jak	5th-late 6th	Tibia		68.7		47.19
Jak	6th	Tibia		58.58		
Jak	6th	Tibia	62.56	87.33	388	68.12
Jak	6th	Tibia		68.89		
Jak	beg. 7th	Tibia		54.32		
Jak	beg. 7th	Tibia		57.46		
Adl	Mid 4th	Tibia		64.51		
Adl	Mid 4th	Tibia		51.81		
Adl	mid 5 - late 6th	Tibia		54.87		
		count	1	11	1	3
		min	62.56	51.81	388.00	42.56
		mean	62.56	62.96	388.00	52.62
		max	62.56	87.33	388.00	68.12
		sd		10.00		13.62
		coef of V		15.88%		25.88%

Area	Date	Element	GLl	GLm	Bd	Dl	Dm
Jak	n.d.	Astragalus	70.52	65.09	43.15	39.61	40.01
Jak	6th	Astragalus			42.14	36.44	
Jak	6th	Astragalus	74.18	67.17	46.69	40.32	40.34
Jak	beg. 7th	Astragalus	61.73		42.46	33.58	
Jak	beg. 7th	Astragalus	62.3	59.52	40.04	36.23	36.63
Jak	6th	Astragalus	55.55	50.4	35.49	32.74	27.52
Jak	beg. 7th	Astragalus		55.48	40.52		
Jak	5th-late 6th	Astragalus	70.5	64.84	42.9	39.02	39.24
Jak	5th-late 6th	Astragalus	70.58			38.58	
Jak	beg. 7th	Astragalus	61.96	59.37	41.39	34.29	34.45
Adl	Mid 4th	Astragalus		62.97		38.38	36.87
Adl	450-early 500	Astragalus	68.94		46.86	42.13	
Adl	Mid 4th	Astragalus	62.22	56.03	38.48	36.19	35.17
Adl	mid 5 - late 6th	Astragalus	70.88	66	46.04	42.77	
Adl	mid 5 - late 6th	Astragalus	74.6	66.6	47.23	41.83	43.95
Adl	mid 5 - late 6th	Astragalus	58.06	53.9	34.78	33.21	31.15
Adl	Mid 4th	Astragalus	68.44	61.06	48.47	39.81	40.04
Adl	Mid 4th	Astragalus	71.6		48.6	43.02	41.11
Adl	Mid 4th	Astragalus		62.05	47.75		
Adl	Mid 4th	Astragalus	66.04	60.1	45.96	36.2	40.04
		count	16	15	18	18	13
		min	55.55	50.40	34.78	32.74	27.52
		mean	66.76	60.71	43.28	38.02	37.42
		max	74.60	67.17	48.60	43.02	43.95
		sd	5.87	5.06	4.53	3.50	4.61
		CoV	8.80%	8.33%	10.48%	9.20%	12.31%

Area	Date	Element	Bp	Bd	BFp	BFd	SD	GL
Jak	6thC	Radius		83.34		71.76		
Jak	6thC	Radius	85.95	80.22	78.98			
Jak	beg. 7thC	Radius			73.77			
Jak	5th-late 6th	Radius	52.9		49.17			
Jak	6thC	Radius	81.99		74.53			
Jak	6thC	Radius	79.71					
Jak	5th-late 6th	Radius	93.29		86.66			
Jak	6thC	Radius	74.52		69.79			
Jak	beg. 7thC	Radius	68.31		63.03			
Jak	6thC	Ulna und Radius	91.34	80.69	83.67			
Jak	6thC	Ulna und Radius		82.39		75.36		
Jak	beg. 7thC	Ulna und Radius	72.72		65.74			
Jak	4-6thC	Ulna und Radius	89.05		81.71			
Adl	Mid 4thC	Radius	84.3	74.27	78.19	75.13		
Adl	mid 5 - late 6thC	Radius		68.66		65.65	43.68	268
Adl	mid 5 - late 6thC	Radius			77.67			
Adl	mid 5 - late 6thC	Radius				61.37		
Adl	mid 5 - late 6thC	Ulna und Radius	87.93	78.33	80.14	68.45		
Adl	mid 5 - late 6thC	Ulna und Radius		89.53		64.83		
Adl	mid 5 - late 6thC	Ulna und Radius		59.38		48.78		
		count	12	9	13	8	1	1
		min	52.90	59.38	49.17	48.78	43.68	268.00
		mean	80.17	77.42	74.08	66.42	43.68	268.00
		max	93.29	89.53	86.66	75.36	43.68	268.00
		sd	11.53	8.93	10.12	8.69		
		CoV	14.38%	11.53%	13.67%	13.08%		

Table 6.2.3-1; Raw metrical data from Kaiseraugst for elements with more than ten repeated measurements, all measurements in mm, measurement codes follow von den Driesch (1976), Jak -Kaiseraugst Jakobli-Haus,
Adl - Kaiseraugst Gasthof Adler, min - minimum, max - maximum, sd - standard deviation, (

Area	Date	Element	Bp	SD	Bd	DD	GL
Jak	5th-late 6th	Metacarpus III+IV	46.79	23.74	46.54	18.32	181.11
Jak	5th-late 6th	Metacarpus III+IV	65.68				
Jak	6th	Metacarpus III+IV	56.93		55.56	20.1	
Jak	6th	Metacarpus III+IV	52.79				
Jak	6th	Metacarpus III+IV			52.76		
Jak	6th	Metacarpus III+IV	51.93				
Jak	6th	Metacarpus III+IV	64.45	35.35	64.45	23.3	202
Jak	6th	Metacarpus III+IV	64.37	36.2		23.17	
Jak	beg. 7th	Metacarpus III+IV		66.81			
Jak	6th	Metacarpus III+IV		53.18			
Jak	5th-late 6th	Metacarpus III+IV	56.35	31.5	67.69	21.76	195
Jak	6th	Metacarpus III+IV	57.4				
Jak	5th-late 6th	Metacarpus III+IV			75.4	24.49	
Jak	5th-late 6th	Metacarpus III+IV	72.62			24.46	
Jak	5th-late 6th	Metacarpus III+IV	52.66	31.24	56.78	21.94	187
Jak	6th	Metacarpus III+IV	58.27				
Jak	beg. 7th	Metacarpus III+IV	55.85				
Jak	beg. 7th	Metacarpus III+IV	54.77				
Adl	Mid 4th	Metacarpus III+IV	32.54		31.21	22.27	
Adl	mid 5 - late 6 th	Metacarpus III+IV	60.99	31.33	59.75	23.47	205
Adl	mid 5 - late 6 th	Metacarpus III+IV	46.3				
Adl	mid 5 - late 6 th	Metacarpus III+IV	70.17				
Adl	Mid 4th	Metacarpus III+IV	74.73				
Adl	mid 5 - late 6 th	Metacarpus III+IV	51.27				
		count	20	8	9	10	5
		min	32.54	23.74	31.21	18.32	181.11
		mean	57.34	38.67	56.68	22.33	194.02
		max	74.73	66.81	75.40	24.49	205.00
		sd	9.87	14.16	12.79	1.93	10.01
		CoV	17.21%	36.61%	22.57%	8.66%	5.16%

Area	Date	Element	Bp	SD	Bd	DD	GL
Jak	n.d.	Metatarsus III+IV	52.11			23.67	
Jak	n.d.	Metatarsus III+IV	52.31				
Jak	n.d.	Metatarsus III+IV			62.94		
Jak	5th-late 6th	Metatarsus III+IV	44.6		50.27		
Jak	5th-late 6th	Metatarsus III+IV	54.93				
Jak	5th-late 6th	Metatarsus III+IV			50.89		
Jak	6th	Metatarsus III+IV	46.5				
Jak	6th	Metatarsus III+IV			52.75	23.35	
Jak	beg. 7th	Metatarsus III+IV	44.54		51.43	23.91	
Jak	6th	Metatarsus III+IV	47.3				
Jak	6th	Metatarsus III+IV			49.95	22.87	
Jak	beg. 7th	Metatarsus III+IV			50.69	17.59	
Jak	6th	Metatarsus III+IV	53.94			28.2	
Jak	6th	Metatarsus III+IV	48.68				
Jak	6th	Metatarsus III+IV				25.06	
Jak	6th	Metatarsus III+IV			47.92	22.06	
Jak	5th-late 6th	Metatarsus III+IV	61.57			30.88	
Jak	5th-late 6th	Metatarsus III+IV	55.54			27.19	
Jak	6th	Metatarsus III+IV	50.53				
Jak	6th	Metatarsus III+IV			58.22		
Jak	4-6th	Metatarsus III+IV			51.43		
Jak	4-6th	Metatarsus III+IV			53.49		
Adl	Mid 4th	Metatarsus III+IV	46.76	27.24	54.53	25.11	225
Adl	Mid 4th	Metatarsus III+IV	50.36				
Adl	Mid 4th	Metatarsus III+IV	43.45				
Adl	mid 5 - late 6 th	Metatarsus III+IV	49.57	26.51	57.1	25.55	216
Adl	mid 5 - late 6 th	Metatarsus III+IV	49.96				
Adl	mid 5 - late 6 th	Metatarsus III+IV			52.44	23.75	
Adl	mid 5 - late 6 th	Metatarsus III+IV			67.09	30.6	
Adl	mid 5 - late 6 th	Metatarsus III+IV			71.79	25.46	
Adl	mid 5 - late 6 th	Metatarsus III+IV			59.48	25.81	
Adl	mid 5 - late 6 th	Metatarsus III+IV	43.91		0	0	
Adl	mid 5 - late 6 th	Metatarsus III+IV	48.12		0	0	
Adl	mid 5 - late 6 th	Metatarsus III+IV			62.56	27.09	
Adl	Mid 4th	Metatarsus III+IV			50.65	24.45	
		count	19	2	21	20	2
		min	43.45	26.51	0.00	0.00	216.00
		mean	49.72	26.88	50.27	22.63	220.50
		max	61.57	27.24	71.79	30.88	225.00
		sd	4.64	0.52	17.83	8.27	6.36
		CoV	9.33%	1.92%	35.46%	36.55%	2.89%

Table 6.2.3-1 Contd

Area	Date	Element	Bp	SD	Bd	Glpe
Jak	n.d.	Phalanx 1 ant	32.58	26.24	32.5	62.57
Jak	5th-late 6th	Phalanx 1 ant	30.94	25.52	29.24	56.18
Jak	5th-late 6th	Phalanx 1 ant	33.98	28.91	32.68	68.38
Jak	5th-late 6th	Phalanx 1 ant	32.86	25.82	31.02	68.79
Jak	6th	Phalanx 1 ant	30.23	25.64	27.87	56.31
Jak	beg. 7th	Phalanx 1 ant	30.39	26.04	30.85	58.84
Jak	beg. 7th	Phalanx 1 ant	30.38	26.43	31	59.43
Jak	beg. 7th	Phalanx 1 ant	26.46	31.37	23.59	52.47
Jak	beg. 7th	Phalanx 1 ant	26.3	21.14	25.01	50.99
Jak	beg. 7th	Phalanx 1 ant	34.66	28.9	31.44	66.66
Jak	5th-late 6th	Phalanx 1 ant			33.53	
Jak	6th	Phalanx 1 ant	34.47	29	30.96	60.76
Jak	beg. 7th	Phalanx 1 ant			23.67	
Jak	6th	Phalanx 1 ant	36.11	31.05	33.93	65.41
Jak	5th-late 6th	Phalanx 1 ant	33.85	28.76	32.21	
Jak	5th-late 6th	Phalanx 1 ant	32.66	26.35	32.2	59.07
Jak	6th	Phalanx 1 ant	34.79	28.98	34.13	61.02
Jak	5th-late 6th	Phalanx 1 ant	36.04	28.17	34.55	
Jak	5th-late 6th	Phalanx 1 ant			32.86	
Jak	5th-late 6th	Phalanx 1 ant			34.75	
Jak	5th-late 6th	Phalanx 1 ant	31.33	25.06	31.59	58.32
Jak	5th-late 6th	Phalanx 1 ant	29.08	23.45	27.07	61.15
Jak	5th-late 6th	Phalanx 1 ant	32.58	25.81		66.39
Jak	6th	Phalanx 1 ant	55.58	49.35	51.1	81.75
Jak	6th	Phalanx 1 ant	28.71	23.61	27.93	55.59
Jak	6th	Phalanx 1 ant	33.96	28.15	32.65	57.99
Jak	6th	Phalanx 1 ant	35.75	30.84	34.54	63.32
Jak	6th	Phalanx 1 ant	30.18	25.92	28.05	56.54
Jak	6th	Phalanx 1 ant	31.94	26.24	30.79	60.4
Jak	6th	Phalanx 1 ant	33.2	28.2	31.83	58.33
Jak	6th	Phalanx 1 ant	28.7	24	27.55	59.4
Jak	beg. 7th	Phalanx 1 ant	29.64			
Jak	4-6th	Phalanx 1 ant	29.43	24.79	26.56	64.83
Jak	4-6th	Phalanx 1 ant	27.92	23.98	24.72	60.66
Jak	4-6th	Phalanx 1 ant			34.62	
Jak	4-6th	Phalanx 1 ant	29.87	27.08	28.16	59.88
Jak	4-6th	Phalanx 1 ant	31.86	26.31	28.66	58.61
Jak	4-6th	Phalanx 1 ant	34.87	25.94	28.14	45.17
Jak	n.d.	Phalanx 1 post	26.68	22.21		
Jak	5th-late 6th	Phalanx 1 post	29.29	24.97	26.55	59.59
Jak	5th-late 6th	Phalanx 1 post	33.37	27.25	33.78	61.82
Jak	5th-late 6th	Phalanx 1 post	30.19	26.35	31.69	65.57
Jak	5th-late 6th	Phalanx 1 post	26.13	21.79	25.47	57.25
Jak	6th	Phalanx 1 post	31.81	26.63	31.56	62.29
Jak	6th	Phalanx 1 post	31.37	25.87	32.46	61.05
Jak	beg. 7th	Phalanx 1 post	27.01	21.37	24.33	56.14
Jak	beg. 7th	Phalanx 1 post	24.19	20.33	23.13	51.12
Jak	5th-late 6th	Phalanx 1 post	27.68	21.87	25.09	53.65
Jak	6th	Phalanx 1 post			25.93	
Jak	5th-late 6th	Phalanx 1 post	27.95	22.95	26.39	57.38
Jak	5th-late 6th	Phalanx 1 post			29.75	
Jak	6th	Phalanx 1 post	47.52	43.31	47.45	55.41
Jak	6th	Phalanx 1 post	36.92	30.77		62.43
Jak	6th	Phalanx 1 post	26.75	23.47	26.27	57.26

Table 6.2.3-1 Contd

Area	Date	Element	Bp	SD	Bd	Glpe
Jak	beg. 7th	Phalanx 1 post	25.69	21.45	24.96	51.89
Jak	beg. 7th	Phalanx 1 post	28.54	24.89	27.52	60.71
Jak	4-6th	Phalanx 1 post	29.63			
Adl	12th	Phalanx 1 ant	32.49	26.89	30.76	66.33
Adl	Mid 4th	Phalanx 1 ant	31.68	26.62	30.47	62.3
Adl	Mid 4th	Phalanx 1 ant	32.96	27.53	31.13	57.54
Adl	Mid 4th	Phalanx 1 ant	29.69		28.3	58.01
Adl	Mid 4th	Phalanx 1 ant	28.63	23.54	27.62	55.19
Adl	Mid 4th	Phalanx 1 ant	35.81	31.19	35.64	69.72
Adl	mid 5 - late 6th	Phalanx 1 ant	36.12	29.83	34.28	63.71
Adl	mid 5 - late 6th	Phalanx 1 ant	34.39	29.03	37.36	64.62
Adl	mid 5 - late 6th	Phalanx 1 ant			36.12	
Adl	mid 5 - late 6th	Phalanx 1 ant	34.37	28.05	33.28	60.47
Adl	mid 5 - late 6th	Phalanx 1 ant			30.52	
Adl	mid 5 - late 6th	Phalanx 1 ant	35.33	29.51	37.63	68.03
Adl	mid 5 - late 6th	Phalanx 1 ant	33.21	27.06	29.36	59.9
Adl	mid 5 - late 6th	Phalanx 1 ant	33.19	26.65	32.05	60.48
Adl	mid 5 - late 6th	Phalanx 1 ant	33.64	28.18	31.11	60.5
Adl	Mid 4th	Phalanx 1 ant	36.35			
Adl	mid 5 - late 6th	Phalanx 1 post	36.67	29.36	35.87	67.15
Adl	mid 5 - late 6th	Phalanx 1 post	30.07	24.15	28.75	63.7
Adl	mid 5 - late 6th	Phalanx 1 post	25.95	21.07	23.81	59.71
Adl	Mid 4th	Phalanx 1 post	27.33	22.87	26.14	56.24
Adl	450-early 500	Phalanx 1 post	31.05	25.16		62.53
Adl	Mid 4th	Phalanx 1 post	30.37	27.53	30.52	69.2
Adl	Mid 4th	Phalanx 1 post	27.08	23.48	27.5	58.83
Adl	mid 5 - late 6th	Phalanx 1 post	32.19	25.8	33.22	66.73
Adl	mid 5 - late 6th	Phalanx 1 post	30.04	23.42	27.14	58.74
Adl	mid 5 - late 6th	Phalanx 1 post	29.61	23.82	27.21	58.58
Adl	mid 5 - late 6th	Phalanx 1 post	29.77	24.41	28.48	62.67
Adl	mid 5 - late 6th	Phalanx 1 post	29.77	22.89	27.28	65.2
Adl	mid 5 - late 6th	Phalanx 1 post	37.13			
Adl	mid 5 - late 6th	Phalanx 1 post	31.04	25.6	32.95	67.02
Adl	mid 5 - late 6th	Phalanx 1 post	32.43	25.86	30.62	70.04
Adl	mid 5 - late 6th	Phalanx 1 post	27.24	22.77	26.29	57.2
Adl	Mid 4th	Phalanx 1 post	31.6	27.3	32.11	67.96
Adl	Mid 4th	Phalanx 1 post	30.78	26.24	27.77	56.82
Adl	Mid 4th	Phalanx 1 post	34.45	26.7	32.35	63.88
Adl	n.d.	Phalanx 1 ant/post			24.34	
	All	count	47	46	50	43
		min	24.19	20.33	23.13	45.17
		mean	31.88	26.87	30.44	59.91
		max	55.58	49.35	51.10	81.75
		sd	5.27	5.03	5.17	5.85
		CoV	16.52%	18.70%	16.98%	9.76%
	Ant	count	47	44	51	43
		min	26.30	21.14	23.59	45.17
		mean	32.75	27.53	31.33	60.98
		max	55.58	49.35	51.10	81.75
		sd	4.32	4.06	4.35	5.86
		CoV	13.18%	14.75%	13.89%	9.61%
	Post	count	33	32	31	31
		min	24.19	20.33	23.13	51.12
		mean	30.65	25.24	29.29	61.07
		max	47.52	43.31	47.45	70.04
		sd	4.39	4.10	4.70	4.79
		CoV	14.34%	16.23%	16.06%	7.85%

Area	Date	Element	Bp	SD	Bd	Glpe	s.Depth	Dd	Dp
Jak	n.d.	Phalanx 2 ant	32.32	26.71	27.57	40.49	25.04	31.21	33.77
Jak	beg. 7th	Phalanx 2 ant	32.82	26.89	26.01	44.19	24.86	30.52	34.44
Jak	beg. 7th	Phalanx 2 ant	30.1	23.85			23.37		31.99
Jak	5th-late 6th	Phalanx 2 ant	34.51	29.42		45.46	26.85	32.13	36.63
Jak	6th	Phalanx 2 ant	33.86	25	25.63	41.24	23.37	28.43	33.58
Jak	6th	Phalanx 2 ant	30.28						
Jak	5th-late 6th	Phalanx 2 ant	30.81	24.48	26.94	39.75	25.23	32.09	33.01
Jak	5th-late 6th	Phalanx 2 ant	33.58	26.1	27.65	45.75	25.26	31.09	34.4
Jak	6th	Phalanx 2 ant	34.29	25.36	29.44	40.85	27.83	34.81	35.67
Jak	5th-late 6th	Phalanx 2 ant	32.03	26.27	25.83	43.34	23.95	31.05	32.78
Jak	5th-late 6th	Phalanx 2 ant	37.02	29.58	28.72	44.79	25.78	31.54	37.11
Jak	5th-late 6th	Phalanx 2 ant	29.26	22.98	23.07		22.77	27.87	29.36
Jak	5th-late 6th	Phalanx 2 ant	28.92	22.78	22.78	41.22	21.6	27.33	29.61
Jak	6th	Phalanx 2 ant	32.95	26.54	28.08	37.38	25.8	32.11	33.24
Jak	beg. 7th	Phalanx 2 ant	35.01	28.01	28.77		26.18	32.1	35.05
Jak	4-6th	Phalanx 2 ant	29.05	21.72	21.83		24.8		31.52
Jak	4-6th	Phalanx 2 ant	32.01	24.84	26.06	39.72	23.73	29.18	33.02
Jak	6th	Phalanx 2 post	31.07	24.87	26.76	42.96	22.76	30.32	31.29
Jak	6th	Phalanx 2 post	33.24	25.34		39.21	22.53	27.61	32.84
Jak	beg. 7th	Phalanx 2 post	32.22	26.36	26.51	37.31	27.35	30.87	31.98
Jak	5th-late 6th	Phalanx 2 post	31.79	25.23	27.15	40.92	23.26	29.22	32.91
Jak	6th	Phalanx 2 post		25.38		38.13	26.88	32.14	32.15
Jak	4-6th	Phalanx 2 post	29.62	22.95	24.89	42.35	22.25	28.42	29.35
Jak	4-6th	Phalanx 2 post			25.47			27.62	31.75
Jak	4-6th	Phalanx 2 post	27.72	20.73	22.96	39.47	25.49	31.5	34.05
Jak	4-6th	Phalanx 2 post	34.25	26.49	26.87	49.01	25.43	31.5	33.76
Adl	Mid 4th	Phalanx 2 ant	16.32	13.86	13.81	22.08		14.25	15.48
Adl	mid 5 - late 6th	Phalanx 2 ant	34.76	29.34	33.5	49.58	28.87	35.29	35.39
Adl	mid 5 - late 6th	Phalanx 2 ant	33.84	26.51	27.95	29.17	23.88	28.98	34.2
Adl	Mid 4th	Phalanx 2 post	31.15	24.07	26.05	41.74	23.25	28.56	31.95
Adl	mid 5 - late 6th	Phalanx 2 post	36.41	29.15		46.21	31.75	43.24	41.59
Adl	mid 5 - late 6th	Phalanx 2 post	29.81	23.8	30.08	40.44	23.04	27.54	30.94
Adl	mid 5 - late 6th	Phalanx 2 post	31.07	23.75	25.72	43.19	23.71	29.78	32.89
	All	count	31	31	27	27	30	30	32
		min	16.32	13.86	13.81	22.08	21.60	14.25	15.48
		mean	32.03	25.33	26.14	41.68	24.68	30.46	33.01
		max	37.02	29.58	33.50	49.58	31.75	43.24	41.59
		sd	3.64	3.03	3.47	5.51	2.20	4.33	3.96
		CoV	11.37%	11.97%	13.26%	13.23%	8.90%	14.23%	12.00%

Table 6.2.3-1 Contd

Area	Date	Element	DLS	Ld	MBS
Jak	N/A	Phalanx 3 ant	78.78	62.83	25.69
Jak	N/A	Phalanx 3 ant	88.44	70.88	34.83
Jak	N/A	Phalanx 3 ant	87.99	64.91	29.85
Jak	N/A	Phalanx 3 ant	74.92	56.04	26.56
Jak	N/A	Phalanx 3 ant	69.9	55.37	21.71
Jak	N/A	Phalanx 3 ant	76.22	56.43	29.7
Jak	N/A	Phalanx 3 post	67.58	51.77	21.34
Jak	N/A	Phalanx 3 post			26.93
Adl	N/A	Phalanx 3 ant	68.53	56.05	24.23
Adl	N/A	Phalanx 3 ant			27.62
Adl	N/A	Phalanx 3 ant			23.48
Adl	N/A	Phalanx 3 ant			24.86
Adl	N/A	Phalanx 3 ant			24.41
Adl	N/A	Phalanx 3 post	71.64	57.63	26.73
Adl	N/A	Phalanx 3 post	76.27	57.62	22.01
Adl	N/A	Phalanx 3 post	65	50.58	19.48
Adl	N/A	Phalanx 3 post	71.51	52.17	21.6
		count	12	12	17
		min	65.00	50.58	19.48
		mean	74.73	57.69	25.35
		max	88.44	70.88	34.83
		sd	7.46	5.89	3.83
		CoV	9.98%	10.20%	15.12%

Area	Date	Element	Bd	BT	HT	HTC
Stadthof	Early 12th C	Humerus	67.60	61.82		
Stadthof	12th C	Humerus	66.42			
Stadthof	Early 11th C	Humerus		61.12		
GMZ		Humerus			27.76	17.90

Area	Date	Element	Bd	BFd
GMZ	Late 6th C	Ulna und Radius	78.67	59.76

Area	Date	Element	Bd
GMZ	Early 9th C	Tibia	58.27
GMZ	10th C	Tibia	48.52
Stadthof	Late 7th C	Tibia	61.82
Stadthof	Early 11thC	Tibia	58.11

Area	Date	Element	GLl	GLm	Bd	Dl	Dm
GMZ	Early 8thC	Astragalus	64.29	59.56	45.44	39.52	37.85
GMZ	Late 10th C	Astragalus	66.48	61.28	47.47	43.32	45.29
Stadthof	Late 12th C	Astragalus	61.83	56.19	38.81	35.37	30.63
Stadthof	Late 12th C	Astragalus		65.05			39.99
Stadthof	12th C	Astragalus	62.00				
Stadthof	12th C	Astragalus	53.58	48.72	32.00	30.22	
Stadthof	12th C	Astragalus	58.99	54.82	37.55	31.63	29.46
AB	Late 7- late 8th C	Astragalus	59.05	52.74	37.14	33.35	33.54

Area	Date	Element	Bp	SD	Bd	GL	DD
GMZ	Early 7th C	Metatarsus III+IV	42.95				
GMZ	Early 9th C	Metatarsus III+IV	47.83				
GMZ	10thC	Metatarsus III+IV	45.01				
GMZ	Late 10th C	Metatarsus III+IV	44.52				
GMZ	9/10th C	Metatarsus III+IV			48.46		27.49
Stadthof	Late 12th C	Metatarsus III+IV	32.56				
Stadthof	Late 7th C	Metatarsus III+IV	42.90				
Stadthof	Late 7th C	Metatarsus III+IV	46.14	23.94	49.70	223.00	30.54
Stadthof	Early 11 th C	Metatarsus III+IV	50.55				
AB	Early 8thC	Metatarsus III+IV	48.97				
AB	Late 7th- late 8thC	Metatarsus III+IV	44.82				
		count	10	1	2	1	2
		min	32.56	23.94	48.46	223.00	27.49
		mean	44.63	23.94	49.08	223.00	29.02
		max	50.55	23.94	49.70	223.00	30.54
		sd	4.92		0.88		2.16
		coef of V	11.03%		1.79%		7.43%

Area	Date	Element	Bp	SD	Bd	Glpe
GMZ	Late 6th C	Phalanx 1 ant	30.09	25.13	28.72	56.83
GMZ	Late 6th C	Phalanx 1 ant			17.84	
GMZ	8th C	Phalanx 1 ant	36.66	30.11	34.12	63.52
GMZ	Early 11th C	Phalanx 1 ant	27.36	21.23	24.8	58.53
GMZ	Late 11th C	Phalanx 1 ant	31.49	26.1	29.21	57.58
Stadthof	mid 12th C	Phalanx 1 ant	29.34	22.87	27	59.8
Stadthof	mid 11th C	Phalanx 1 ant	27.19	22.95	27	60.64
GMZ	early 7th C	Phalanx 1 post	35.8			
GMZ	Late 6th C	Phalanx 1 post	27.59		25.54	62.37
GMZ	8th C	Phalanx 1 post	30.17	24.71	27.79	61.55
GMZ	9th C	Phalanx 1 post	23.99	20.49	24.61	55.33
GMZ	9th C	Phalanx 1 post	30.82			
GMZ	8th C	Phalanx 1 post	26.67	21.23	25.75	50.04
Stadthof	late 7thC	Phalanx 1 post	22.21			
Stadthof	late 12th C.	Phalanx 1 post	25.84	21.8	24.17	48.87
AB	Late7th-late8thC	Phalanx 1 post	30.92	22.83	31.97	63.25
AB	Late 6th-late 7thC	Phalanx 1 post	27.45	23.66	26.69	57.7
GMZ	ca. 7/8th C	Phalanx 1 post		20.01	24.04	55.56
Stadthof	n.d	Phalanx 1 ant/post	27.09	23.85	27.43	55.92
		count	17	14	16	15
		min	22.21	20.01	17.84	48.87
		mean	28.86	23.36	26.67	57.83
		max	36.66	30.11	34.12	63.52
		sd	3.72	2.63	3.63	4.36
		coef of V	12.88%	11.27%	13.60%	7.53%

Table 6.2.3-2; Raw metrical data of Cattle from Reinach, only elements that samples of greater than 10 are illustrated alongside those that are used in other analysis, GMZ - Gemeindezentrum, AB- Altebrauerei, n.d.-no date, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance, All measurement codes as von den Driesch (1976)

Area	Date	Element	Bp	Bd	Dp	BT	HT	HTC
grube 11	first1/2 11thC	Humerus		81.25		68.55		
grube 11	first1/2 11thC	Humerus	80.95		93.76			
grube 11	first1/2 11thC	Humerus				49.14		
grube 38	mid 12th C	Humerus				39.05		
grube 28	c. 9th C	Humerus					41.46	
grube 28	c. 9th C	Humerus					40.04	
grube 28	c. 9th C	Humerus				72.49	42.17	30.43

Area	Date	Element	Bp	BFp
grube 38	mid 12th C	Radius	72.41	65.95
grube 50	Late 6th-late 7th	Radius	80.05	70.86
grube 1	Late 6th-late 7th	Ulna und Radius	74.5	68.02
grube 8	c. 8/9th C	Ulna und Radius	69.46	63.43
grube 56	Late 6th-late 7th	Ulna und Radius	85.19	77.88

Area	Date	Element	Bd	Dd
grube 56	Late 6th-late 7th	Tibia	68.76	
grube 38	mid 12th C	Tibia	51.96	
grube 20	c. 11th	Tibia	48.57	38.2
grube 50	Late 6th-late 7th	Tibia	54.47	36.69
grube 54	c. 10th	Tibia	63.49	43.7
grube 54	c. 10th	Tibia	56.74	
grube 28	c. 9th C	Tibia	53.24	38.6
grube 28	c. 9th C	Tibia	61.07	44.54
grube 28	c. 9th C	Tibia		38.55

Area	Date	Element	GLl	GLm	Bd	Dl	Dm
grube 10	c. 11th	Astragalus	57.27	51.96	37.07	30.37	29.06
grube 1	Late 6th-late 7th	Astragalus	68.5	42.46	44.65	38.26	38.5
grube 9	c. 9th	Astragalus	57.23	51.16	35.68	31.23	30.56
grube 45	c. 11th	Astragalus	63.6	55.88	42.14	34.5	33.86
grube 38	mid 12th C	Astragalus	63.66	59.47	38.26	35.65	35.12
grube 50	Late 6th-late 7th	Astragalus	60.19	55.48		32.67	31.71
grube 45	c. 11th	Astragalus		65.31			
grube 28	c. 9th C	Astragalus	59.37	52.86	36.5	33.57	32.43
grube 28	c. 9th C	Astragalus	62.45	57.58	0	36.22	35.81
grube 28	c. 9th C	Astragalus	61.32	55.53	37.1	34.32	32.99
		count	9	10	8	9	9
		min	57.23	42.46	0.00	30.37	29.06
		mean	61.51	54.77	33.93	34.09	33.34
		max	68.50	65.31	44.65	38.26	38.50
		sd	3.56	5.96	14.05	2.47	2.87
		CoV	5.79%	10.88%	41.42%	7.25%	8.60%

Area	Date	Element	Bp	SD	Bd	DD	GL
grube 10	c. 11th	Metacarpus III+IV	57.48	32.23	61.27	20.78	190
grube 9	c. 9th	Metacarpus III+IV	47.32				
grube 56	Late 6th-late 7th	Metacarpus III+IV	56.97	32.69	58.28	21.86	185
grube 56	Late 6th-late 7th	Metacarpus III+IV	59.43			21.47	
grube 38	mid 12th C	Metacarpus III+IV	54.88				
grube 38	mid 12th C	Metacarpus III+IV	58.44				
grube 57	c. 11th	Metacarpus III+IV				17.86	
grube 36	c. 11th	Metacarpus III+IV	48.86				
n.d	n.d.	Metacarpus III+IV					

Table 6.2.3-3; Raw metrical data of Cattle from Lausen, only elements that samples of greater than 10 are illustrated alongside those that are used in other analysis, n.d.-no date, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance,
All measurement codes as von den Driesch (1976)

Area	Date	Element	Bp	Bd
grube 9	c. 9th	Metatarsus III+IV	43.46	
grube 4	Late 11-12th C	Metatarsus III+IV		52.92
grube 8	c. 8/9th C	Metatarsus III+IV	46.61	
grube 50	Late 6th-late 7th	Metatarsus III+IV	47.45	
grube 28	c. 9th	Metatarsus III+IV	42.96	

Area	Date	Element	Bp	SD	Bd	Glpe
grube 9	c. 9th	Phalanx 1 ant	28.12	23.34		55.18
grube 10	c. 11th	Phalanx 1 ant	28.45	23.03	25.63	52.36
grube 20	c. 11th	Phalanx 1 ant	30.00	23.88	31.44	59.08
grube 36	c. 11th	Phalanx 1 ant	27.00	22.87	24.84	54.45
?	n.d.	Phalanx 1 ant	31.02	27.98	31.05	55.49
grube 28	c. 9th	phalanx 1 ant	29.41	26.03	29.92	56.40
grube 28	c. 9th	phalanx 1 ant			27.80	
grube 28	c. 9th	phalanx 1 ant			30.15	
grube 56	Late 6th-late 7th	Phalanx 1 post	24.92	21.40	23.07	56.39
grube 56	Late 6th-late 7th	Phalanx 1 post	28.63			
grube 36	c. 11th	Phalanx 1 post	26.89	21.17	24.04	59.11
grube 54	c. 10th	Phalanx 1 post	23.71			
grube19/52	c. 11th	Phalanx 1 post	29.32			
grube 50	Late 6th-late 7th	Phalanx 1 post	26.98			
grube 54	c. 10th	Phalanx 1 post			22.13	
grube 28	c. 9th	phalanx 1 post	27.01	20.61	26.56	56.69
grube 28	c. 9th	phalanx 1 ant/post		22.31	25.11	49.45
		count	13	10	12	10
		min	23.71	20.61	22.13	49.45
		mean	27.80	23.26	26.81	55.46
		max	31.02	27.98	31.44	59.11
		sd	2.02	2.27	3.21	2.92
		coef of V	7.28%	9.75%	11.95%	5.26%

Area	Date	Element	Bp	SD	Bd	Glpe	s.Depth	Dd	Dp
grube 45	c. 11th	Phalanx 2 ant	25.65	18.90	20.97	32.78	20.90	25.83	26.36
grube 65	Late 7th-late 8th	Phalanx 2 ant	30.93						30.29
grube 9	c. 9th	Phalanx 2 ant	28.31	22.21	22.26	35.61	20.86		27.15
grube 9	c. 9th	Phalanx 2 ant	28.17	21.74	21.85	35.05	20.73	25.47	27.65
grube 36	c. 11th	Phalanx 2 ant	24.85	19.06	20.93	36.92	22.98	20.20	25.01
grube 28	c. 9th	Phalanx 2 ant	26.61	21.03	22.39	32.97	22.17	27.25	26.33
grube 28	c. 9th	Phalanx 2 ant	25.87	20.57	22.66	36.86	20.10	26.62	
grube 28	c. 9th	Phalanx 2 ant						26.43	
grube 54	c. 10th	Phalanx 2 post	29.29	23.51	23.01	42.34	22.40	26.65	31.59
grube 54	c. 10th	Phalanx 2 post	28.17	22.38		33.41	21.85		
grube 28	c. 9th	Phalanx 2 post	25.86	20.14	22.37	35.37			
grube 28	c. 9th	Phalanx 2 post	25.20	19.03	22.41	35.20	20.82	26.43	26.09
grube 9	c. 9th	Phalanx 2 ant/post	29.73						
grube 10	c. 11th	Phalanx 2 ant/post	28.34						
grube 28	c. 9th	Phalanx 2 ant/post	29.56	21.60	23.81	39.14	20.46		32.64
		count	14	11	10	11	10	8	9
		min	24.85	18.90	20.93	32.78	20.10	20.20	25.01
		mean	27.61	20.92	22.27	35.97	21.33	25.61	28.12
		max	30.93	23.51	23.81	42.34	22.98	27.25	32.64
		sd	1.92	1.53	0.87	2.83	0.95	2.25	2.70
		coef of V	6.97%	7.33%	3.90%	7.86%	4.46%	8.79%	9.61%

Table 6.2.3-3 contd

Area	Date	Element	DLS	Ld	MBS
?	n.d.	Phalanx 3 ant	55.98	43.76	16.68
grube 36	c. 11th	Phalanx 3 ant	73.33	56.11	25.60
grube 54	c. 10th	Phalanx 3 ant	72.21		25.79
grube 28	c. 9th	Phalanx 3 ant	73.02	52.93	23.28
grube 28	c. 9th	Phalanx 3 ant	60.89	47.37	20.51
grube 38	mid 12th C	Phalanx 3 post	65.75	46.25	20.05
grube 10	c. 11th	Phalanx 3 post	73.62	52.01	21.53
grube 38	mid 12th C	Phalanx 3 post	70.53	49.82	22.31
grube 54	c. 10th	Phalanx 3 post	61.76	49.14	21.50
grube 28	c. 9th	Phalanx 3 post	66.26	48.24	20.33
grube 28	c. 9th	Phalanx 3 post	73.97	57.84	21.96
grube 28	c. 9th	Phalanx 3 post	67.60	50.36	17.64
grube 28	c. 9th	Phalanx 3 post	64.60	52.83	19.84
grube 9	c. 9th	Phalanx 3 ant/post			21.54
		count	13	12	14
		min	55.98	43.76	16.68
		mean	67.66	50.56	21.33
		max	73.97	57.84	25.79
		sd	5.75	4.04	2.54
		coef of V	8.50%	7.99%	11.93%

Table 6.2.3-3 contd

Site	Area	Element	Gl mm	factor	height mm	height m
KA	Adler	Radius	268	4.3	1152.40	1.15
KA	Adler	Metacarpus III+IV	205	6.125	1255.63	1.26
KA	Adler	Metacarpus III+IV	225	5.45	1226.25	1.23
KA	Adler	Metatarsus III+IV	216	5.45	1177.20	1.18
KA	Jak	Metacarpus III+IV	181.11	6.125	1109.30	1.11
KA	Jak	Metacarpus III+IV	202.00	6.125	1237.25	1.24
KA	Jak	Metacarpus III+IV	195.00	6.125	1194.38	1.19
KA	Jak	Metacarpus III+IV	187.00	6.125	1145.38	1.15
Lausen	grube 10	Metacarpus III+IV	190	6.125	1163.75	1.16
Lausen	grube 56	Metacarpus III+IV	185	6.125	1133.13	1.13
Lausen	grube 50	Femur (GLC)	353	3.47	1224.91	1.22
Reinach	Stadthof	Metatarsus III+IV	223	5.45	1215.35	1.22

Kaiseraugst Gasthof Adler

Min.	Mean	Max.	S:D.	Range
1.15	1.20	1.26	0.05	0.10

Kaiseraugst Jakobli-Haus

Min.	Mean	Max.	S:D.	Range
1.11	1.17	1.24	0.06	0.13

Lausen

min	mean	max	S.D.	Range
1.133	1.174	1.225	0.05	0.092

Table 6.2.3-4; Withers Height of cattle at all sites (after Maltosci, 1970); Jak- KA Jakobli-Haus
Adler- Gasthof Adler, KA - Kaiseraugst; Measurements taken as von den Driesch (1976)

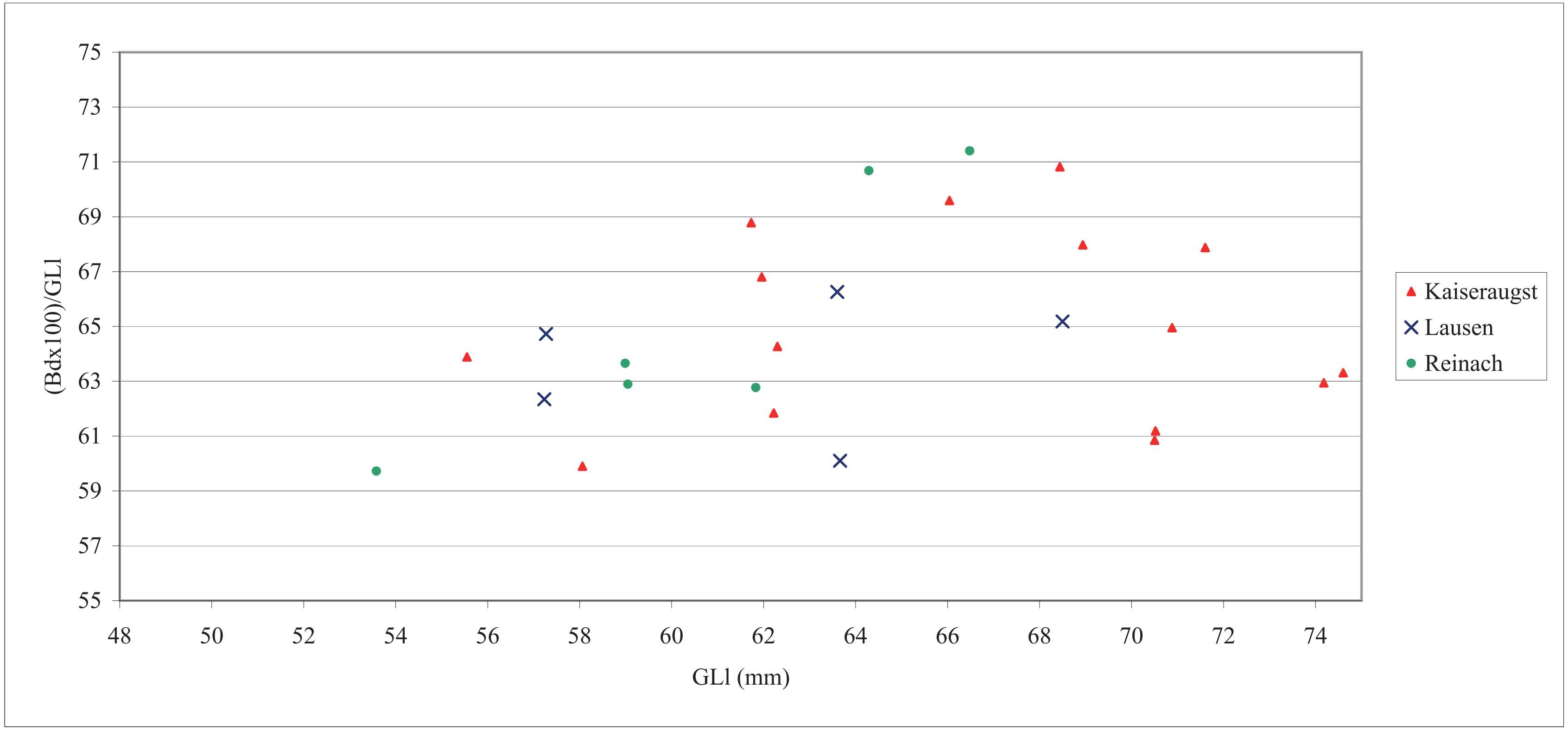


Figure 6.2.3-5; Cattle astragalus measuremets as a size indicator, measurements from all sites, measurement codes as von den Driesch (1976)

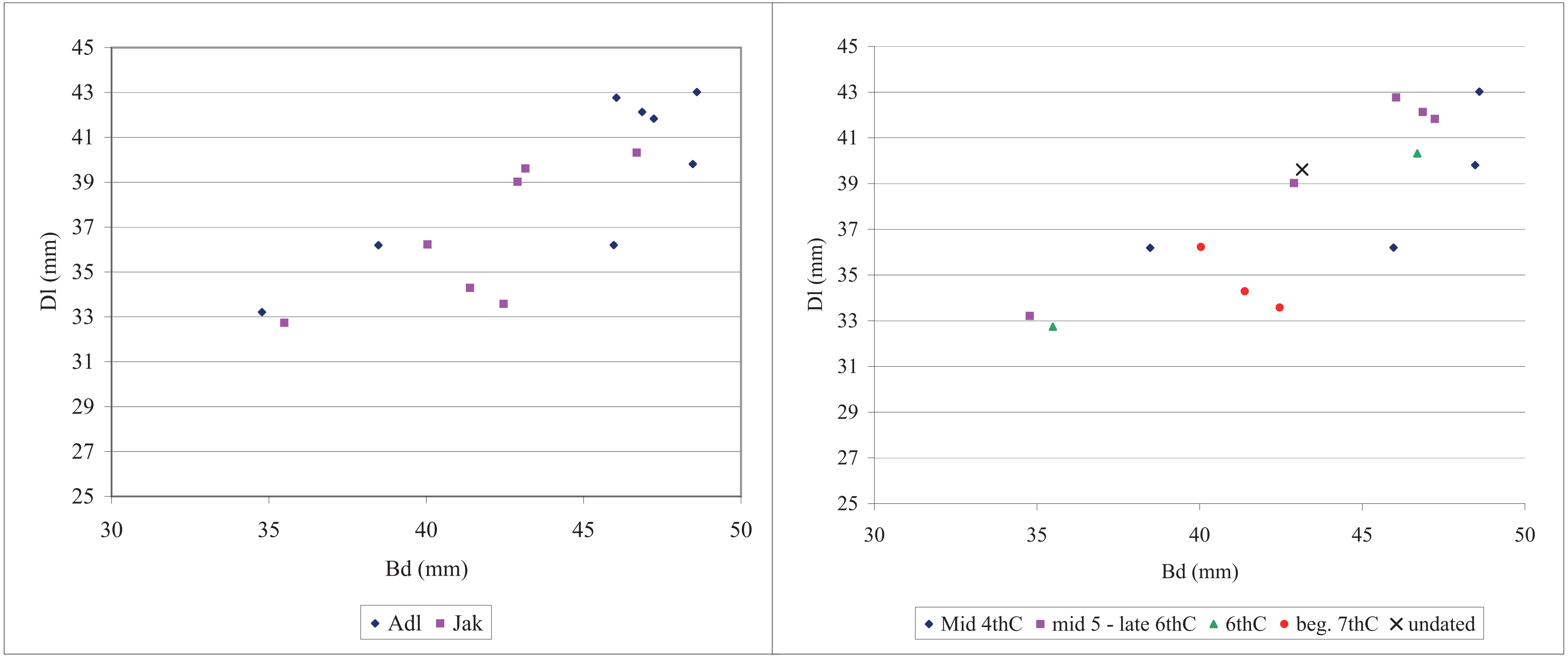
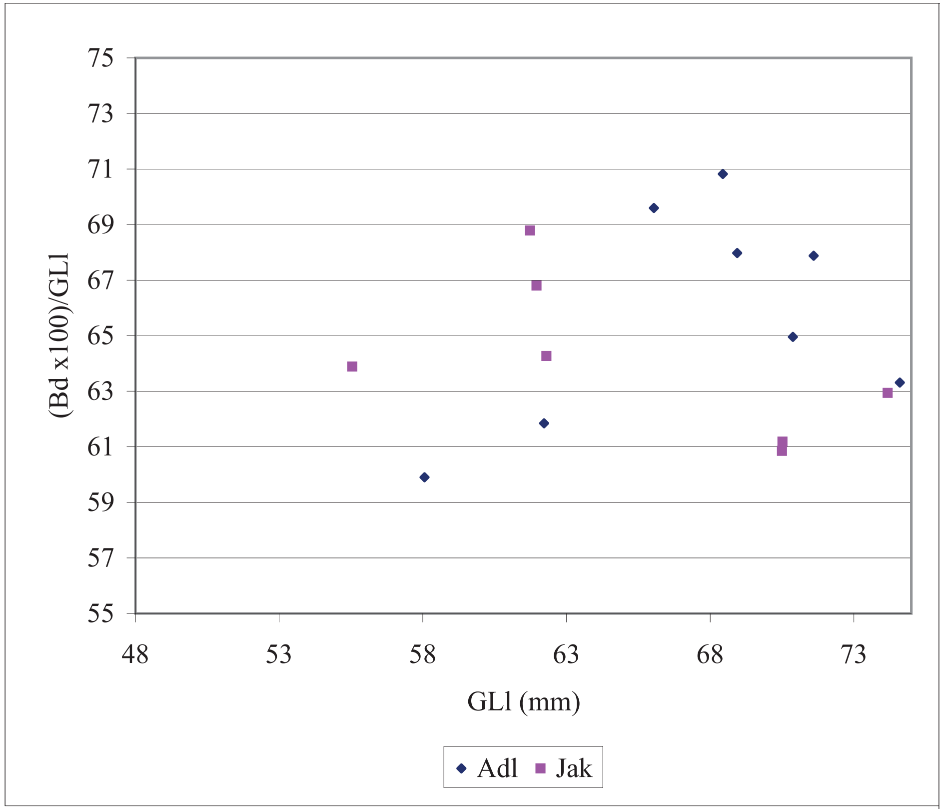


Fig. 6.2.3-6a; Cattle astragalus measurements from Kaiseraugst, by area (left graph) and by period (right graph); Jak- KA Jakobli-Haus, Adl- KA Gasthof Adler measurement codes as von den Driesch (1976)



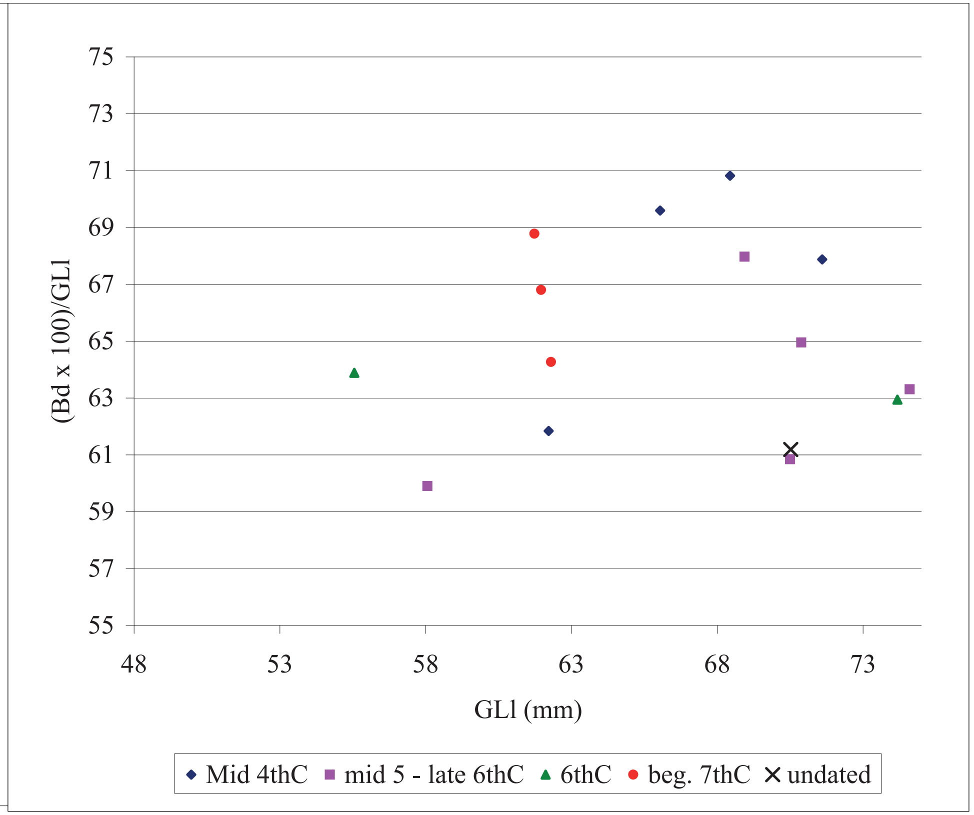


Fig. 6.2.3-6b; Cattle astragalus measurements from Kaiseraugst, by area (left graph) and by period (right graph); Jak- KA Jakobli-Haus, Adl- KA Gasthof Adler measurement codes as von den Driesch (1976)

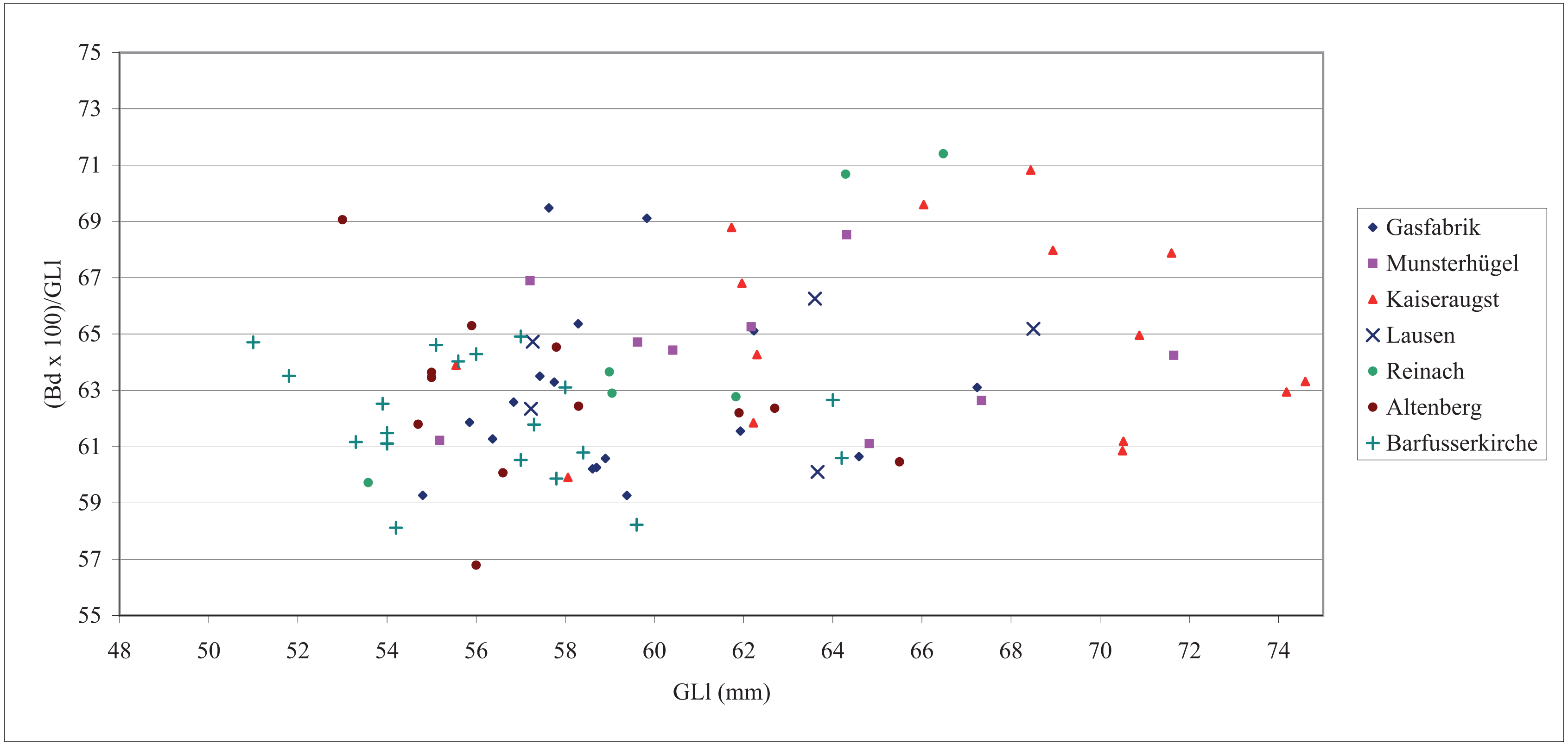
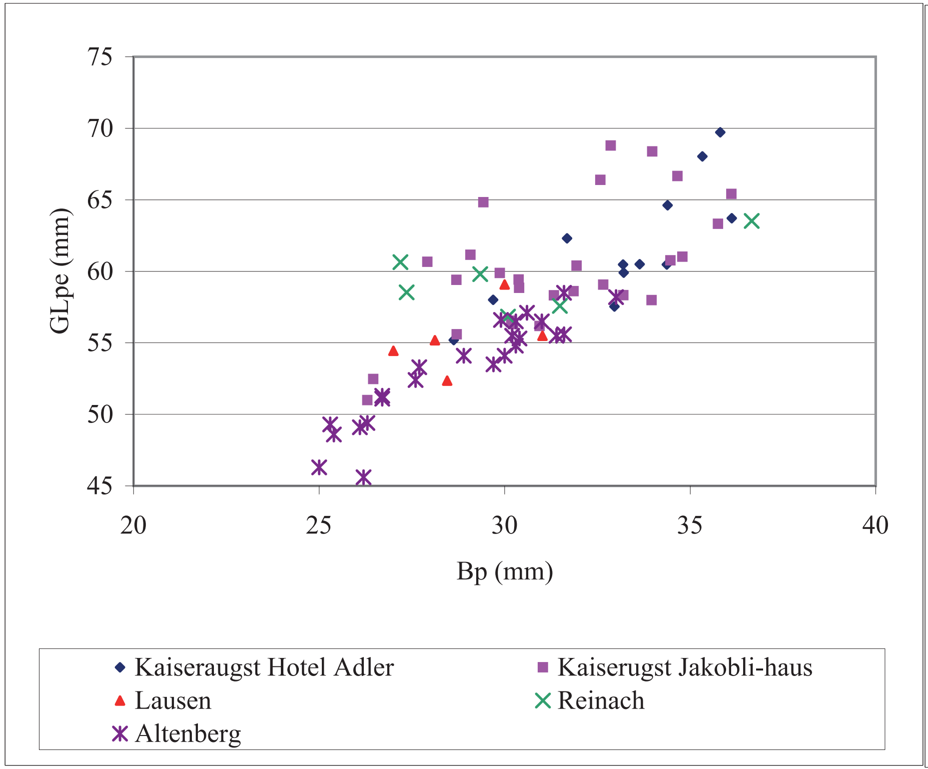


Figure 6.2.3-7; Cattle astragalus measurements as a size indicator, measurements from the sites studied here compared to contemprary sites codes as von den Driesch (1976), Basel Gasfabrik and Munsterhügel (both Stopp 2007); Altenberg (Marti-Grädel, 2008); Barfüsserkirche (Schibler and Stopp 1987)



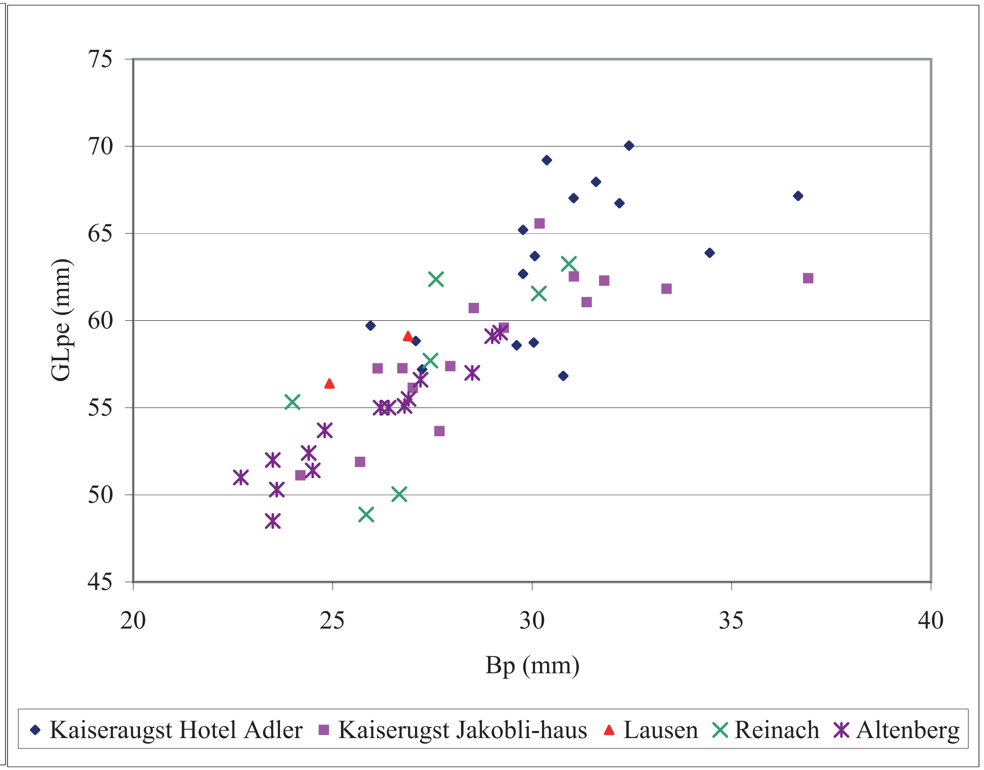
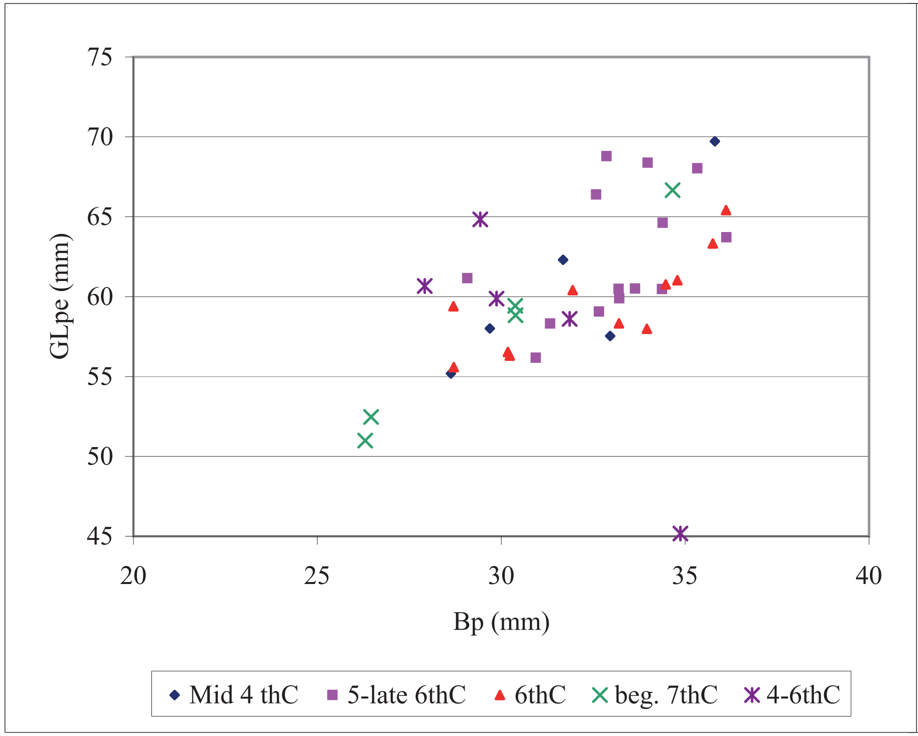


Figure 6.2.3-8; Cattle 1st Phalanx measurements as an indicator of size split by site, Anterior phalanx 1 (left graph), Posterior Phalanx 1 (right graph), Altenberg (Marti-Grädel 2008)



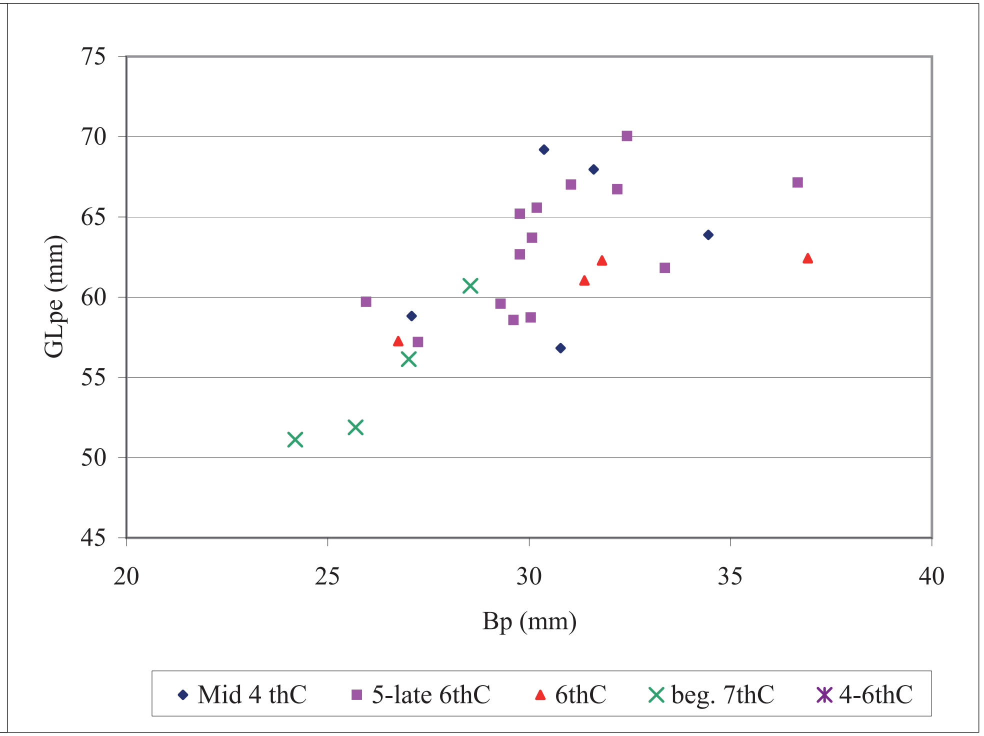


Fig. 6.2.3-9; Cattle 1st Phalanx measurements as an indicator of size from Kaiseraugst split by period, Anterior phalanx 1 (left graph), Posterior Phalanx 1 (right graph),

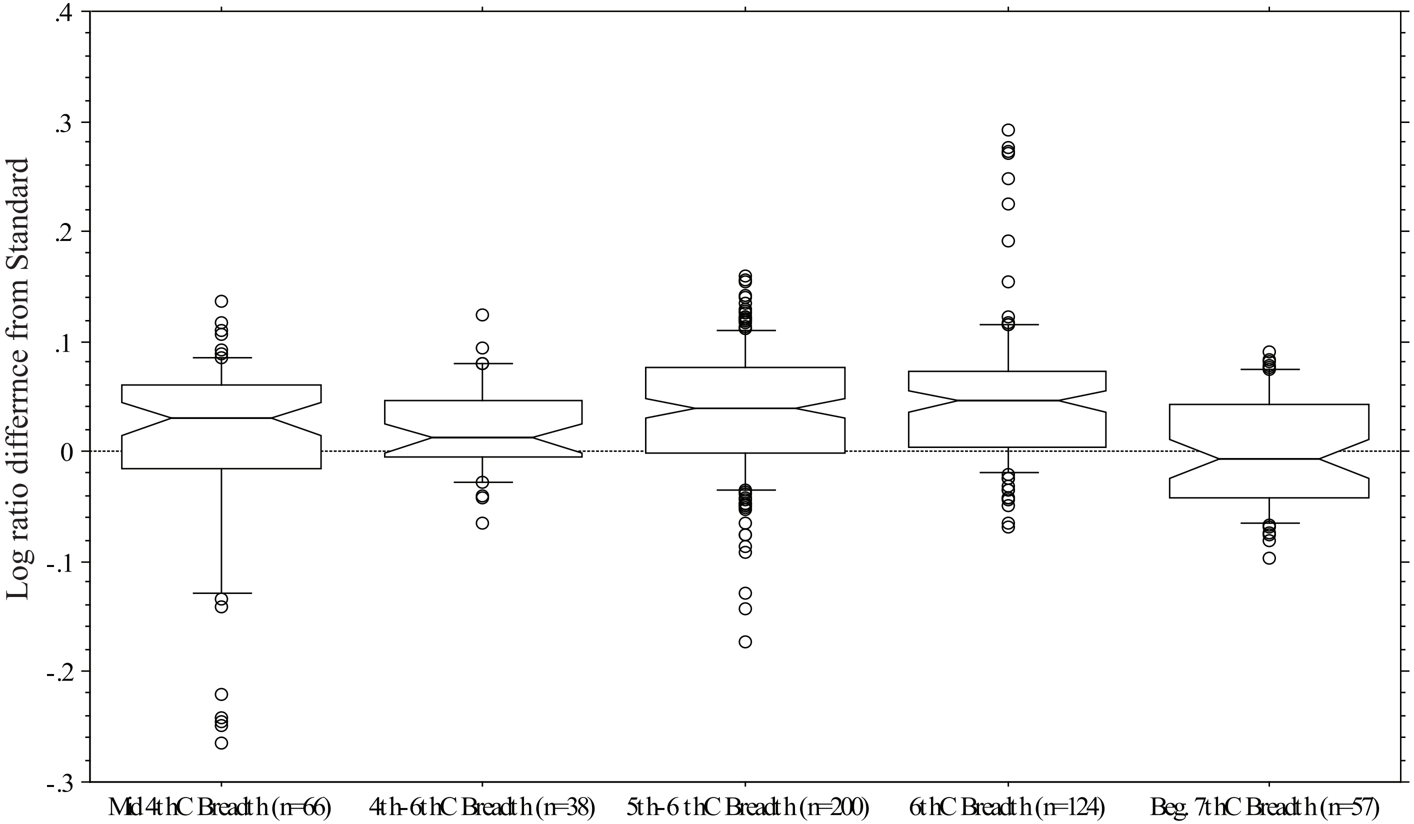


Fig. 6.2.3-10; Cattle log ratio breadth measurements from Kaiseraugst split by time period; Boxes represent the interquartile range, the dividing band shows the median, whilst the whiskers represent the 11th to 24th and 76th to 89th quartiles, the points are the outer most 10% at either end of the data.

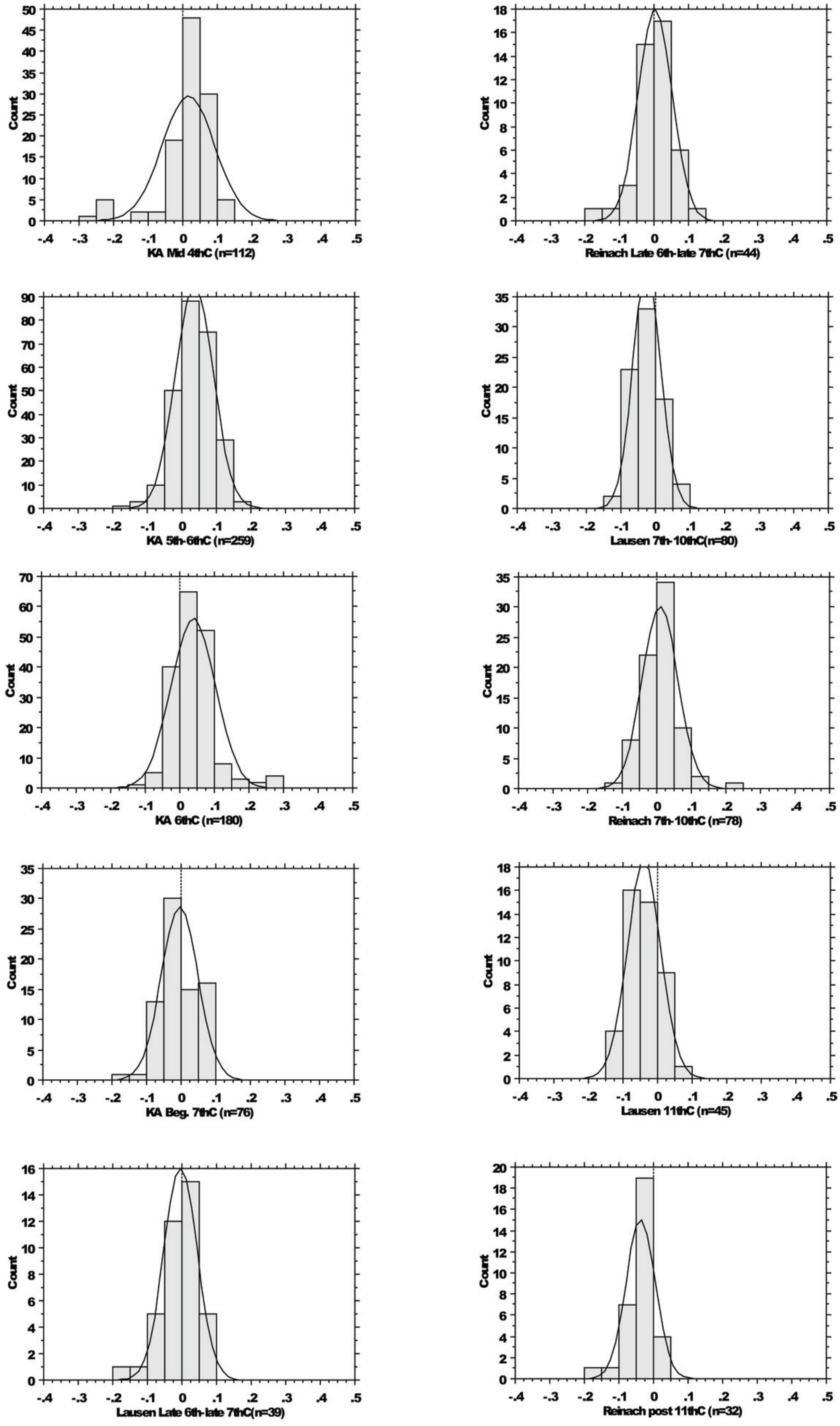


Fig. 6.2.3-11; Histograms of the distribbution of the log ratio data from various sites and time periods, the normal curve has been added to observe the presence of skew in the data

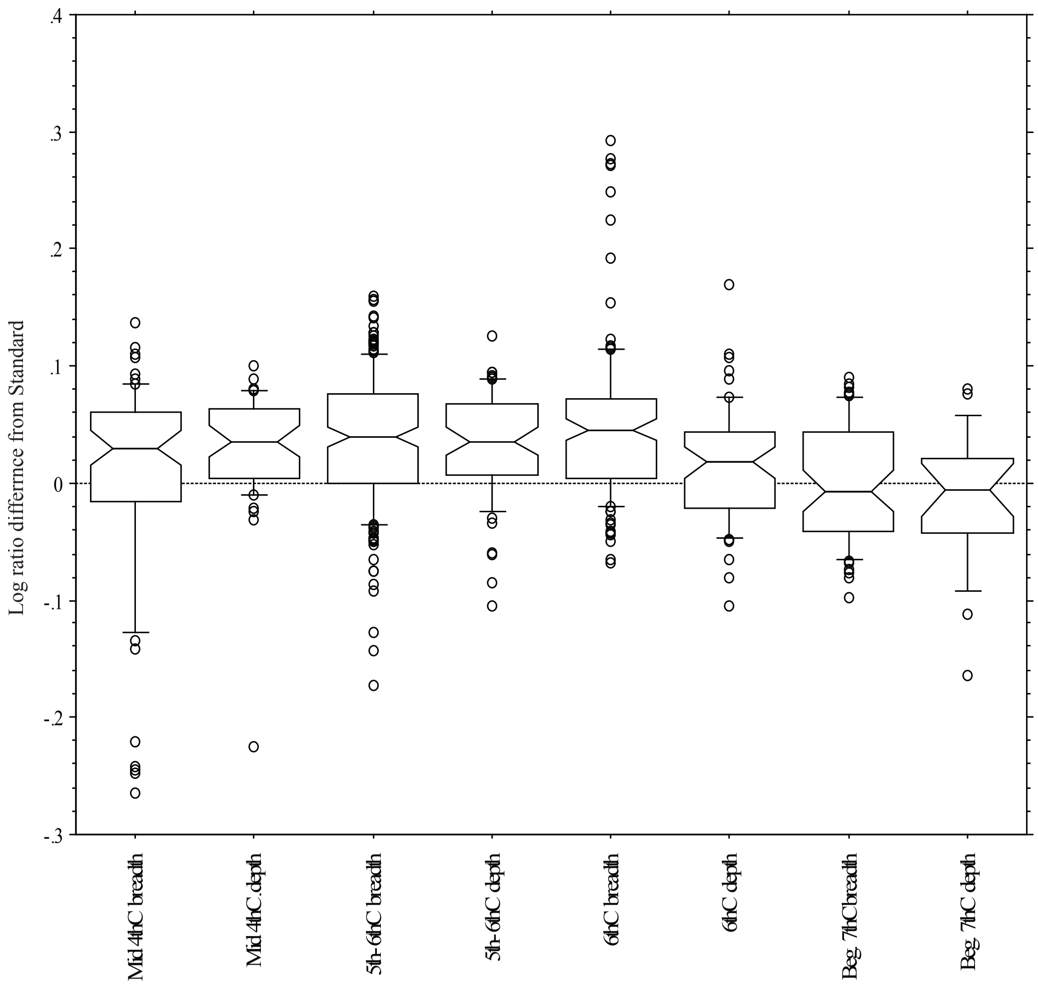


fig. 6.2.3-12; Comparison of depth and breadth log ratio measurements in cattle from Kasieraugst split by period

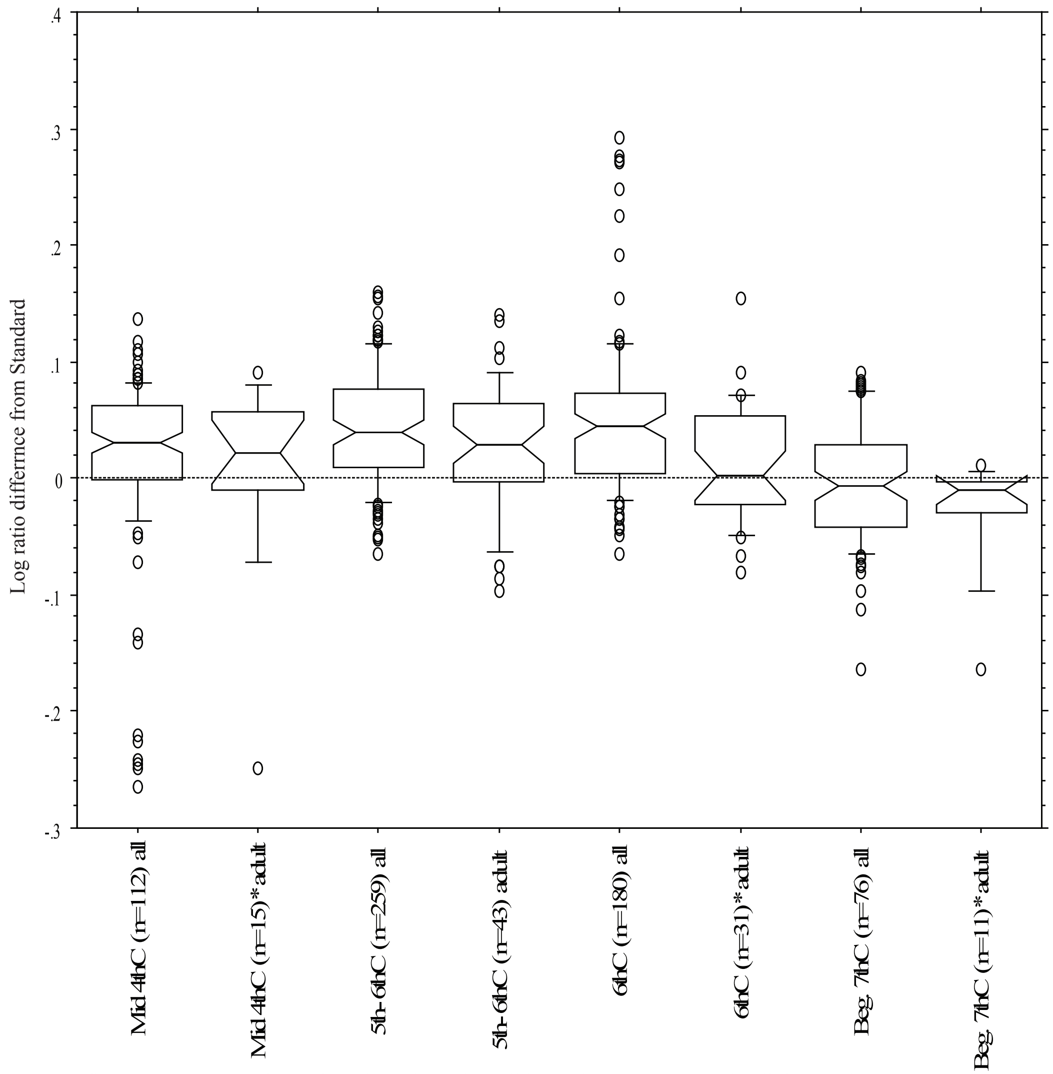


fig. 6.2.3-13 Comparison of Adult cattle against all log ratio measurements in all time periods at Kaiseraugst,

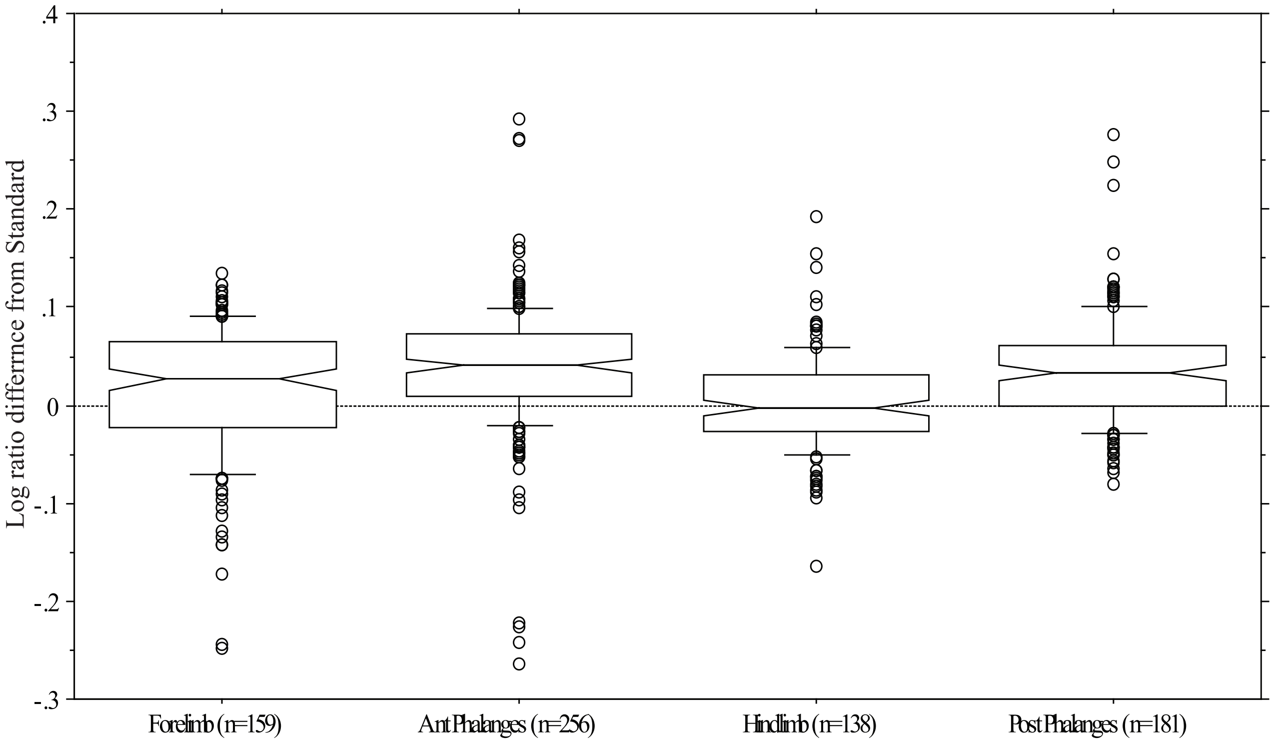


Fig 6.2.3-14; Comparison of thedifferent limb areas from the assemblages at Kaiseraugst, ant - Anterior, post-Posterior.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1																									
2	<0.001***																								
3		0.242																							
4		<0.001***	<0.001***																						
5				<0.001***																					
6					0.148																				
7					<0.001***	0.024**																			
8					<0.001***	<0.001***	0.636																		
9							<0.001***	<0.001***																	
10							<0.001***	0.487	<0.001***																
11								<0.001***	<0.001***	<0.001***															
12								<0.001***			0.790														
13								<0.001***			0.313	0.485													
14											<0.001***	<0.001***	<0.001***												
15												<0.001***	<0.001***	0.565											
16														0.326	0.670										
17														0.046**	0.244	0.618									
18															0.010**	0.009**	<0.001***								
19															0.100	0.283	0.682	<0.001***							
20																	<0.001***	0.180	<0.001***						
21																		0.105	<0.001***	0.931					
22																		<0.001***	<0.001***	<0.001***	<0.001***				
23																		0.312	<0.001***	0.762	0.841	<0.001***			
24																		0.582	<0.001***	0.223	0.168	<0.001***	0.375		
25																				0.005**	0.002**	0.736	<0.001***	<0.001***	
26																				0.013*	0.012*	0.123	0.003**	<0.001***	0.225

6.2.3-15; Mann-Witney significance testing of cattle log ratios between the different sites and time periods, site numbers relate to the order of sites in fig 6.2.3-14

*** Highly significant (99.9%)
** significant (99%)
* marginally significant (95%)
not significant

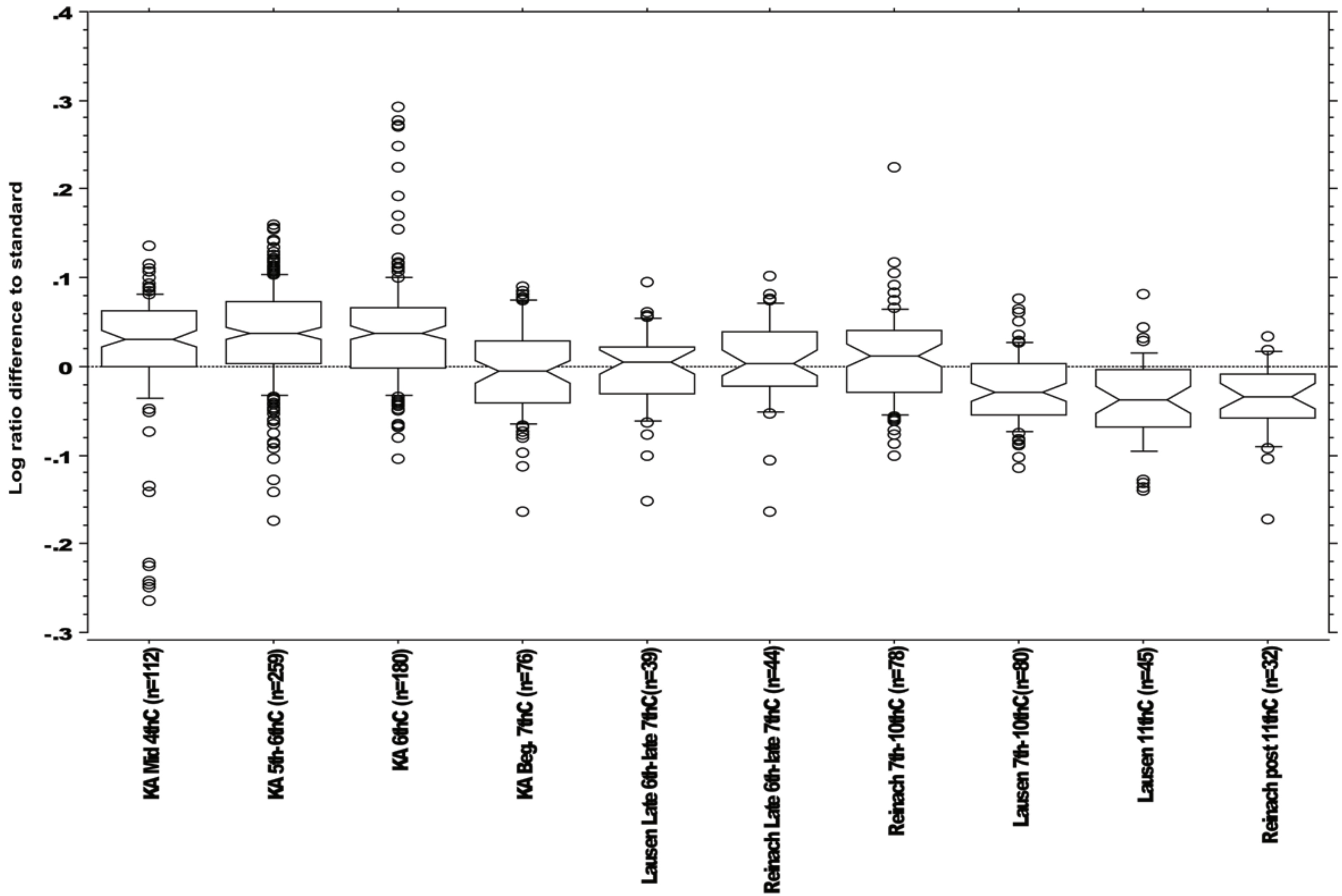


Fig. 6.2.3-16; Log ratio diagram of all cattle measurements from all three sites discussed here and split by period, KA-Kaiseraugst

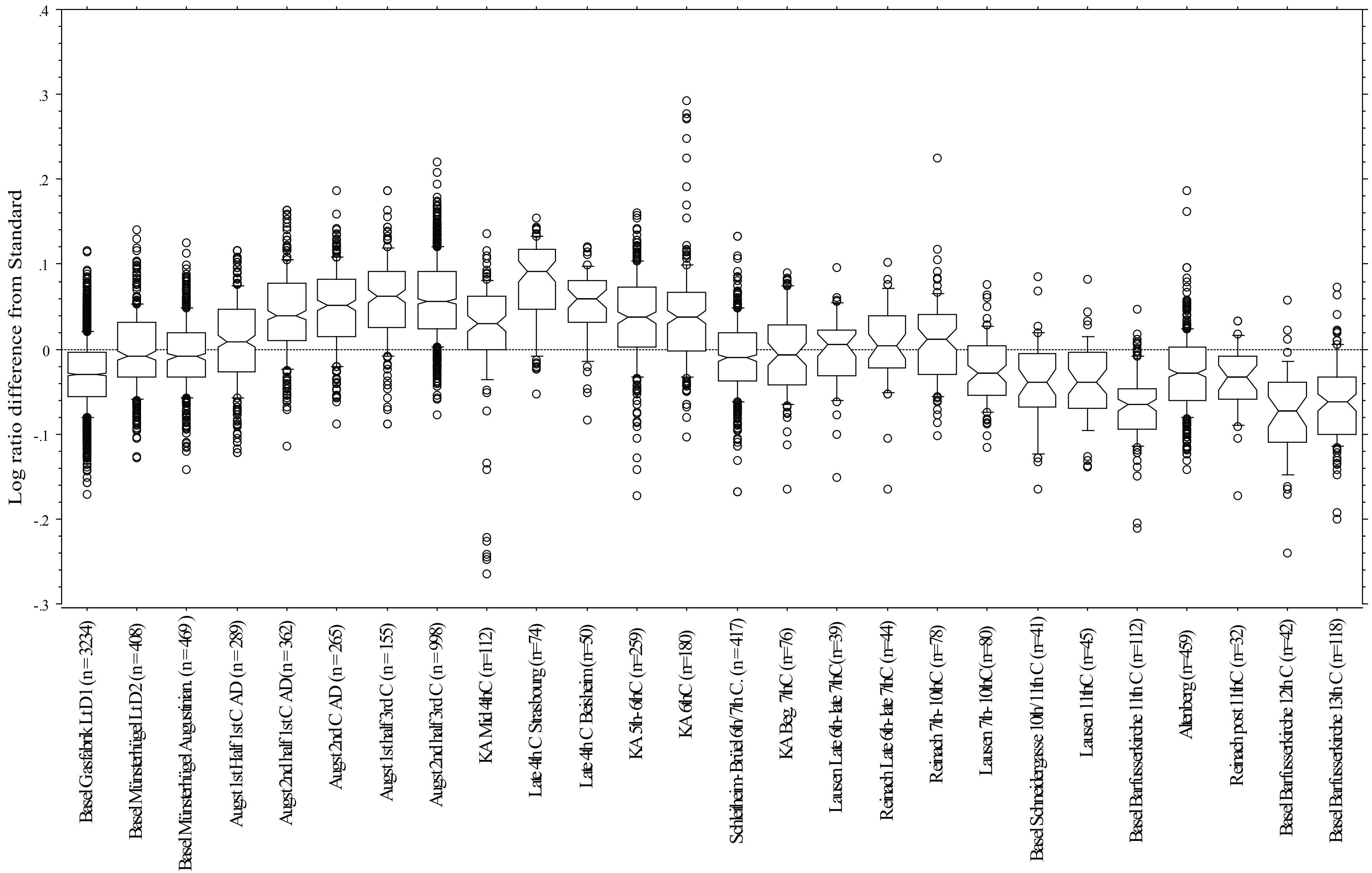


Fig. 6.2.3-17; Comparative log ratio box plots from the Late Iron Age to the Medieval for sites in and around North-West Switzerland. KA - Kaiseraugst, n- number

	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	Total n. frag	%Path
KA	2	12	2	20	16	52	1817	2.86%
Reinach	5	4	4	3	5	21	999	2.10%
Lausen	0	3	3	0	3	9	1535	0.59%

Table 6.2.4-1; Pathology in cattle as a proportion of the assemblage at all sites with repsect to body area. KA- Kaiseraugst, n. number

Site	Pathology type	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	
Kaiseraugst	Developmental				1		1	1.92%
	Infectious/inflammation		1	1	4		6	11.54%
	Trauma			1			1	1.92%
	Arthropathy	2	11		15	16	44	84.62%
	Dental						0	0.00%
	Total	2	12	2	20	16	52	
Reinach	Developmental		1			1	2	9.52%
	Infectious/inflammation	1	2	4	1	2	10	47.62%
	Trauma						0	0.00%
	Arthropathy	1	1		2	2	6	28.57%
	Dental	3					3	14.29%
	Total	5	4	4	3	5	21	
Lausen	Developmental			2			2	22.22%
	Infectious/inflammation		2			1	3	33.33%
	Trauma						0	0.00%
	Arthropathy		1	1		2	4	44.44%
	Dental						0	0.00%
	Total	0	3	3	0	3	9	
	Grand total	7	19	9	23	24	82	
	% grandtotal	8.54%	23.17%	10.98%	28.05%	29.27%		

Table 6.2.4-2; Pathology type recorded in cattle at all sites with repsect to body area.

Fig. 6.2.3-3; Pathology of cattle incisors from Reinach,
scale 1 major divison on rule = 10mm

	Mid 4thC*					4-6thC*					450-500*					5-6thC				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	0	0	0	0	0.00%	0	0	0	0	-	0	0	0	0	0.00%	0	0	0	0	0.00%
< subadult	0	2	0	2	13.33%	0	0	0	0	-	0	0	0	0	0.00%	1	1	0	2	6.67%
Subadult	0	3	0	3	20.00%	0	0	0	0	-	0	1	0	1	33.33%	1	7	0	8	26.67%
Adult/Senile	0	10	0	10	66.67%	0	0	0	0	-	0	2	0	2	66.67%	3	17	0	20	66.67%
Total	0	15	0	15		0	0	0	0		0	3	0	3		5	25	0	30	

	6thC					beg. 7thC*					12thC*				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	0	0	0	0	0.00%	0	0	0	0	0.00%	0	0	0	0	0.00%
< subadult	3	0	0	3	8.33%	1	0	0	1	12.50%	0	2	0	2	11.11%
Subadult	12	0	0	12	33.33%	2	0	0	2	25.00%	0	0	1	1	5.56%
Adult/Senile	21	0	0	21	58.33%	5	0	0	5	62.50%	0	4	11	15	83.33%
Total	36	0	0	36		8	0	0	8		0	6	12	18	

Table 6.3.1.1-1; Age distribution of ovicaprids using combined dental and epiphyseal data from the three areas at Kaiseraugst split by period, Jak - Jakobli-Haus, Adl - Gasthof Adler, Fstr - Fabrikstrasse

* - denotes statistically small samples

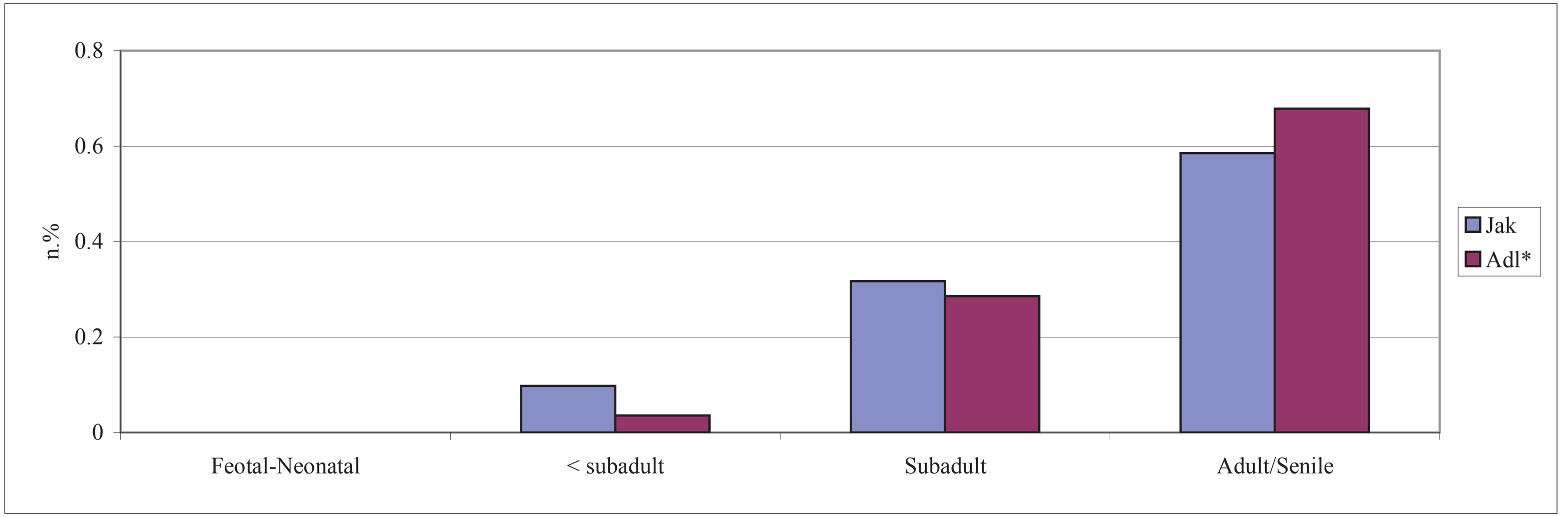


Fig. 6.3.1.1-2; Age distribution of ovicaprids using combined dental and epiphyseal data from the fifth to sixth and sixth Century periods at Kaiseraugst split by area
Jak - Jakobli-Haus, Adl - Gasthof Adler

	6-7thC*		8thC		9thC		10thC*		11thC*	
Feotal-Neonatal	2	13.33%	0	0.00%	0	0.00%	1	4.76%	2	7.14%
< subadult	1	6.67%	1	33.33%	12	19.67%	1	4.76%	2	7.14%
Subadult	9	60.00%	0	0.00%	24	39.34%	9	42.86%	17	60.71%
Adult/Senile	3	20.00%	2	66.67%	25	40.98%	10	47.62%	7	25.00%
Total	15		3		61		21		28	

Table 6.3.1.2-1; Age distribution of ovicaprids using combined dental and epiphyseal data from the Lausen site split by period
* - denotes statistically small samples

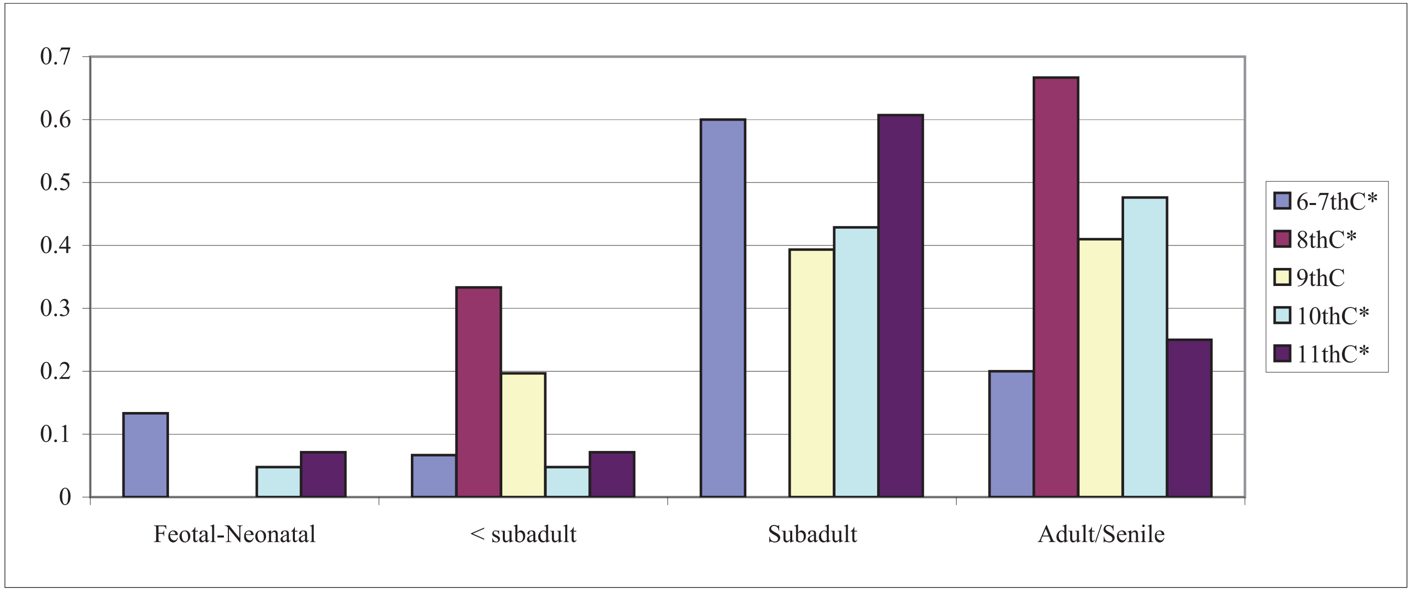


Fig. 6.3.1.2-2; Age distribution of ovicaprids using combined dental and epiphyseal data from Lausen split by date
* - denotes statistically small samples

	6thC*		7thC*		8thC*		9thC*		10thC*		11thC*		12thC*	
Feotal-Neonatal	1	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	7.69%
< subadult	0	0.00%	5	20.83%	3	17.65%	1	100.00%	0	0.00%	1	12.50%	9	69.23%
Subadult	0	0.00%	5	20.83%	7	41.18%	0	0.00%	1	100.00%	5	62.50%	1	7.69%
Adult/Senile	0	0.00%	14	58.33%	7	41.18%	0	0.00%	0	0.00%	2	25.00%	2	15.38%
Total	1		24		17		1		1		8		13	

Table 6.3.1.3-1; Age distribution of ovicaprids using combined dental and epiphyseal data from the Reinach site split by period
* - denotes statistically small samples

	7thC*	8thC*	**7-8thC**		11thC*	12thC*	**11-12thC***	
Feotal-Neonatal	0	0	**0**	**0.00%**	0	1	**1**	**4.76%**
< subadult	5	3	**8**	**19.51%**	1	9	**10**	**47.62%**
Subadult	5	7	**12**	**29.27%**	5	1	**6**	**28.57%**
Adult/Senile	14	7	**21**	**51.22%**	2	2	**4**	**19.05%**
Total	24	17	**41**		8	13	**21**	

Fig. 6.3.1.3-2; Age distribution of amalgamated time periods using combined dental and epiphyseal data from Reinach
* - denotes statistically small samples

Site	Area	Date	Element	Sex			
KA	Adler	Mid 4thC	horncore	female			
	Adler	mid 5 - late 6thC	horncore	poss male		n.	%
	Adler	mid 5 - late 6thC	horncore	poss female	male	1	20.00%
	Adler	mid 5 - late 6thC	horncore	poss female	female	4	80.00%
	Jakobli	beg. 7thC	skull and horncore	female	n.	5	
R'nach	Alte Brauerei	7thC	horncore	poss male	male	1	33.33%
	Stadthof	Late 7thC	pelvis	poss female	female	2	66.67%
	Alte Brauerei	8thC	pelvis	poss female	n.	3	
Lausen	Grube 28	c. 9th	pelvis	poss female		n.	%
	Grube 28	c. 9th	pelvis	poss female	male	2	50.00%
	Grube 28	c. 9th	pelvis	poss male	female	2	50.00%
	Grube 28	c. 9th	pelvis	male	n.	4	

Table 6.3.2-1; Sex determintion of ovicaprids through all sites using both horncores and pelvis possible assignations are counted within the determined sex for the analsis here.
KA - Kaiseraugst, Adler - Kaiseraugst Gasthof Adler, Jakobli - Kaiseraugst Jakobli-Haus,
R'nach - Reinach, n. - number

Area	Species	Element	Bd	Dp	BT	HT	HTC
Jak	OC	Humerus			27	17.63	14.05
Jak	OC	Humerus	33.41		31.37	19.1	13.44
Jak	OC	Humerus	29.5		27.29	16.78	13.17
Jak	OC	Humerus		46.01			
Adl	OC	Humerus	29.83		26.96	17.52	14.6
Adl	OC	Humerus	31.65		29.69	18.87	14.48
Adl	OC	Humerus	30.12		26.24		
Adl	Ovis	Humerus	29.25		26.33	16.26	12.72
Adl	Ovis	Humerus	31.18		28.95	18.11	14.17
Adl	OC	Humerus				17.9	
		count	7	1	8	8	7
		min	29.25	46.01	26.24	16.26	12.72
		mean	30.71	46.01	27.98	17.77	13.80
		max	33.41	46.01	31.37	19.10	14.60
		sd	1.48		1.84	0.96	0.71
		CoV	4.81%		6.56%	5.40%	5.12%

Area	Species	Element	Bp	BFp	Bd	BFd	GL w.d.Epi
Jak	Ovis	Radius	31.34	29.72			
Jak	Ovis	Radius	32.02	30.82			
Jak	Ovis	Radius	32.25	29.76			
Jak	Ovis	Ulna and Radius	30.56	28.52			
Jak	Ovis	Ulna and Radius	29.67	28.19			
Jak	Capra	Ulna and Radius	30.64	28.61			
Jak	Capra	Ulna and Radius	29.89	28.26			
Jak	Capra	Ulna and Radius	30.84	29.26			
Jak	prob. Ovis	Radius	29.23	26.84			
Jak	OC	Radius	27.52	26.6			123.38
Jak	OC	Radius	30.99	29.51			
Jak	OC	Radius	29.18	26.61			
Jak	OC	Ulna and Radius	32.21	30.74			
Jak	OC	Ulna and Radius	34.93	32.02			
Adl	Ovis	Radius			30.65	25.37	
Adl	Ovis	Radius		22.36			
Adl	Ovis	Radius	31.51	27.29			
Adl	Capra	Radius	34.24	30.32			
		count	16	17	1	1	1
		min	27.52	22.36	30.65	25.37	123.38
		mean	31.06	28.55	30.65	25.37	123.38
		max	34.93	32.02	30.65	25.37	123.38
		sd	1.87	2.24			
		CoV	6.01%	7.83%			

Area	Species	Element	SLC	GLP	LG	BG
Jak	OC	Scapula	16.8	29.97	22.57	17.43
Jak	OC	Scapula	21.71		28.45	24.31
Jak	OC	Scapula		36.25	30.69	27.25
Jak	OC	Scapula				20.26
Jak	OC	Scapula	17.93			
Jak	prob. Ovis	Scapula	19.63			
Adl	OC	Scapula		36.7	29.18	25.29
Adl	OC	Scapula	14.82			17.96
Adl	OC	Scapula	21.65	35.06	22.75	23.78
Adl	OC	Scapula	19.55	31.85	24.02	19.77
Adl	OC	Scapula				21.8
Adl	OC	Scapula			27.88	22.66
Adl	OC	Scapula				23.97
		count	7	5	7	11
		min	14.82	29.97	22.57	17.43
		mean	18.87	33.97	26.51	22.23
		max	21.71	36.70	30.69	27.25
		sd	2.53	2.93	3.32	3.10
		CoV	13.41%	8.63%	12.52%	13.93%

Table 6.3.3-1; Raw metrical data from Kaiseraugst for elements with more than ten repeated measurements, all measurements in mm, measurement codes follow von den Driesch (1976), Jak -Kaiseraugst Jakoblihaus, Adl - Kaiseraugst Gasthof Adler, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance

Area	Species	Element	Bp	SD	Bd	DD	GL	1	2	3	Dp
Jak	Ovis	Metacarpus III+IV	21.01	12.99	25.07	9.42	120.64	10.79	15.19	10.75	15.88
Jak	Ovis	Metacarpus III+IV	20.45	12.45	23.19	7.47	123.4	10.76	15.05	10.21	
Jak	Ovis	Metacarpus III+IV	24.6			9.01		10.66	15.15	10.01	
Jak	OC	Metacarpus III+IV	24.18								
Jak	OC	Metacarpus III+IV	21.78								
Jak	OC	Metacarpus III+IV	21.4								
Jak	OC	Metacarpus III+IV	28.87								
Jak	OC	Metacarpus III+IV	21.39	14.43	25.48	9.22	122.57	11.27	16.5	12.08	
Adl	OC	Metacarpus III+IV	24.74								
Adl	OC	Metacarpus III+IV	28.69								
Adl	OC	Metacarpus III+IV	25.93								
Adl	Ovis	Metacarpus III+IV			24.42	12.61			10.41	14.59	9.84
Adl	Ovis	Metacarpus III+IV	23.02								
Adl	Ovis	Metacarpus III+IV	23.67		25.89	10.42	123.59	14.7	10.02	17.12	12.21
Adl	Capra	Metacarpus III+IV	25.4								
Adl	Capra	Metacarpus III+IV			28.77	10.46					
		count	14	3	6	7	4	5	6	6	3
		min	20.45	12.45	23.19	7.47	120.64	10.66	10.02	10.01	9.84
		mean	22.96	13.29	24.58	8.78	122.20	10.87	15.47	10.76	15.88
		max	28.87	14.43	28.77	12.61	123.59	14.70	16.50	17.12	15.88
		sd	2.68	1.02	1.87	1.59	1.35	1.73	2.77	2.84	3.04
		CoV	11.67%	7.70%	7.62%	18.16%	1.10%	15.91%	17.90%	26.41%	19.16%

			Bp	SD	Bd	DD	GL	1	2	3
Jak	Ovis	Metatarsus III+IV		22.74	7.9			10	14.63	9.83
Jak	Capra	Metatarsus III+IV		32.11				14.57	17.95	12.21
Jak	Capra	Metatarsus III+IV	26.64							
Jak	Capra	Metatarsus III+IV	20.3							
Jak	OC	Metatarsus III+IV	21.18							
Jak	OC	Metatarsus III+IV	20.32							
Adl	OC	Metatarsus III+IV	20.85							
Adl	OC	Metatarsus III+IV	21.79	25.2	9.82	128.88	12.71			
Adl	Ovis	Metatarsus III+IV	21.76	28.86	11.41	165.46	13.29	12.63	17.82	12.21
Adl	OC	Metatarsus III+IV						13.45	16.16	10.92
		count	7	4	3	2	2	4	4	4
		min	20.30	22.74	7.90	128.88	12.71	10.00	14.63	9.83
		mean	21.83	27.23	9.71	147.17	13.00	12.66	16.64	11.29
		max	26.64	32.11	7.90	0.00	0.00	14.57	17.95	12.21
		sd	2.20	4.11	1.76	25.87	0.41	1.94	1.57	1.15
		CoV	10.09%	15.11%	18.10%	17.58%	3.15%	15.36%	9.43%	10.18%

Table 6.3.3-1 Contd

Area	Species	Element	Bd	Dd
Jak	Ovis	Tibia	28.15	22.69
Jak	Ovis	Tibia	24.71	19.15
Jak	Ovis	Tibia	25.81	19.31
Jak	Ovis	Tibia	23.73	20.98
Jak	Ovis	Tibia	25.59	19.16
Jak	OC	Tibia	25.96	19.67
Adl	Prob ovis	Tibia	26.74	19.79
Adl	Ovis	Tibia	23.99	
Adl	Ovis	Tibia	24.49	
Adl	Ovis	Tibia	24.06	
Adl	Ovis	Tibia	26.52	20.21
Adl	Ovis	Tibia	23.82	18.45
Adl	Capra	Tibia	25.69	
		count	13	9
		min	23.73	18.45
		mean	25.33	19.93
		max	28.15	22.69
		sd	1.34	1.26
		CoV	5.29%	6.31%

Table 6.3.3-1 Contd

Area	Species	Element	Bd	BT	HT	HTC
GMZ	OC	Humerus	32.78	30.73	18.67	13.8
GMZ	OC	Humerus	30.72	38.75		

Area	Species	Element	Bd	Dd
GMZ	OC	Tibia	23.58	
GMZ	OC	Tibia	24.32	19.47

Area	Species	Element	Bp	Bd	DD
Stadthof	OC	Metacarpus III+IV	20.95	23.13	15.25

Table 6.3.3-2; Raw metrical data from Reinach for elements with more than ten repeated measurements, all measurements in mm, measurement codes follow von den Driesch (1976), GMZ - Reinach Gemeindezentrum, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance

Area	Species	Element	Bd	BT	HT	HTC
grube 11	first1/2 11thC	Humerus	26.66	25.27	16.15	13.27
grube 45	c. 11th	Humerus	32.56	30.36	18.33	14.88
n/a	n.d.	Humerus	32.96	31.47	19.07	13.82
grube 54	c. 10th	Humerus	31.67	29.76	17.62	14.18
grube28	c. 9th	Humerus	30.98	29.24	19.27	15.83
grube28	c. 9th	Humerus		24.35		13.9
grube28	c. 9th	Humerus	32.05		18.43	15.33
grube28	c. 9th	Humerus				15.74
grube28	c. 9th	Humerus				13.03
grube28	c. 9th	Humerus	27.55	24.23	15.73	12.77
grube28	c. 9th	Humerus	32.1	29.31	17.42	14.89
grube28	c. 9th	Humerus	30.08	26.59	17.7	14.4
grube28	c. 9th	Humerus		28.5	19.31	15.76
		count	9	10	10	13
		min	26.66	24.23	15.73	12.77
		mean	30.73	27.91	17.90	14.45
		max	32.96	31.47	19.31	15.83
		sd	2.24	2.61	1.24	1.06
		coef of V	7.27%	9.34%	6.92%	7.33%

Area	Species	Element	Bp	BFp	SD	Bd	BFd	GL	DPA	SDO
grube 45	c. 11th	Radius		26.37						
grube28	c. 9th	Radius	30.25	28.14						
grube28	c. 9th	Radius	31.63	29.08						
grube28	c. 9th	Radius	31.85	29.27						
grube 45	c. 11th	Ulna und Radius	33.06	31.15						
grube 10	c. 11th	Ulna und Radius	30.37	26.45						
grube 1	Late 6-late 7th	Ulna und Radius	34.9	31.42	20.3	31.93	28.81	158.39		
grube 10	c. 11th	Ulna und Radius	34.07	33.31					30	25.69
grube 45	c. 11th	Ulna und Radius	30.19	29.31						
grube 45	c. 11th	Ulna und Radius	33.43	31.25						
		count	9	10	1	1	1	1	1	1
		min	30.19	26.37	20.30	31.93	28.81	158.39	30.00	25.69
		mean	32.19	29.58	20.30	31.93	28.81	158.39	30.00	25.69
		max	34.90	33.31	20.30	31.93	28.81	158.39	30.00	25.69
		sd	1.76	2.24						
		coef of V	5.46%	7.57%						

Area	Species	Element	Bp	Bd	Dd
grube 9	c. 9th	Tibia		23.76	17.50
grube 20	c. 11th	Tibia		26.40	19.24
grube 45	c. 11th	Tibia	36.14		
grube28	c. 9th	Tibia		22.11	15.53
grube28	c. 9th	Tibia		25.86	20.21
grube28	c. 9th	Tibia		23.91	18.37
grube28	c. 9th	Tibia		25.26	19.40
grube28	c. 9th	Tibia		22.30	19.08
grube28	c. 9th	Tibia		22.85	18.36

Table 6.3.3-3; Raw metrical data from Lausen for elements with more than ten repeated measurements, all measurements in mm, measurement codes follow von den Driesch (1976), min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance

Area	Date	Element	Bp	SD	Bd	DD	GL	1	2	3
grube 11	Early 11th	Metacarpus III+IV	20.73	11.92	23.92	7.68	114.34	10.36	14.57	10.18
grube19/52	c. 11th	Metacarpus III+IV	22.44							
n/a	n.d.	Metacarpus III+IV	21.33							
grube28	c. 9th	Metacarpus III+IV	21.13	11.96	22.27	8.68	122.33	15.09	10.18	10.29
grube28	c. 9th	Metacarpus III+IV	24.48							

Area	Date	Element	Bp	SD	Bd	DD	GL	1	2	3
grube 54	c. 10th	Metatarsus III+IV			22.64	8.94		10.14	15.49	10.26
grube 54	c. 10th	Metatarsus III+IV			24.91	10.59		10.49	15.26	10.36
grube 17	c. 10th	Metatarsus III+IV	25.69							
grube28	c. 9th	Metatarsus III+IV	20.82		25.83	11.12	134.76	10.67	15.70	11.89
grube28	c. 9th	Metatarsus III+IV	20.55	13.73	24.29	10.37		10.09	16.03	11.29
grube28	c. 9th	Metatarsus III+IV	21.12							
grube28	c. 9th	Metatarsus III+IV	18.64							
grube28	c. 9th	Metatarsus III+IV						9.65	15.00	9.41

Table 6.3.3-3 contd

Site	Area	Species	Element	Gl mm	factor	height mm	height cm
KA	Jak	Ovis aries	Metacarpus III+IV	120.64	4.89	589.93	58.99
KA	Jak	Ovis aries	Metatarsus III+IV	123.40	4.89	603.43	60.34
KA	Jak	Ovis aries	Metacarpus III+IV	122.57	4.89	599.37	59.94
KA	Adler	Ovis aries	Metacarpus III+IV	123.59	4.89	604.36	60.44
KA	Adler	Ovis aries	Metatarsus III+IV	165.46	4.54	751.19	75.12
KA	Adler	Ovis aries	Metatarsus III+IV	128.88	4.54	585.12	58.51
Lausen	n/a	Capra hircus	Radius and ulna	158.39	4.02	636.728	63.673
Lausen	n/a	Ovis aries	Metacarpus III+IV	122.33	4.89	598.194	59.819
Lausen	n/a	prob Capra	Metatarsus III+IV	134.76	4.89	658.976	65.898
Lausen	n/a	Ovis aries	Metacarpus III+IV	114.34	4.89	559.123	55.912

Min.	Mean	Max.	S:D.	Range
58.99	59.76	60.34	0.69	1.35

Min.	Mean	Max.	S:D.	Range
58.51	64.69	75.12	9.08	16.61

min	mean	max	S.D.	Range
55.912	60.543	65.898	4.396	9.985

Table 6.3.3-4; Withers heights (after Teichert, 1963) of Ovicaprids at all sites

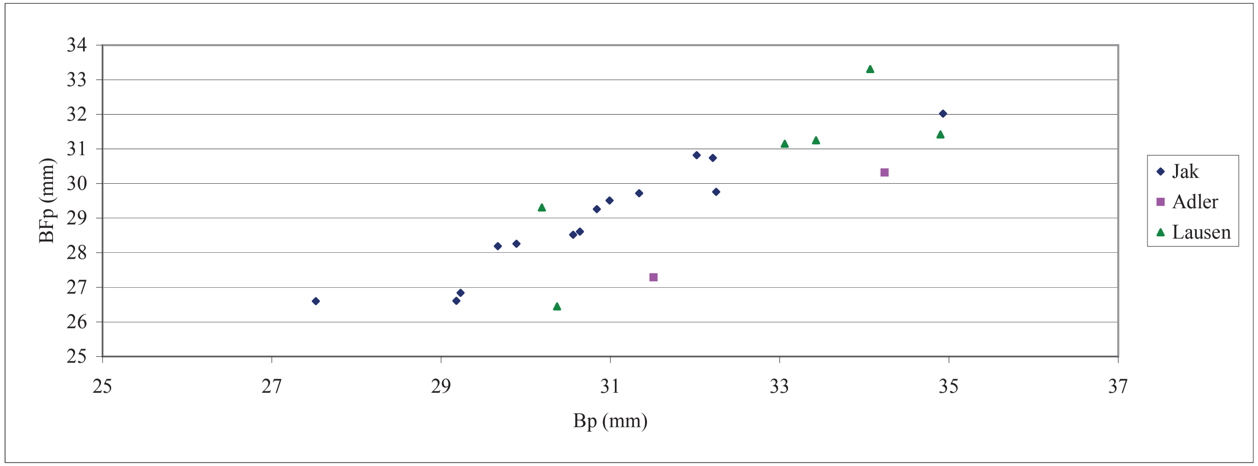
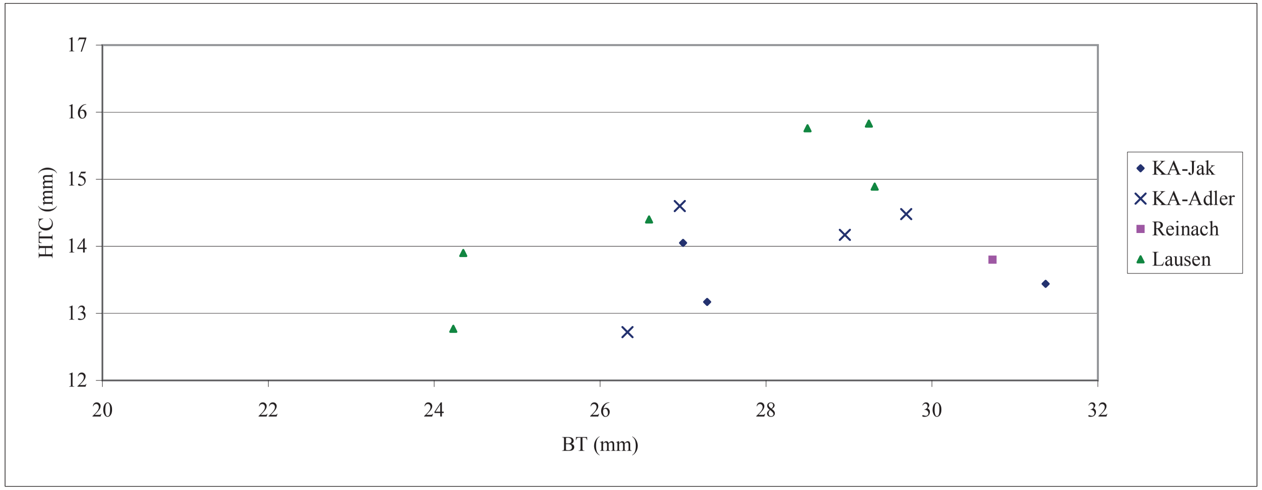


Figure 6.3.3-5; Radius proximal articulation measurements of Ovicaprids from all sites studied here, Jak -Kaiseraugst Jakobli-Haus, Adl - Kaiseraugst Gasthof Adler, measurement codes follow von den Driesch (1976),



6.3.3-6; Humerus distal articulation measurements of Ovicaprids from all sites studied here, KA Jak -Kaiseraugst Jakobli-Haus, KA Adl - Kaiseraugst Gasthof Adler, measurement codes follow von den Driesch (1976),

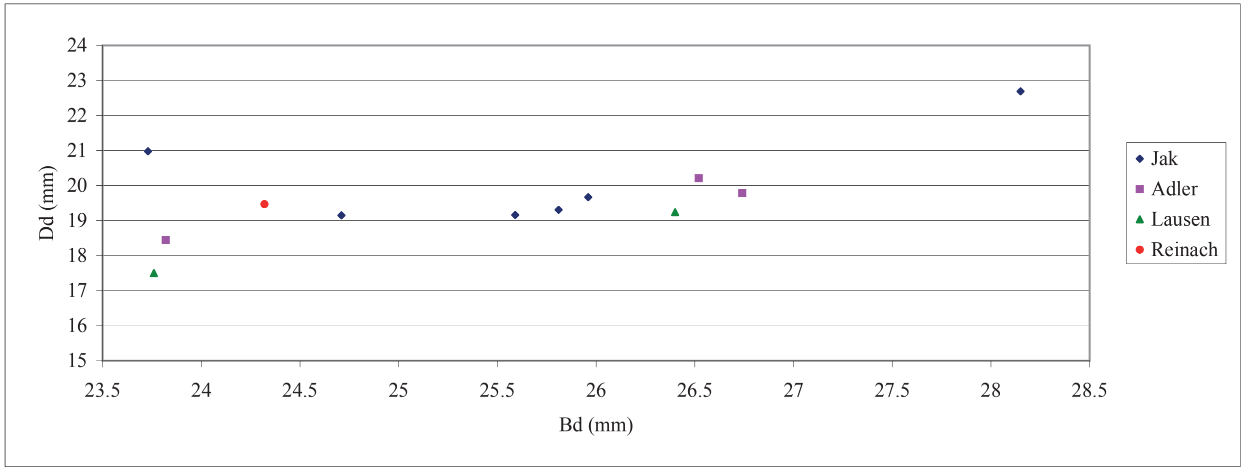


Figure 6.3.3-7; Tibia distal articulation measurements of Ovicaprids from all sites studied here, Jak -Kaiseraugst Jakobli-Haus, Adl - Kaiseraugst Gasthof Adler, measurement codes follow von den Driesch (1976),

Site	Pathology type	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	% Total
Kaiseraugst	Developmental						0	0.00%
	Infectious/inflammation	1	1		1		3	33.33%
	Trauma						0	0.00%
	Arthropathy		3		3		6	66.67%
	Dental						0	0.00%
	Total	1	3	0	2	0	9	
Reinach	Developmental						0	0.00%
	Infectious/inflammation	6	3		2	3	14	87.50%
	Trauma						0	0.00%
	Arthropathy		1				1	6.25%
	Dental	1					1	6.25%
	Total	7	4	0	2	2	16	
Lausen	Developmental						0	0.00%
	Infectious/inflammation			3			3	60.00%
	Trauma						0	0.00%
	Arthropathy						0	0.00%
	Dental	2					2	40.00%
	Total	2	0	3	0	5	5	
	Grand total	10	8	3	6	3	30	
	% Grand total	33.33%	26.67%	10.00%	20.00%	10.00%		

Table 6.3.4-1; Pathology type recorded in ovicaprids at all sites with repsect to body area.

	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	Total n. frag	%Path
KA	1	4	0	3	0	8	592	1.35%
Reinach	7	4	0	2	3	16	519	3.08%
Lausen	2	0	3	0	0	5	1515	0.33%

Table 6.3.4-2; Pathology in ovicaprids as a proportion of the assemblage at all sites with repsect to body area.

	Mid 4thC					4-6thC*					450-500*				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	0	3	0	3	5.66%	5	0	0	5	17.86%	0	0	0	0	0.00%
< subadult	0	18	0	18	33.96%	15	2	0	17	60.71%	0	5	0	5	38.46%
Subadult	0	23	0	23	43.40%	4	1	0	5	17.86%	0	6	0	6	46.15%
Adult/Senile	0	9	0	9	16.98%	0	1	0	1	3.57%	0	2	0	2	15.38%
Total	0	53	0	53		24	4	0	28		0	13	0	13	

Table 6.2.1.1-1; Age distribution of cattle using combined dental and epiphyseal data from the three areas at Kaiseraugst split by period, Jak - Jakobli-Haus, Adl - Gasthof Adler, Fstr - Fabrikstrasse; * - denotes statistically small samples

	5-6thC					6thC					beg. 7thC					12thC*				
	Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total		Jak	Adl	Fstr	Total	
Feotal-Neonatal	3	1	0	4	3.10%	2	0	0	2	1.85%	1	0	0	1	2.44%	0	0	0	0	0.00%
< subadult	7	30	0	37	28.68%	38	0	0	38	35.19%	14	0	0	14	34.15%	0	5	0	5	21.74%
Subadult	6	40	0	46	35.66%	39	0	0	39	36.11%	11	0	0	11	26.83%	0	11	1	12	52.17%
Adult/Senile	7	35	0	42	32.56%	29	0	0	29	26.85%	15	0	0	15	36.59%	0	1	5	6	26.09%
Total	23	106	0	129		108	0	0	108		41	0	0	41		0	17	6	23	

Table 6.2.1.1-1; contd

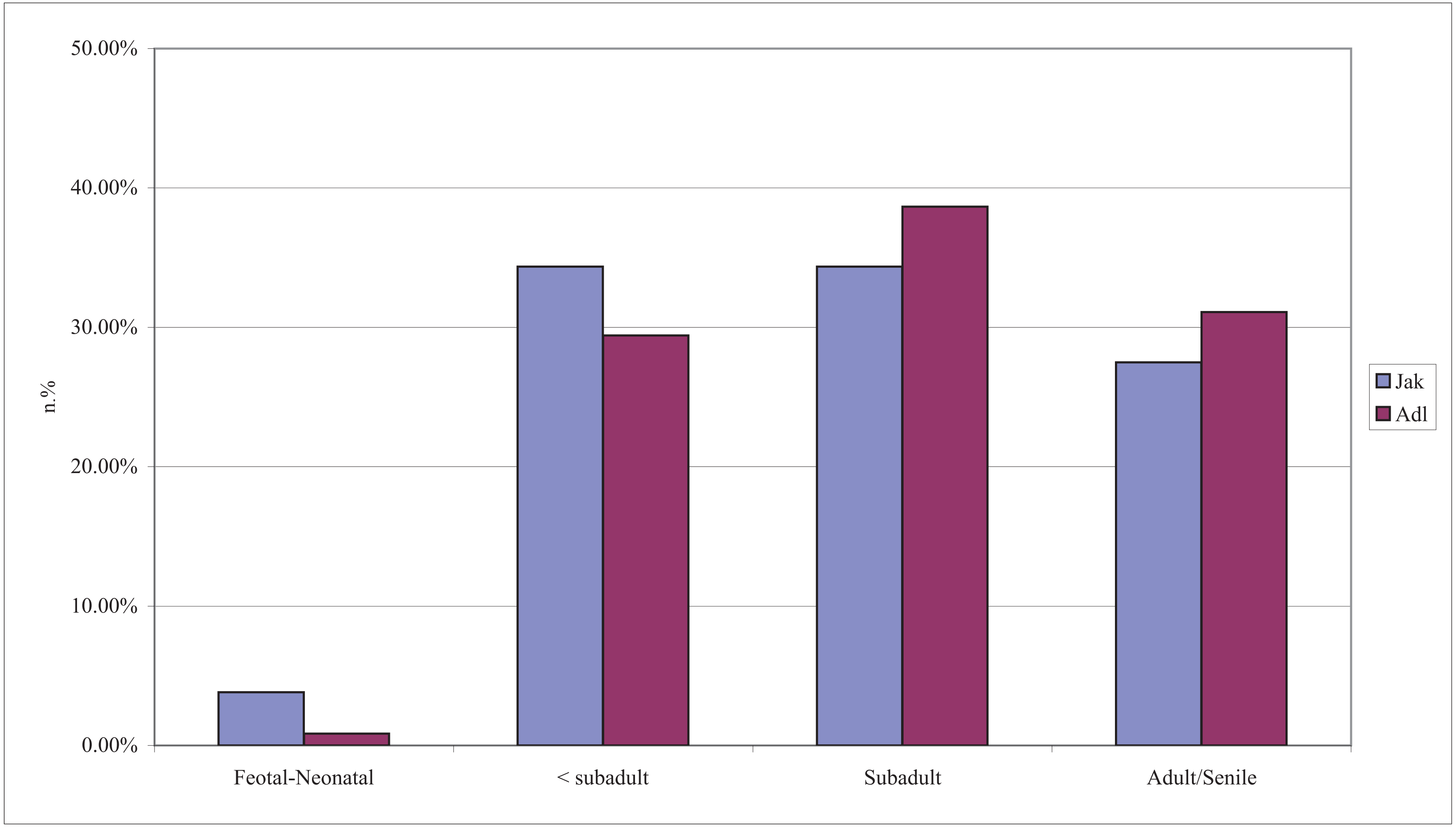


Fig. 6.4.1.1-2; Age distribution of pig using combined dental and epiphyseal data from the fifth to sixth and sixth Century periods at Kaiseraugst split by area
Jak - Jakobli-Haus, Adl - Gasthof Adler

	6-7thC*	6-7thC*	8thC*	8thC*	9thC	9thC	10thC	10thC	11thC	11thC	12thC*	12thC*
Feotal-Neonatal	0	0.00%	0	0.00%	6	2.71%	3	3.61%	5	3.60%	0	0.00%
< subadult	3	20.00%	2	33.33%	80	36.20%	34	40.96%	57	41.01%	6	35.29%
Subadult	6	40.00%	2	33.33%	102	46.15%	33	39.76%	64	46.04%	9	52.94%
Adult/Senile	6	40.00%	2	33.33%	33	14.93%	13	15.66%	13	9.35%	2	11.76%
Total	15		6		221		83		139		17	

Table 6.4.1.2-1; Age distribution of pig using combined dental and epiphyseal data from the Lausen site split by period
* - denotes statistically small samples

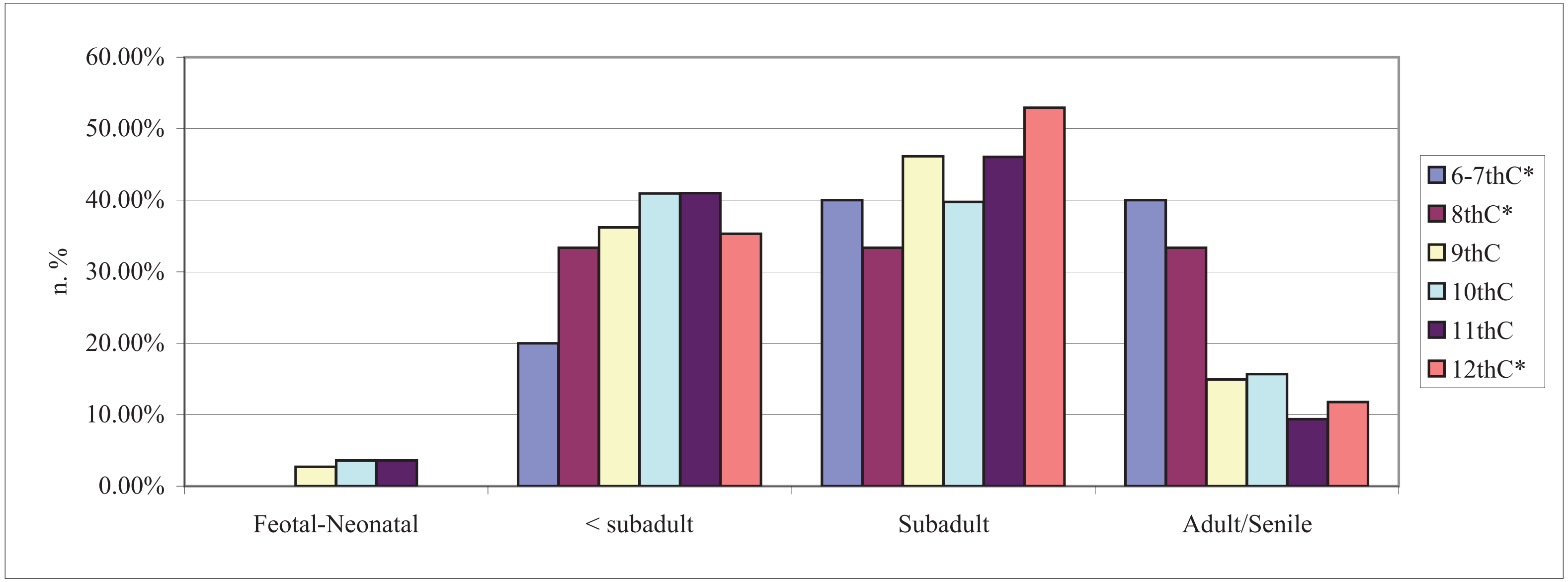


Fig. 6.4.1.2-2; Age distribution of pig using combined dental and epiphyseal data from Lausen split by date
* - denotes statistically small samples

	Grube 10	%Grube 10	Grube 45	%Grube 45
feotal-neonatal	0	0.00%	4	8.70%
>subadult	15	42.86%	20	43.48%
Subadult	18	51.43%	15	32.61%
adult/senile	2	5.71%	7	15.22%
Total	35		46	

Table 6.4.1.2-3; Age distribution of pig for specific structures using combined dental and epiphyseal data from Lausen

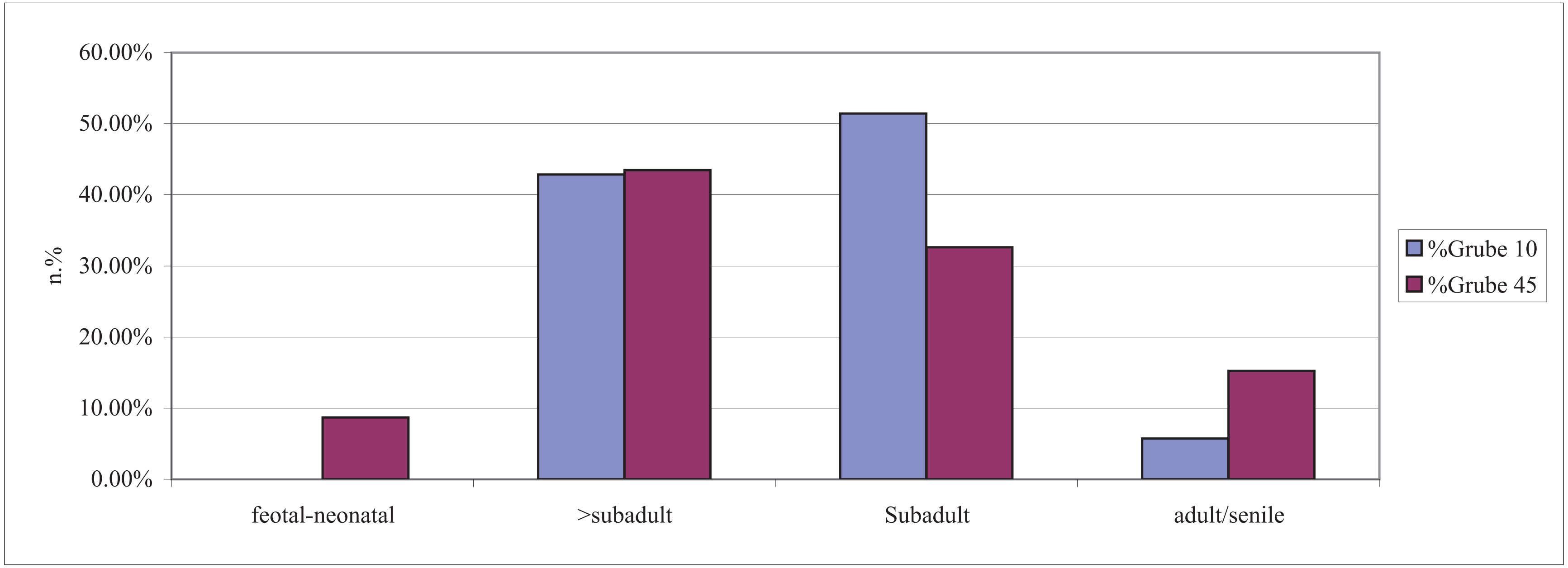


Fig. 6.4.1.2-4; Age distribution of pig for specific structures using combined dental and epiphyseal data from Lausen

Age Group	Grube 10	Grube 45
feotal-neonatal	0	4
foetal or infantile	0	0
Infantile	5	3
less than subadult	8	14
infantile or juvenile	0	0
juvenile	2	3
juvenile or subadult	4	0
subadult	1	4
subadult or adult	2	0
not adult	11	11
young adult	0	6
adult	2	1
adult or senile	0	0
Total	35	46

Table 6.4.1.2-5; Detailed age distribution of pig for specific structures using combined dental and epiphyseal data from Lausen

	6thC*	6thC*	7thC	7thC	8thC*	8thC*	9thC	9thC	10thC*	10thC*	11thC*	11thC*	12thC	12thC
Feotal-Neonatal	4	21.05%	2	1.50%	1	5.88%	1	3.33%	0	0.00%	0	0.00%	0	0.00%
< subadult	6	31.58%	41	30.83%	8	47.06%	9	30.00%	1	100.00%	7	33.33%	20	58.82%
Subadult	6	31.58%	52	39.10%	8	47.06%	17	56.67%	0	0.00%	13	61.90%	11	32.35%
Adult/Senile	3	15.79%	38	28.57%	0	0.00%	3	10.00%	0	0.00%	1	4.76%	3	8.82%
Total	19		133		17		30		1		21		34	

Table 6.4.1.3-1; Age distribution of pig using combined dental and epiphyseal data from the Reinach site split by period
* - denotes statistically small samples

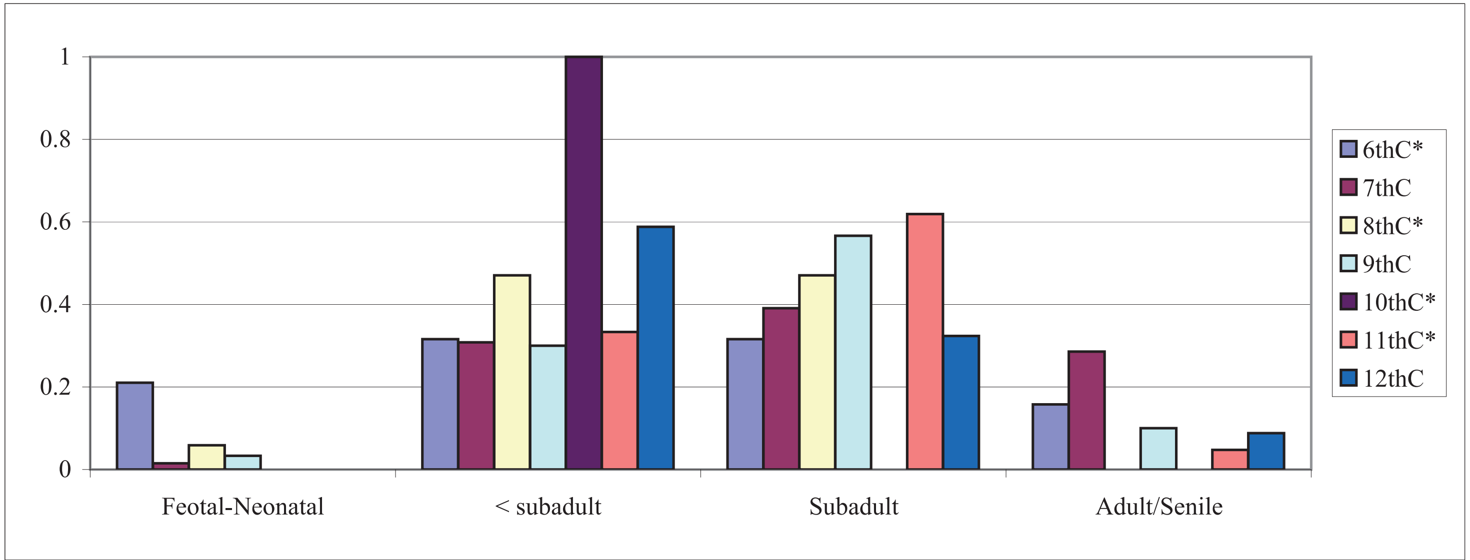


Fig. 6.4.1.3-2; Age distribution of pig using combined dental and epiphyseal data from Reinach split by date
* - denotes statistically small samples

	Kaiseraugst					Reinach				Lausen			
Tooth morphology	mid 4thC	4-6thC	5-6thC	7thC	12thC	6-7thC	8-9thC	10thC	11-12thC	6-7thC	8-9thC	10thC	11-12thC
Female	3	2	15	2	0	2	1	0	3	1	6	9	6
Male	1	1	7	3	1	4	3	2	3	3	9	7	10
Total	4	3	22	5	1	6	4	2	6	4	15	16	16
%Female	75.00%	66.67%	68.18%	40.00%	0.00%	33.33%	25.00%	0.00%	50.00%	25.00%	40.00%	56.25%	37.50%
%Male	25.00%	33.33%	31.82%	60.00%	100.00%	66.67%	75.00%	100.00%	50.00%	75.00%	60.00%	43.75%	62.50%

Table 6.4.2-1; Sex differentiation according to tooth morphology at all sites and split by period

	Kaiseraugst					Reinach				Lausen			
Pelvis	mid 4thC	4-6thC	5-6thC	7thC	12thC	6-7thC	8-9thC	10thC	11-12thC	6-7thC	8-9thC	10thC	11-12thC
Female						1			2				
Male							1						
Poss female			1				1				1		
Poss male												1	

Table 6.4.2-2; Sex differentiation according to pelvis morphology at all sites and split by period

	Kaiseraugst					Reinach				Lausen			
All Data	mid 4thC	4-6thC	5-6thC	7thC	12thC	6-7thC	8-9thC	10thC	11-12thC	6-7thC	8-9thC	10thC	11-12thC
Female	3	2	16	2	0	3	1	0	5	1	7	9	6
Male	1	1	7	3	1	4	4	2	3	3	9	8	10
Total	4	3	23	5	1	7	5	2	8	4	16	17	16
%Female	75.00%	66.67%	69.57%	40.00%	0.00%	42.86%	20.00%	0.00%	62.50%	25.00%	43.75%	52.94%	37.50%
%Male	25.00%	33.33%	30.43%	60.00%	100.00%	57.14%	80.00%	100.00%	37.50%	75.00%	56.25%	47.06%	62.50%

Table 6.4.2-3; All assigned sex differences at all sites and split by period

5-6thC	Adl	Jak	Total
Female	10	10	20
Male	6	5	11
Total	16	15	31
%Female	62.50%	66.67%	64.52%
%Male	37.50%	33.33%	35.48%

Table 6.4.2-4; All assigned sex differences in the fifth to sixth Century period from the two areas of the Kaiseraugst excavation

Area	Element	SLC	GLP	LG	BG
Jak	Scapula	23.51	34.92	27.23	24.4
Jak	Scapula		35.92	31.45	24.04
Jak	Scapula	20.81	31.75	27.58	21.49
Jak	Scapula	26.91			
Jak	Scapula	23.61			
Jak	Scapula	20.79			
Jak	Scapula	19.49			
Jak	Scapula	25.3			28.73
Jak	Scapula	21.53			
Jak	Scapula	21.49			23.23
Jak	Scapula				23.83
Jak	Scapula	22.57			
Jak	Scapula	23.41	32.91	29.12	23.46
Jak	Scapula			30.88	25.11
Jak	Scapula	24.77	36.06	28.4	23.25
Jak	Scapula	25.06	38.35	29.33	27.77
Jak	Scapula	22.67	36.25	25.87	23.67
Jak	Scapula	23.09	33.72	27.12	24.5
Jak	Scapula	17.52	28.77	21.71	20.72
Jak	Scapula				25.88
Jak	Scapula				24.02
Jak	Scapula	22.69	34.44	26.95	24.84
Jak	Scapula	25.13			
Jak	Scapula	23.37	34.88	29.04	25.8
Jak	Scapula	22.99	34.91	28.63	25.28
Jak	Scapula	24.81	37.78	29.55	
Jak	Scapula	22.06			
Jak	Scapula				25.87
Jak	Scapula	18.63	31.45	24.26	22.34
Jak	Scapula		36.2	31.21	25.89
Jak	Scapula	24.12	37.71	33.87	27.09
Jak	Scapula	19.7			
Jak	Scapula	26.47			
Jak	Scapula	25.19	36.57	31.17	27.91
Jak	Scapula				26.12
Jak	Scapula	25.2			25.16
Jak	Scapula				25.4
Jak	Scapula	24.65	36.77	31.65	26.97
Jak	Scapula	24.85			
Jak	Scapula			24.15	23.65
Jak	Scapula	19.59			
Jak	Scapula	21.29	34.09	27.16	25.62
Jak	Scapula	24.08		31.05	27.29
Jak	Scapula	22.73			24.77
Jak	Scapula				21.31
Jak	Scapula	24.79	37.46	29.72	27.69
Adl	Scapula	22.99		26.25	24.04
Adl	Scapula	20.51			
Adl	Scapula	21.65			
Adl	Scapula	18.71			
Adl	Scapula	20.2			
Adl	Scapula	21.78	35.75	26.62	24.21
Adl	Scapula	19.64			
Adl	Scapula	21.43			24.37
Adl	Scapula	21.93			
Adl	Scapula	25.19			
Adl	Scapula	23.66			27.25
Adl	Scapula				23.32
Adl	Scapula				22.49
	count	46	21	25	39
	min	17.52	28.77	21.71	20.72
	mean	22.66	35.08	28.40	24.84
	max	26.91	38.35	33.87	28.73
	sd	2.23	2.37	2.78	1.91
	coef of V	9.83%	6.76%	9.77%	7.68%

Table 6.4.3-1; Raw metrical pig data from Kaiseraugst for elements with more than ten repeated measurements, all measurements in mm, measurement codes follow von den Driesch (1976), Jak -Kaiseraugst Jakoblihaus, Adl - Kaiseraugst Gasthof Adler, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance

Area	Element	Bp	Bd	BT	HT
Jak	Humerus			31.6	
Jak	Humerus		39.74	30.45	
Jak	Humerus		40.56	30.26	
Jak	Humerus		37.47	29.78	
Jak	Humerus		41.47	31.09	
Jak	Humerus		35.09	24.17	
Jak	Humerus		40.81	31.54	29.26
Jak	Humerus		40.36	30.29	26.98
Jak	Humerus		39.24	31.37	
Jak	Humerus		39.13	30.45	
Jak	Humerus		38.53	29.65	
Jak	Humerus		43.07	32.51	
Jak	Humerus	39.55		29.56	
Jak	Humerus			28.69	
Jak	Humerus		50.96	37.76	
Jak	Humerus		34.65	26.94	
Adl	Humerus				29.26
Adl	Humerus		39.39	28.22	
Adl	Humerus		31.2	28.08	
Adl	Humerus		39.46	30.32	28.62
Adl	Humerus		38.97	29.74	29.05
Adl	Humerus		38.38	28.74	26.38
Adl	Humerus		38.27	30.32	
Adl	Humerus		36.76		26.74
Adl	Humerus		37.24	28.64	
Adl	Humerus		41.03	30.41	27.23
Adl	Humerus		40.76	30.35	28.71
Adl	Humerus		48.26	35.63	27.28
Adl	Humerus		38.18	27.23	
	count	1	25	27	10
	min	39.55	31.20	24.17	26.38
	mean	39.55	39.56	30.14	27.95
	max	39.55	50.96	37.76	29.26
	sd		3.91	2.56	1.13
	coef of V		9.88%	8.49%	4.05%

Area	Element	Bp	BpF
Jak	Radius	28.99	
Jak	Radius	30	
Jak	Radius	28.62	
Jak	Radius	27.96	
Jak	Radius	28.48	
Jak	Radius	28.94	
Jak	Radius	30.35	
Jak	Radius	25.31	
Jak	Radius	28.55	
Jak	Radius	28.76	
Jak	Radius	27.64	
Jak	Radius	30.95	
Jak	Radius	27.24	
Jak	Radius	28.55	
Jak	Radius	30.49	
Jak	Radius	28.66	
Jak	Radius	29.23	
Jak	Radius	26.72	
Jak	Radius	29.6	
Jak	Radius	26.39	
Jak	Radius	31.09	

Table 6.4.3-1 Contd

Area	Element	Bp	BpF
Jak	Radius and ulna	27.74	21.95
Adl	Radius	32.14	
Adl	Radius	28.2	
Adl	Radius	31.8	
Adl	Radius	34.15	
Adl	Radius	29.47	
Adl	Radius	27.78	
Adl	Radius	31.51	
Adl	Radius	28.96	
Adl	Radius	29.69	
Adl	Radius	27.51	
Adl	Radius	25.29	
Adl	Radius	29.89	
Adl	Radius	27.35	
Adl	Radius	28.58	
	count	36	1
	min	25.29	21.95
	mean	28.96	21.95
	max	34.15	21.95
	sd	1.86	
	coef of V	6.42%	

Area	Element	BPC	DPA	SDO	GL w.Epi
Jak	Ulna	16.52	22.62		
Jak	Ulna	23.15	38.99	28.01	
Jak	Ulna	22.81	39.57		
Jak	Ulna	22.56			
Jak	Ulna	21.52			
Jak	Ulna	20.13			
Jak	Ulna	21.84	35.16		
Jak	Ulna	21.34	35.65	26.53	
Jak	Ulna	20.67	37.78		
Jak	Ulna	20.38	34.73		
Jak	Ulna	22.82	37.85	27.49	
Jak	Ulna	21.63	34.53		
Jak	Ulna	19.74			
Jak	Ulna	23.47	40.16		
Jak	Ulna	21.55	38.78	28.17	
Jak	Ulna	21.59			
Jak	Ulna	21.78	35.5	27.41	
Jak	Ulna	23.09	39.59	29.26	
Jak	Ulna		38.67		
Jak	Ulna	22.05			
Jak	Ulna	23.64	38.94		
Jak	Ulna	22.21	38.52		
Jak	Ulna	15.47	30.72	21.76	
Jak	Ulna	22.55			
Jak	Ulna	21.15	37.18	27.22	
Jak	Ulna	20.34			
Jak	Ulna	20.98			
Jak	Ulna	18.7	28.38	22.43	
Jak	Ulna	21.49	37.84		
Jak	Ulna	22.65	37.84	26.24	
Jak	Ulna	24.56	47.05		
Adl	Ulna		25.66		
Adl	Ulna	21.92	37.44		
Adl	Ulna	22.29	36.6		
Adl	Ulna	20.64	36.54	27.33	
Adl	Ulna		38.77	27.73	
Adl	Ulna	21.26	32.82		
Adl	Ulna	19.58	31.3		
Adl	Ulna	18.83	34.12		

Table 6.4.3-1 Contd

Area	Element	BPC	DPA	SDO	GL w.Epi
Adl	Ulna	21.06	34.18	27.01	
Adl	Ulna	22.63		28.85	182
Adl	Ulna	28.44	46.21		
Adl	Ulna	21.33			
Adl	Ulna	22.48	39.67	27.96	
Adl	Ulna			26.5	
Adl	Ulna	19.99			
Adl	Ulna	19.31	31.88		
	count	43	34	16	1
	min	15.47	22.62	21.76	182.00
	mean	21.45	36.21	26.87	182.00
	max	28.44	47.05	29.26	182.00
	sd	2.06	4.86	2.03	
	coef of V	9.62%	13.41%	7.57%	

Area	Element	Bd	GL w.E.	Dd
Jak	Tibia	31.35		
Jak	Tibia	27.56		
Jak	Tibia	28.2		24.72
Jak	Tibia	27.57		
Jak	Tibia	31.34		
Jak	Tibia	29.26		
Jak	Tibia	32.12		
Jak	Tibia	29.98		
Jak	Tibia	29.18		
Jak	Tibia		45.44	
Adl	Tibia	28.7		
Adl	Tibia	30.01		
Adl	Tibia	32.93		
Adl	Tibia	28.68		
Adl	Tibia	29.51		
Adl	Tibia	27.39		
Adl	Tibia	30.47		26.78
Adl	Tibia	31.87		25.3
Adl	Tibia	30.22		
Adl	Tibia	34.63		
Adl	Tibia	30.06		
Adl	Tibia	29.2		
	count	21	1	3
	min	27.39	45.44	24.72
	mean	30.01	45.44	25.60
	max	34.63	45.44	26.78
	sd	1.86		1.06
	coef of V	6.20%		4.15%

Area	Element	Bp	B	Bd	GL	LeP
Jak	Metacarpus III	23.14	18.59	20.75	78.63	
Jak	Metacarpus III	20.58				
Jak	Metacarpus III	20.75				
Jak	Metacarpus III	21.78				
Jak	Metacarpus III	22.17	16.48	19.68	79.4	
Jak	Metacarpus III	16.83				
Jak	Metacarpus III	20.17				
Jak	Metacarpus III					32.09
Adl	Metacarpus III	20.15				
Adl	Metacarpus III	19.9				
Adl	Metacarpus III	21.36	15	16.8	71.97	
Adl	Metacarpus III	23.14				
Adl	Metacarpus III	16.37	10.49			
Adl	Metacarpus III	22.12	16	18.44	76.76	
Adl	Metacarpus III	22.35	15.37	18.56	72.01	
Adl	Metacarpus III	21.69				
	count	15	6	5	5	1
	min	16.37	10.49	16.80	71.97	32.09
	mean	20.83	15.32	18.85	75.75	32.09
	max	23.14	18.59	20.75	79.40	32.09
	sd	2.00	2.68	1.48	3.57	#DIV/0!
	coef of V	9.61%	17.50%	7.85%	4.71%	#DIV/0!

Table 6.4.3-1 Contd

Area	Element	Bp	B	Bd	GL
Jak	Metacarpus IV	13.55			
Jak	Metacarpus IV	17.54	13.07	18.87	76.2
Jak	Metacarpus IV	15.1	11.98	16.8	71.8
Jak	Metacarpus IV	16.26	13.24	17.31	75.31
Jak	Metacarpus IV	19.03			
Jak	Metacarpus IV	14.45			
Jak	Metacarpus IV	17.62			
Jak	Metacarpus IV	14.57			
Adl	Metacarpus IV	15.1	12.71	17.43	74.73
Adl	Metacarpus IV	15.76	13.38	16	76.18
Adl	Metacarpus IV	14.38	12.15		
Adl	Metacarpus IV	15.3			
	count	12	6	5	5
	min	13.55	11.98	16.00	71.80
	mean	15.72	12.76	17.28	74.84
	max	19.03	13.38	18.87	76.20
	sd	1.61	0.58	1.05	1.81
	coef of V	10.25%	4.56%	6.08%	2.42%

Area	Element	Bp	B	Bd	GL	LeP
Jak	Metatarsus III	18.21				
Jak	Metatarsus III	15.92				
Jak	Metatarsus III	14.54	12.3	15.56	78.06	80.75
Jak	Metatarsus III			15.14		
Jak	Metatarsus III	17.37	13.01	16.39	83.58	80.92
Jak	Metatarsus III	16.04				
Jak	Metatarsus III	17.23				
Jak	Metatarsus III	16.25				
Jak	Metatarsus III	16.53				
Jak	Metatarsus III	18.38				
Jak	Metatarsus III	15.86	13.26	16.7	80.99	80.13
Jak	Metatarsus III	15.49				
Jak	Metatarsus III	17.23				
Adl	Metatarsus III	21.68				
Adl	Metatarsus III	15.78	13.99	16.05	73.07	85.88
Adl	Metatarsus III	17.66	13.85			
Adl	Metatarsus III	14.07				
	count	16	5	5	4	4
	min	14.07	12.30	15.14	73.07	80.13
	mean	16.77	13.28	15.97	78.93	81.92
	max	21.68	13.99	16.70	83.58	85.88
	sd	1.78	0.68	0.63	4.51	2.66
	coef of V	10.63%	5.14%	3.93%	5.71%	3.25%

Area	Element	Bp	B	Bd	GL	LeP
Jak	Metatarsus IV	15.34	12.95	17.98	97.9	
Jak	Metatarsus IV	16.87				
Jak	Metatarsus IV	17.39				
Jak	Metatarsus IV	17.19				
Jak	Metatarsus IV	14.73				
Adl	Metatarsus IV	15.76				
Adl	Metatarsus IV	16.85				
Adl	Metatarsus IV	14.63				
Adl	Metatarsus IV	16.16	13.46	18.01	89.08	
Adl	Metatarsus IV	16.09	11.97			
Adl	Metatarsus IV	14.93				
Adl	Metatarsus IV		12		91	
	count	11	4	2	3	
	min	14.63	11.97	17.98	89.08	
	mean	15.99	12.60	18.00	92.66	
	max	17.39	13.46	18.01	97.90	
	sd	1.00	0.73	0.02	4.64	
	coef of V	6.25%	5.83%	0.12%	5.01%	

Table 6.4.3-1 Contd

Area	Date	Element	LAR
Stadthof	12thC	Pelvis	26.76
Stadthof	12thC	Pelvis	26.01
GMZ	6thC	Pelvis	31.04
Stadthof	9thC	Pelvis	28.68
Stadthof	9thC	Pelvis	34.59

Area	Date	Element	SLC	GLP	BG
GMZ	10thC	Scapula	20.72		
AB	7thC	Scapula	20.47		
AB	7thC	Scapula		29.68	22.14
GMZ	9thC	Scapula	23.64		

Area	Date	Element	Bd	BT
Stadthof	12thC	Humerus	36.19	27.60
GMZ	6thC	Humerus	37.14	28.41
GMZ	7thC	Humerus	40.12	30.88

Area	Date	Element	Bp
GMZ	6thC	Radius	31.53
GMZ	7thC	Radius	29.64
GMZ	9thC	Radius	27.72

Area	Date	Element	BPC	DPA
GMZ	10thC	Ulna	21.34	38.14
GMZ	11thC	Ulna	16.76	
Stadthof	12thC	Ulna	17.04	
GMZ	6thC	Ulna	21.74	32.70
GMZ	8thC	Ulna	19.90	37.03
Stadthof	9thC	Ulna	20.45	
Stadthof	9thC	Ulna	20.73	34.17
GMZ	9thC	Ulna	22.88	37.43

Area	Date	Element	DC
Stadthof	11thC	Femur	23.06

Area	Date	Element	Bd
Stadthof	11thC	Tibia	29.37
GMZ	6thC	Tibia	29.74
GMZ	6thC	Tibia	31.32
Stadthof	Late 7thC	Tibia	27.45

Area	Date	Element	GLl	GLm
GMZ	10thC	Astragalus	36.29	35.50
GMZ	10thC	Astragalus	42.88	39.79
Stadthof	11thC	Astragalus	39.52	37.77
Stadthof	12thC	Astragalus	38.33	35.24
GMZ	6thC	Astragalus	43.26	39.86
GMZ	7thC	Astragalus	40.19	36.96
GMZ	9thC	Astragalus	37.97	36.08

Area	Date	Element	GL	GB
Stadthof	11thC	Calcaneus	73.99	28.9
Stadthof	12thC	Calcaneus		19.39
Stadthof	12thC	Calcaneus		20.03
GMZ	7thC	Calcaneus		24.09
GMZ	8thC	Calcaneus		23.55
Stadthof	9thC	Calcaneus		31.2

Table 6.4.3-2; Raw metrical data of pig from Reinach, only elements that samples of greater than 10 are illustrated alongside those that are used in other analysis, GMZ - Gemeindezentrum, AB- Altebrauerei, All measurement codes as von den Driesch (1976)

Element	Date	Element	Bp	Bd
GMZ	6thC	Mc2		14.9
GMZ	6thC	Mc3	21.16	
GMZ	6thC	Mc3		18.51
GMZ	6thC	Mc4	15.45	
GMZ	6thC	Mc4	16.12	16.44
GMZ	7thC	Mc2		9.73
AB	7thC	Mc3	21	
GMZ	7thC	Mc3	16.07	
GMZ	7thC	Mc5		10.6
Stadthof	Late 7thC	Mc2		9.79

Element	Date	Element	Bp	Bd	Lep
GMZ	11thC	Mt3	13.8		
Stadthof	12thC	Mt3	16.23		
GMZ	6thC	Mt3	18.26		
GMZ	7thC	Mt3	16.04		
GMZ	7thC	Mt3	20.86	17.83	
GMZ	7thC	Mt4	15.66	17.76	89.35
GMZ	7thC	Mt4	16.44	16.47	
GMZ	8thC	Mt3	16.56		
Stadthof	Late 7thC	Mt3	15.97		
Stadthof	Late 7thC	Mt3	21.11		
Stadthof	Late 7thC	Mt4	15.35		
Stadthof	Late 7thC	Mt4	16.41		

Area	Date	Element	Bp
GMZ	7thC	Phalanges 1 ant	15.97
GMZ	7thC	Phalanges 1 post	15.39
GMZ	7thC	Phalanges 1 post	15.35

Area	Date	Element	Bp
GMZ	10thC	Phalanges 2 ant	15.61
GMZ	11thC	Phalanges 2 ant	23.00
GMZ	6thC	Phalanges 2 ant/post	15.92
GMZ	6thC	Phalanges 2 post	19.07
GMZ	7thC	Phalanges 2 post	15.18

Table 6.4.3-2 contd

Area	Date	Element	SLC	GLP	BG	DG
grube 54	c. 10th	scapula	19.31			
grube 54	c. 10th	scapula	20.25			
grube 54	c. 10th	scapula	22.92			
grube 54	c. 10th	scapula	23.19			
grube 54	c. 10th	scapula	23.85			
grube 54	c. 10th	scapula	23.65	36.53	30.85	
grube 54	c. 10th	scapula	23.39	35.58	28.39	24.2
grube 10	c. 11th	scapula	22.08			
grube 36	c. 11th	scapula	22.26	31.3		
grube 8	c. 8/9th C	scapula	17.82			
grube 28	c. 9th	scapula	19.88			
grube 28	c. 9th	scapula	21.51			
grube 28	c. 9th	scapula	21.69			
grube 28	c. 9th	scapula	23.25			
grube 28	c. 9th	scapula	24.51			
grube 28	c. 9th	scapula				24.64
grube 28	c. 9th	scapula	21.89			22.39
grube 28	c. 9th	scapula	22.89			24.21
grube 28	c. 9th	scapula	21.44	33.73		
grube 28	c. 9th	scapula	22.67		27.75	26.25
grube 28	c. 9th	scapula	19.77	32.8	27.1	23.17
grube 28	c. 9th	scapula	21.39	33.39	25.05	24.41
grube 28	c. 9th	scapula	22.04	33.34	29.03	23.59
grube 28	c. 9th	scapula	22.45	34.24	29.55	23.25
grube 28	c. 9th	scapula	25.18	38.33	29.91	24.18
grube 11	first1/2 11thC	scapula	19.64	27.59	23.57	19.34
grube 56	Late 6th-late 7th	scapula	24.75			
grube 38	mid 12th C	scapula	19.96			
		count	27	10	9	11
		min	17.82	27.59	23.57	19.34
		mean	21.99	33.68	27.91	23.60
		max	25.18	38.33	30.85	26.25
		sd	1.81	2.93	2.36	1.72
		coef of V	8.24%	8.71%	8.45%	7.31%

Area	Date	Element	Bd	BT
grube 11	Early 11thC	humerus		28.04
grube 54	c. 10th	humerus		29.55
grube 45	c. 11th	humerus	31.87	23.6
grube 65	Late 7th-late 8th	humerus	35.97	27.62
grube 54	c. 10th	humerus	36.1	28.09
grube 28	c. 9th	humerus	40.15	28.17
grube 8	c. 8/9th C	humerus	37.88	30.5
grube 54	c. 10th	humerus	38.81	30.39
grube 56	Late 6th-late 7th	humerus	41.92	28.73
grube 56	Late 6th-late 7th	humerus	53.37	37.16
grube 28	c. 9th	humerus		
		count	8	10
		min	31.87	23.60
		mean	39.51	29.19
		max	53.37	37.16
		sd	6.37	3.40
		coef of V	16.12%	11.66%

Table 6.4.3-3; Raw metrical data of Pig from Lausen, only elements that samples of greater than 10 are illustrated alongside those that are used in other analysis, n.d.-no date, min - minimum, max - maximum, sd - standard deviation, CoV -Coefficient of variance,
All measurement codes as von den Driesch (1976)

Area	Date	Element	Bp	Bd
grube 28	c. 9th	radius	23.64	
grube 10	c. 11th	radius	25.74	
grube 17	c. 10th	radius	26.09	
grube 10	c. 11th	radius	26.32	
grube 54	c. 10th	radius	26.65	
grube 54	c. 10th	radius	26.65	
grube 8	c. 8/9th C	radius	26.66	
grube 28	c. 9th	radius	26.89	
grube 45	c. 11th	radius	26.89	
grube 28	c. 9th	radius	27.04	
grube 4	Late 11-12th C	radius		
grube 28	c. 9th	radius	28.31	
grube 10	c. 11th	radius	28.38	
grube 54	c. 10th	radius	29.92	
grube 28	c. 9th	radius	30.33	
grube 28	c. 9th	radius	31.31	
grube 8	c. 8/9th C	radius		32.67
		count	15	1
		min	23.64	32.67
		mean	27.39	32.67
		max	31.31	32.67
		sd	1.97	
		coef of V	7.18%	

Area	Date	Element	BPC	DPA	SDO
grube 54	c. 10th	ulna	15.77		
grube 28	c. 9th	ulna	18.22		
grube 7	c. 11th	ulna	18.49		
grube 28	c. 9th	ulna	20.56		
grube 28	c. 9th	ulna	21.25		
grube 28	c. 9th	ulna	21.25		
grube 28	c. 9th	ulna	21.6		
grube 54	c. 10th	ulna	21.63		
grube 28	c. 9th	ulna		34.58	
grube 10	c. 11th	ulna	18.95		24.1
grube 45	c. 11th	ulna	19.46		25.04
grube 28	c. 9th	ulna	19.72	33.21	
grube 28	c. 9th	ulna	19.82	33.25	
grube 10	c. 11th	ulna	19.92	33.88	
grube 1	Late 6th-late 7th	ulna	20.27	33.8	
grube 28	c. 9th	ulna	20.08	34.97	
grube 54	c. 10th	ulna	19.64	35.46	
grube 45	c. 11th	ulna	22.59	34.66	
grube 56	Late 6th-late 7th	ulna	20.85	36.41	
grube 28	c. 9th	ulna	20.62	38.04	
grube 11	Early 11thC	ulna	23.42	35.53	
grube 28	c. 9th	ulna	20.62	38.97	
grube 28	c. 9th	ulna	22.69	41.89	
grube 45	c. 11th	ulna	20.21	35.57	25.21
		count	23	14	3
		min	15.77	33.21	24.10
		mean	20.33	35.73	24.78
		max	23.42	41.89	25.21
		sd	1.63	2.43	0.60
		coef of V	8.01%	6.81%	2.41%

Table 6.4.3-3 Contd

Area	Date	Element	Bp	SD	Bd	Glpe
grube 45	c. 11th	phalanx 1 ant			14.53	
grube 45	c. 11th	phalanx 1 ant			14.60	
grube 45	c. 11th	phalanx 1 ant			14.67	
grube 4	Late 11-12th C	phalanx 1 ant	10.61	6.68	7.17	20.80
grube 17	c. 10th	phalanx 1 ant	9.35	7.17	7.51	22.42
grube 9	c. 9th	phalanx 1 ant	10.63	7.71	7.86	24.07
grube 54	c. 10th	phalanx 1 post	14.35	11.59	13.61	31.55
grube 8	c. 8/9th C	phalanx 1 post	16.47	12.72	16.01	36.70
grube 45	c. 11th	phalanx 1 post	16.94	14.70	17.26	39.91
grube 45	c. 11th	phalanx 1 ant/post			7.46	
grube 28	c. 9th	phalanx 1 ant/post			14.98	
grube 28	c. 9th	phalanx 1 ant/post	15.23	12.08	14.57	34.93
		count	7	7	12	7
		min	9.35	6.68	7.17	20.80
		mean	13.37	10.38	12.52	30.05
		max	16.94	14.70	17.26	39.91
		sd	3.11	3.15	3.82	7.61
		coef of V	23.27%	30.37%	30.48%	25.31%

Area	Date	Element	Bp	SD	Bd	Glpe
grube 54	c. 10th	phalanx 2 ant	17.07			
grube 38	mid 12th C	phalanx 2 ant	15.62	13.01		24.92
grube 36	c. 11th	phalanx 2 ant	13.27	9.54	8.87	23.47
grube 65	Late 7th-late 8th	phalanx 2 ant	15.64	12.15	13.31	22.38
grube19/52	c. 11th	phalanx 2 ant	15.45	12.31	13.88	21.92
grube 8	c. 8/9th C	phalanx 2 ant	16.07	13.65	15.05	23.55
grube 56	Late 6th-late 7th	phalanx 2 post	16.37	12.77	14.78	23.11
grube 61	Late 7th-late 8th	phalanx 2 post	16.37	12.77	14.78	23.11
grube 45	c. 11th	phalanx 2 ant/post	14.84			
grube 45	c. 11th	phalanx 2 ant/post	14.84	12.35	13.17	21.33
grube 28	c. 9th	phalanx 2 ant/post	14.26	11.48	11.82	24.62
grube 45	c. 11th	phalanx 2 ant/post	15.66	13.00	14.02	21.44
grube 45	c. 11th	phalanx 2 ant/post	15.40	12.64	14.04	22.49
		count	13	11	10	11
		min	13.27	9.54	8.87	21.33
		mean	15.45	12.33	13.37	22.94
		max	17.07	13.65	15.05	24.92
		sd	1.03	1.13	1.94	1.23
		coef of V	6.68%	9.19%	14.51%	5.36%

Table 6.4.3-3 Contd

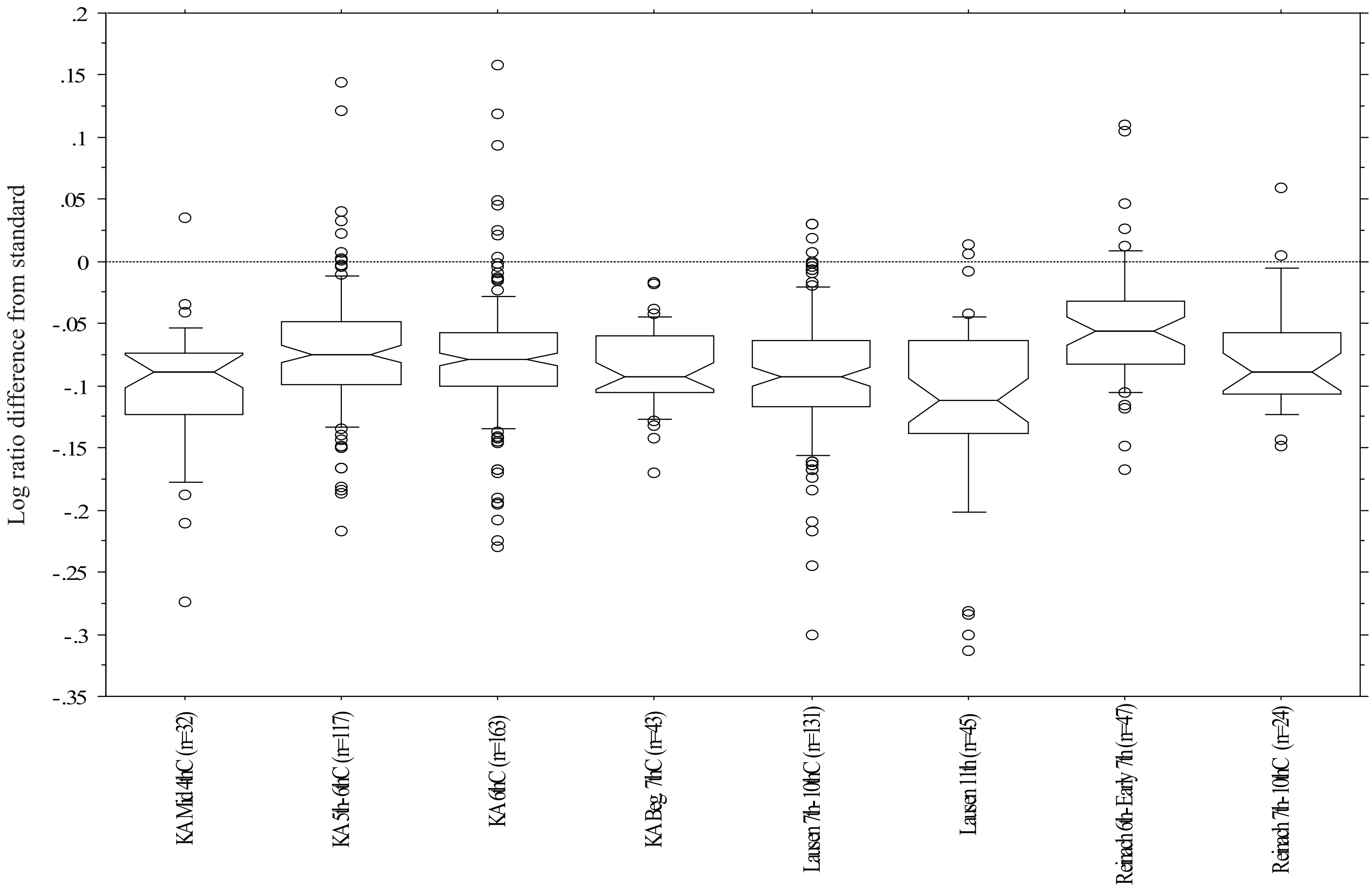


Fig. 6.4.3-4; Box plot of the log ratio diagram of pig measurements compared to the standard, KA - Kaiseraugst, For explanation of the diagram see fig. 6.2.3-10

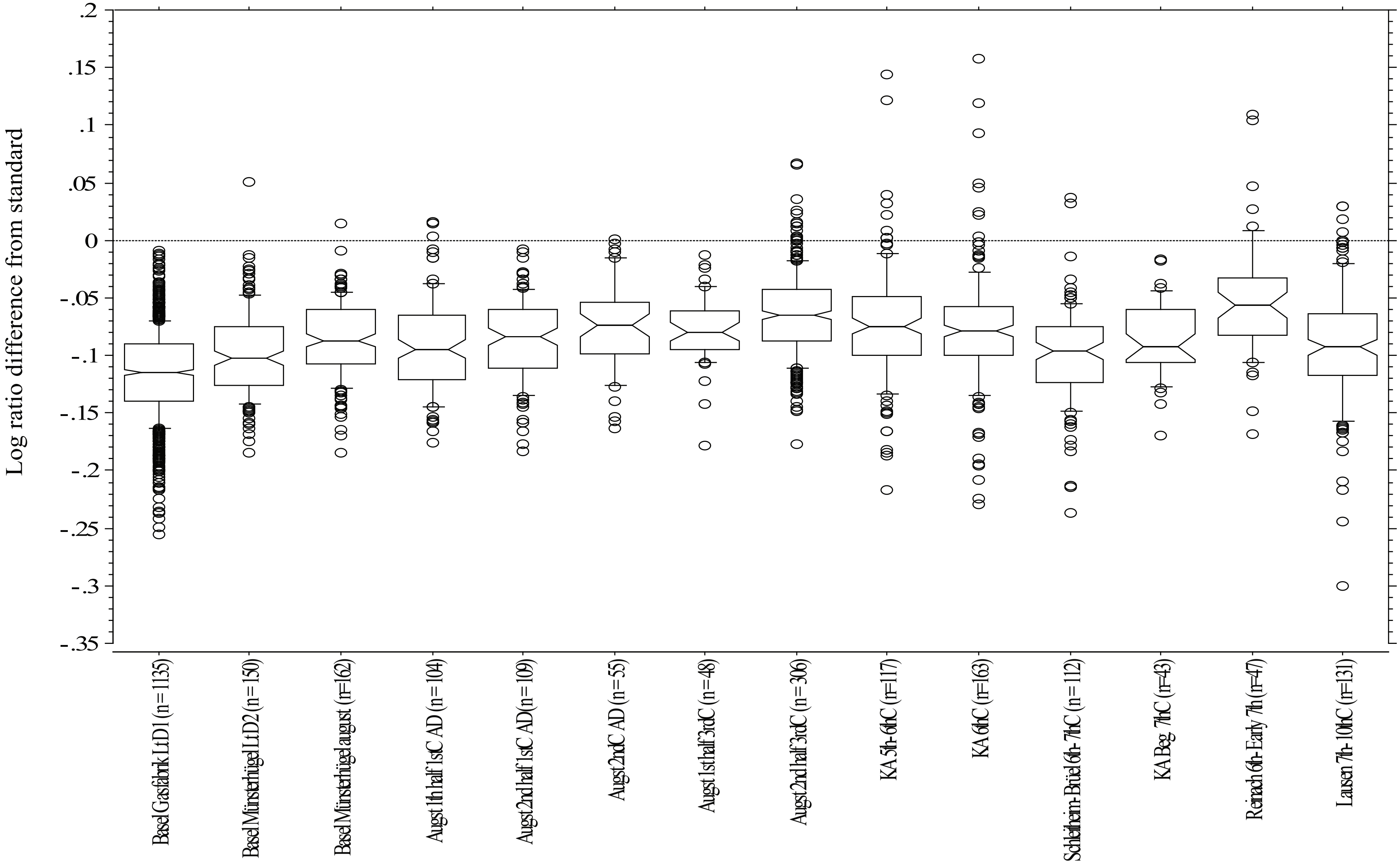


Fig.6.4.3-5; Chronological size change observed through the log ratio changes, KA- Kaiseraugst, Data from Basel Gasfabrik and the Munsterhügel, Augst and Schleitheim taken from Breuer *et al.* (2000).

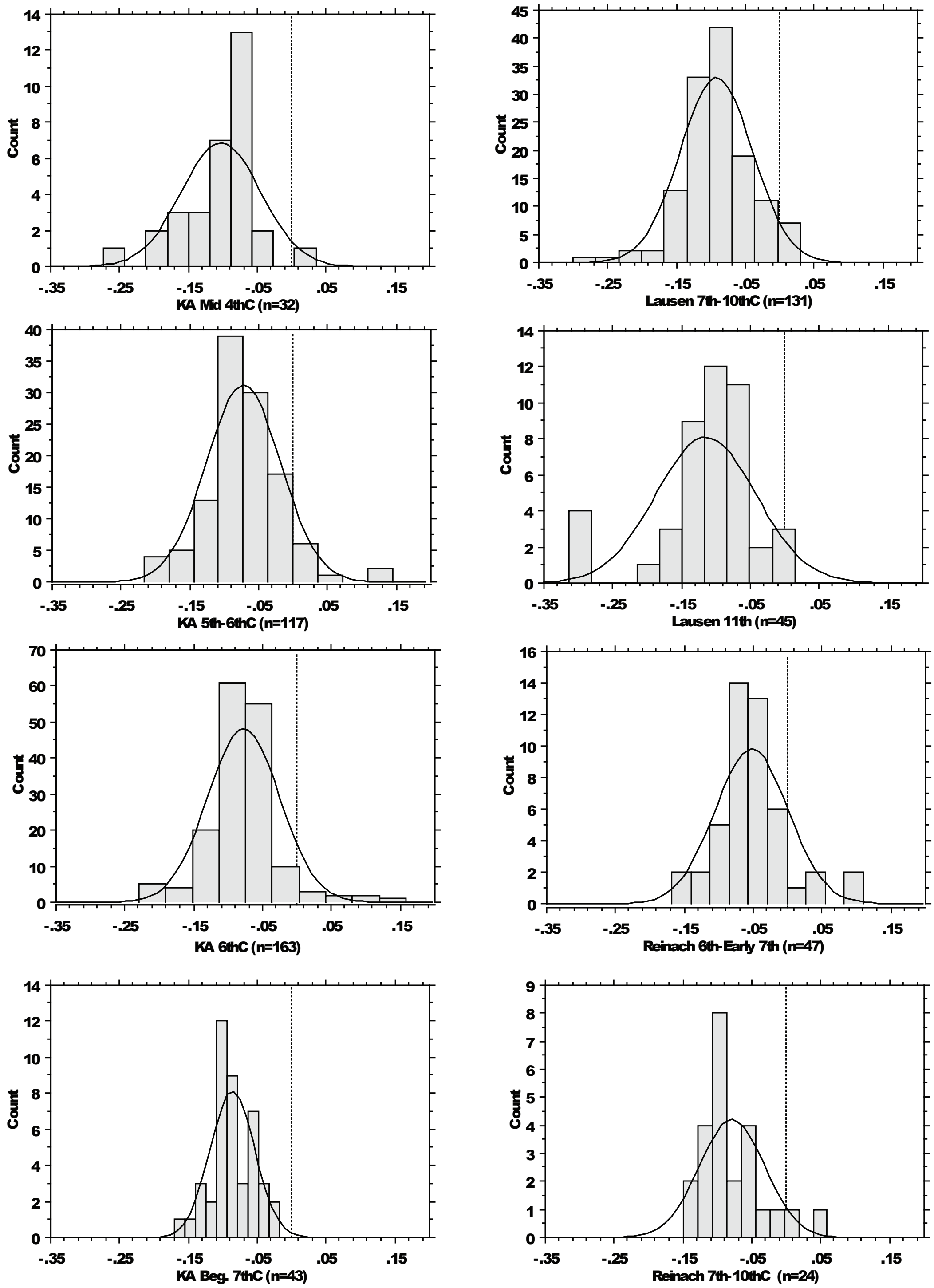


Fig. 6.4.3-6; Selected Histograms of the log ratio measurements from pig at the three sites discussed here.

Site no. According to graph

	1	2	3	4	5	6	7	8	9	10	11	12	13
1													
2	<0.001***												
3	<0.001***	<0.001***											
4	<0.001***	0.108	0.158										
5	<0.001***	0.004**	0.933	0.268									
6	<0.001***	<0.001***	0.064*	0.008**	0.061								
7	<0.001***	<0.001***	0.146	0.020*	0.209	0.49							
8	<0.001***	<0.001***	<0.001***	<0.001***	<0.001***	0.095	0.009**						
9	<0.001***	<0.001***	0.024*	0.003**	0.043*	0.876	0.561	0.025*					
10	<0.001***	<0.001***	0.075	0.007**	0.131	0.478	0.931	<0.001***	0.611				
11	<0.001***	0.603	0.006**	0.33	0.022*	<0.001***	<0.001***	<0.001***	<0.001***	<0.001***			
12	<0.001***	0.024*	0.859	0.374	0.914	0.066	0.129	<0.001***	0.081	0.158	0.074		
13	<0.001***	<0.001***	<0.001***	<0.001***	<0.001***	0.040*	0.005**	0.219	0.020*	0.002**	<0.001***	<0.001***	
14	<0.001***	0.086	0.167	0.985	0.295	0.007**	0.021*	<0.001***	0.002**	0.004**	0.296	0.419	<0.001***

Fig. 6.4.3-7; Mann-Witney significance testing between the log ratio of pigs at different sites and time periods, site numbers relate to the order of sites in fig 6.2.3-14

*** Highly significant (99.9%)
** significant (99%)
* marginally significant (95%)
not significant

Site	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	Total n. frag	%Path
KA	4	3	2	8	0	17	2038	0.83%
Reinach	1	7	5	6	0	19	1045	1.82%
Lausen	2	1	4	6	0	13	2989	0.43%

Table 6.4.4-1; Pathology in pig as a proportion of the assemblage at all sites with repsect to body area.

Site	Pig	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	
Kaiseraugst	Developmental	1					1	5.88%
	Infectious/inflammation		2	1	1		4	23.53%
	Trauma	1		1	1		3	17.65%
	Arthropathy	1	1		6		8	47.06%
	Dental	1					1	5.88%
	Total	4	3	2	8	0	17	
Reinach	Developmental						0	0.00%
	Infectious/inflammation	1	7	2	6		16	84.21%
	Trauma			1			1	5.26%
	Arthropathy			2			2	10.53%
	Dental						0	0.00%
	Total	1	7	5	6	0	19	
Lausen	Developmental						0	0.00%
	Infectious/inflammation		1	3	6		10	76.92%
	Trauma			1			1	7.69%
	Arthropathy						0	0.00%
	Dental	2					2	15.38%
	Total	2	1	4	6	13	13	
	Grand total	7	11	11	20	13	49	

Table 6.4.4-2; Pathology type recorded in pig at all sites with repsect to body area.

Excavation	Area	Date	Element	Age		
Kaiseraugst	Adl	Mid 4thC	thoracic	adult		
Kaiseraugst	Adl	Mid 4thC	thoracic	adult		
Kaiseraugst	Adl	Mid 4thC	radius	>4yrs	Adult	6
Kaiseraugst	Adl	mid 5 - late 6thC	mandible	adult	Non Adult	0
Kaiseraugst	Adl	mid 5 - late 6thC	lower tooth	adult	n.	6
Kaiseraugst	Adl	450-early 500	thoracic	adult		
Kaiseraugst	Jak	5-late 6thC	thoracic	adult		
Kaiseraugst	Jak	5-late 6thC	thoracic	adult		
Kaiseraugst	Jak	5-late 6thC	metatarsal 4	<sub adult	Adult	2(1?)
Kaiseraugst	Jak	6thC	femur	>3.5yrs	Non Adult	3
Kaiseraugst	Jak	beg. 7thC	radius	not adult	n.	6
Kaiseraugst	Jak	beg. 7thC	femur	not adult		
Reinach	GMZ	7thC	thoracic	adult oder senil		
Reinach	GMZ	9thC	metacarpal 4	<sub adult	Adult	1(1?)
Reinach	GMZ	10thC	femur	>3 years	Non Adult	2
Reinach	GMZ	10thC	humerus	not adult	n.	4
Lausen	grube 65	Late 7th-late 8th	tibia	~2yrs	Adult	1?
Lausen	grube 65	Late 7th-late 8th	tibia	>3.5yrs	Non Adult	1
Lausen	grube 9	c. 9th	tibia	>3.5yrs	n.	2
Lausen	grube 28	c. 9th	atlas	adult		
Lausen	grube 28	c. 9th	lower tooth	adult	Adult	6(1?)
Lausen	grube 28	c. 9th	upper tooth	adult	Non Adult	0
Lausen	grube 28	c. 9th	upper tooth	adult	n.	7
Lausen	grube 28	c. 9th	pelvis	adult		
Lausen	grube 28	c. 9th	lower tooth	young adult		
Lausen	grube 54	c. 10th	scapula	~1yr		
Lausen	grube 54	c. 10th	humerus	<1.5yrs		
Lausen	grube 54	c. 10th	pelvis	>2yrs		
Lausen	grube 54	c. 10th	pelvis	>2yrs		
Lausen	grube 54	c. 10th	pelvis	>2yrs		
Lausen	grube 54	c. 10th	pelvis	>2yrs		
Lausen	grube 54	c. 10th	pelvis	>2yrs		
Lausen	grube 54	c. 10th	femur	>3.5yrs	Adult	14(6?)
Lausen	grube 54	c. 10th	lumbar	>4yrs	Non Adult	2
Lausen	grube 54	c. 10th	lumbar	>4yrs	n.	22
Lausen	grube 54	c. 10th	skull	adult		
Lausen	grube 54	c. 10th	lower tooth	adult		
Lausen	grube 54	c. 10th	radius and ulna	adult		
Lausen	grube 54	c. 10th	radius and ulna	adult		
Lausen	grube 54	c. 10th	humerus	adult		
Lausen	grube 54	c. 10th	tibia	adult		
Lausen	grube 54	c. 10th	metacarpal 3	adult		
Lausen	grube 54	c. 10th	metacarpal 3	adult		
Lausen	grube 54	c. 10th	metacarpal 3	adult		
Lausen	grube 54	c. 10th	cevical	adult		
Lausen	grube 54	c. 10th	lumbar	adult		
Lausen	grube 54	c. 10th	sacral	adult		
Lausen	grube 11	first1/2 11thC	radius and ulna	>3.5yrs		
Lausen	grube 45	c. 11th	skull	adult		
Lausen	grube 10	c. 11th	tibia	adult		
Lausen	grube 10	c. 11th	tibia	adult	Adult	4(3?)
Lausen	grube 10	c. 11th	humerus	adult	Non Adult	1
Lausen	grube 20	c. 11th	tibia	>3.5yrs	n.	8
Lausen	grube19/52	c. 11th	tibia	>3.5yrs		
Lausen	grube 45	c. 11th	skull	not adult		

Table 6.5.1-1; Age assignation to Equids at all three sites, the proportions of adult to non adults are also included with possible adult individuals include in brackets with a question mark

Excavation	Area	Date	Element	GL	GB	CH
Lausen	n/a	early 11thC	lower tooth	21.04	14.3	
Lausen	n/a	c. 10th	lower tooth	23.34	16.31	
Lausen	n/a	c. 10th	lower tooth	23.34	16.31	
Lausen	n/a	arly 11thC	lower tooth	25.77	15.37	
Lausen	n/a	c. 11th	lower tooth	25.77	15.94	
Lausen	n/a	c. 11th	lower tooth	28.63	13.5	
Lausen	n/a	c. 10th	lower tooth	24.02	18.12	
Lausen	n/a	c. 10th	lower tooth	27.25	15.09	
Lausen	n/a	c. 10th	lower tooth	27.25	15.09	
Lausen	n/a	mid 12th C	lower tooth	31.33	15.77	38.44
Lausen	n/a	mid 12th C	lower tooth	25.11	17.07	48.03
Lausen	n/a	c. 11th	lower tooth	31.6	13.66	45.28
Lausen	n/a	c. 9th	lower tooth	25.84	72.6	31.19
Lausen	n/a	c. 9th	lower tooth	33.66		
Lausen	n/a	Late 7th- 8th	upper tooth	12.19	8.41	
Lausen	n/a	late11-12th C	upper tooth		22.45	
Lausen	n/a	c. 11th	upper tooth	29.69	28.26	
Lausen	n/a	c. 11th	upper tooth	28.87	24.88	31.08
Lausen	n/a	c. 11th	upper tooth	24.7	26.65	50.77
Lausen	n/a	c. 9th	upper tooth	27.51	46.8	
Lausen	n/a	c. 9th	upper tooth	28.8		
Reinach	GMZ	n/a	upper tooth	28.87	27.82	
Reinach	GMZ	n/a	upper tooth	26.38	26.82	
Reinach	GMZ	n/a	upper tooth	23.97	24.47	
Reinach	GMZ	n/a	upper tooth	24.61	26.47	
Reinach	GMZ	n/a	upper tooth	29.13	25.4	
Reinach	GMZ	n/a	lower tooth	42.87	25.05	
Reinach	GMZ	n/a	lower tooth	27.09	18.18	
Reinach	Stadthof	n/a	lower tooth	30.6	16.89	
Kaiseraugst	Adler	n/a	lower tooth	32.5	17.73	

Excavation	Area	Date	Element	GB mast.	GB occ
Lausen	n/a	c. 10th	skull	84.27	19.03

Excavation	Area	Date	Element	Lpm row
Lausen	n/a	c. 10th	maxilla	91.72

Excavation	Area	Date	Element	PL	BFcr	BFcd	HFcr	HFcd
Lausen	n/a	c. 10th	cevical	86.92				
Lausen	n/a	c. 10th	lumbar			54.27		34.07
Lausen	n/a	c. 10th	lumbar	48.24	49.05	47.83	27.76	24.09
Lausen	n/a	c. 10th	lumbar	51.02	53.37	51.34	33.21	29.47
Lausen	n/a	c. 10th	sacral		42.74			

Excavation	Area	Date	Element	SLC	LG	BG	GLP
Lausen	n/a	c. 10th	Scapula	58.82	57.07	43.62	
Reinach	Stadthof	n/a	Scapula	61.89	55.56	46.52	89.87
Kaiseraugst	Jak	n/a	Scapula	63.62	53.98	42.82	
Kaiseraugst	Adl	n/a	Scapula	68.27	55.19	48.94	86.92

Excavation	Area	Date	Element	Bd	BT
Lausen	n/a	late 11-12th C	humerus		53.09
Lausen	n/a	c. 10th	humerus	78.57	70.97
Lausen	n/a	c. 11th	humerus	80.35	71.34

Excavation	Area	Date	Element	Bp	Bd	Gl	SCD	BFp	BFd
Lausen	n/a	c. 10th	radius and ulna						65.85
Lausen	n/a	c. 10th	radius and ulna	81.86				72.34	
Lausen	n/a	c. 10th	radius and ulna		78.49	316	41.11		65.65
Lausen	n/a	early 11thC	radius and ulna	83.82				74.08	
Kaiseraugst	Adl	n/a	Radius		74.31				61.97

Excavation	Area	Date	Element	BPC
Kaiseraugst	Adl	n/a	Ulna	40.82

Excavation	Area	Date	Element	GB
Lausen	n/a	c. 10th	Carpus	42.39
Kaiseraugst	Adl		Carpus	31.3
Kaiseraugst	Adl		Carpus	46.99

Excavation	Area	Date	Element	Bp	SD	Bd	GLl	Ll	Dp	BFd	Dd	CD
Lausen	n/a	c. 10th	Metacarpal 3			49.12						
Lausen	n/a	c. 10th	Metacarpal 3	46.28					30.81	19.46		
Lausen	n/a	c. 10th	Metacarpal 3	46.28					30.81	19.46		
Lausen	n/a	c. 10th	Metacarpal 3	52.95	34.35	51.16	217	212		21.43		
Kaiseraugst	Jak	n/a	Metacarpal 3	48.29	31.52	49.32	212	208	33.61		35.6	96.25

Table 6.5.3-1; Equid metrical raw data from all sites studied here, Measurement codes follow von den Driesch (1976), all measurements in mm, Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Gemeindezentrum, AB- Altebrauerei

Excavation	Area	Date	Element	Bp	SD	Bd	GL	GLl	Ll	Dd
Kaiseraugst	Jak	n/a	Metatarsus 3	49.98						
Kaiseraugst	Adl	n/a	Metatarsus 3	53.3	32.99	50.46				38.89
Reinach	Stadthof	n/a	Metatarsus 3	46.27	30.38	45.73	260	258	257	
Reinach	Stadthof	n/a	Metatarsus 3	51.52						

Excavation	Area	Date	Element	LAR	LA
Lausen	n/a	c. 10th	pelvis		61.98
Lausen	n/a	c. 10th	pelvis	63.22	67.9
Lausen	n/a	c. 10th	pelvis	63.51	69.79
Lausen	n/a	c. 9th	pelvis		57.67

Excavation	Area	Date	Element	Bd	DC
Reinach	GMZ	n/a	Femur		53.22
Reinach	AB	n/a	Femur	94.88	

Excavation	Area	Date	Element	SD	Bd	Gl	Ll	Dd
Lausen	n/a	c. 11th	tibia		51.71			34.8
Lausen	n/a	Late 7th- 8th	tibia		67.68			43.47
Lausen	n/a	c. 10th	tibia	42.83	75.38	341	325	

Excavation	Area	Date	Element	GB	GH	BFd	LmT
Lausen	n/a	late 11-12th C	astragalus				41.82
Lausen	n/a	c. 10th	astragalus	64.71	57.35	50.1	
Kaiseraugst	Jak	n/a	astragalus	58.96	58.97	51	58.66
Kaiseraugst	Jak	n/a	astragalus	65.56	59.53	54.83	61.12

Excavation	Area	Date	Element	GL	GB
Reinach	Stadthof		Calcaneus	105.65	46.94

Excavation	Area	Date	Element	GB
Kaiseraugst	Adl		Centrotarsale	56.11

Excavation	Area	Date	Element	Bp	SD	Bd	GL	BFp	Dp	BFd
Lausen	n/a	c. 10th	phalanx 1 ant			48.87				43.91
Lausen	n/a	c. 10th	phalanx 1 ant	55.75	37.24	46.68	90.78	49.89	35.39	43.68
Lausen	n/a	Late 6th-7th	phalanx 1 ant/post	52.61	40.15	46.44	83.46	48.85	35.99	43.82
Lausen	n/a	c. 10th	phalanx 1 post	54.61	34.68	46.33	88.17	42.6	39.1	42.56
Reinach	GMZ	n/a	phalanx 1 post	51.5	31.31	40.39	77.48	47.86	35.53	39.5
Reinach	GMZ	n/a	phalanx 1 post	53.58	33.78	42.29	78.76	49.77	37.38	41.12
Reinach	GMZ	n/a	phalanx 1 ant/post			17.86				16.81
Reinach	Stadthof	n/a	phalanx 1 post	47.35				43.54		
Reinach	Stadthof	n/a	phalanx 1 ant		31.47	42.56	85.4			
Reinach	AB	n/a	phalanx 1 ant	44.92					32.68	
Lausen	n/a	c. 10th	phalanx 2 post	52.22	42.66	47.02	48.89	43.39	31.5	
Reinach	Stadthof	n/a	phalanx 2 ant/post	53.83	43.73	50.52	49.41	47.67	33.2	

Excavation	Area	Date	Element	LF	BF
Lausen	n/a	c. 11th	phalanx 3 ant	29.11	49.28

Table 6.5.3-1 Contd

Site	Area	Date	Element	GL	GLl	Ll	Height (cm)	Height (m)
Reinach	Stadthof	9th	Metatarsus 3	260	258	257	1421.21	1.42
Lausen	grube 54	c. 10th	metacarpal 3		217	212	1358.92	1.36
KA	Jak	beg. 7th	metacarpal 3		212	208	1333.28	1.33
Lausen	grube 54	c. 10th	radius and ulna	316			1371.44	1.37
Lausen	grube 54	c. 10th	tibia	341		325	1417.00	1.42

Table 6.5.3-2; Withers height measurements for equids at all three sites,
measurements in mm unless stated, measurement codes after von den Dreisch (1976)

Site	Area	Date	Element	Bp	SD	Bd	GL	BFp	Dp	BFd	SD*100/GL
Reinach	GMZ - G4	Early 7thC	phalanx 1 post	51.50	31.31	40.39	77.48	47.86	35.53	39.50	40.41
Reinach	GMZ - G4	Early 7thC	phalanx 1 post	53.58	33.78	42.29	78.76	49.77	37.38	41.12	42.89
Reinach	Stadthof - GM	12th	phalanx 1 ant		31.47	42.56	85.40				36.85
Reinach	Stadthof - GD	9th	phalanx 1 post	47.35				43.54			
Lausen	Grube 54	c. 10th	phalanx 1 ant			48.87				43.91	
Lausen	Grube 54	c. 10th	phalanx 1 ant	55.75	37.24	46.68	90.78	49.89	35.39	43.68	41.02
Lausen	Grube 50	Late 6th-late 7th	phalanx 1 ant/post	52.61	40.15	46.44	83.46	48.85	35.99	43.82	48.11
Lausen	Grube 54	c. 10th	phalanx 1 post	54.61	34.68	46.33	88.17	42.60	39.10	42.56	39.33

Fig 6.5.3-3; Equid first Phalanx measurements split bydate, site and structure, GMZ - Reinach Gemeindezentrum all measurements in mm, measurement codes after von den Driesch (1976)

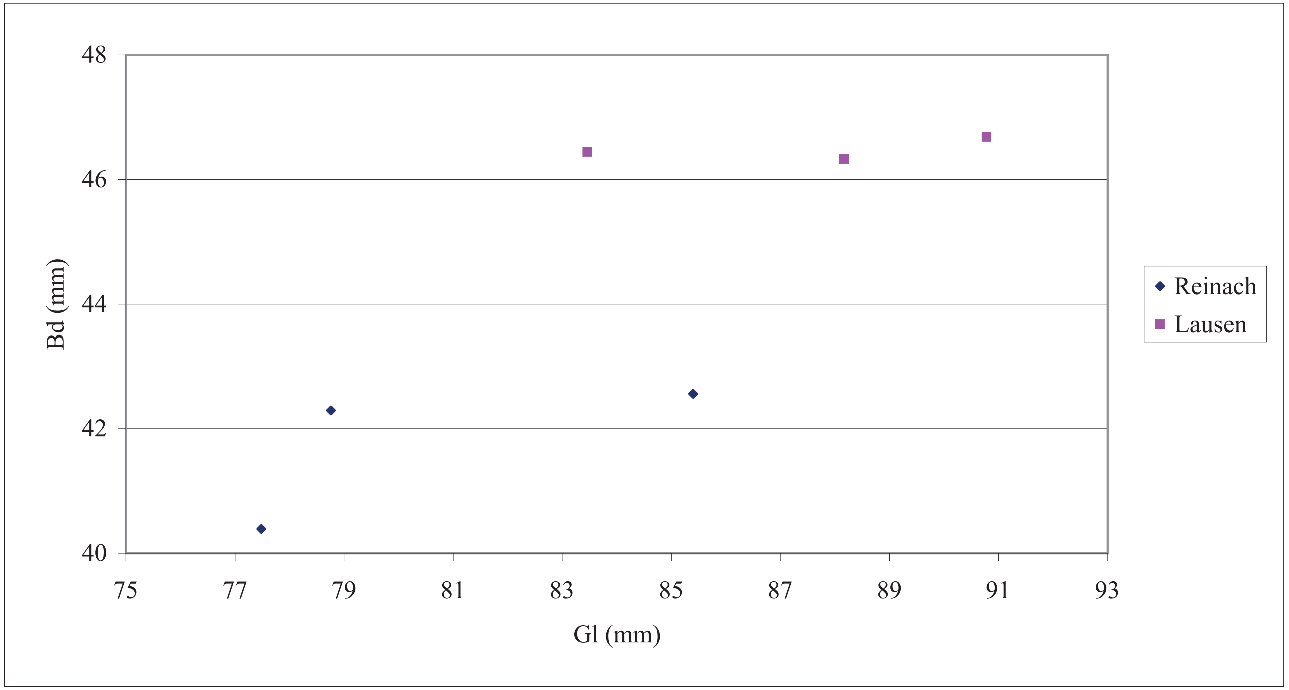


Fig 6.5.3-4; Equid first Phalanx measurements as an indicator of size

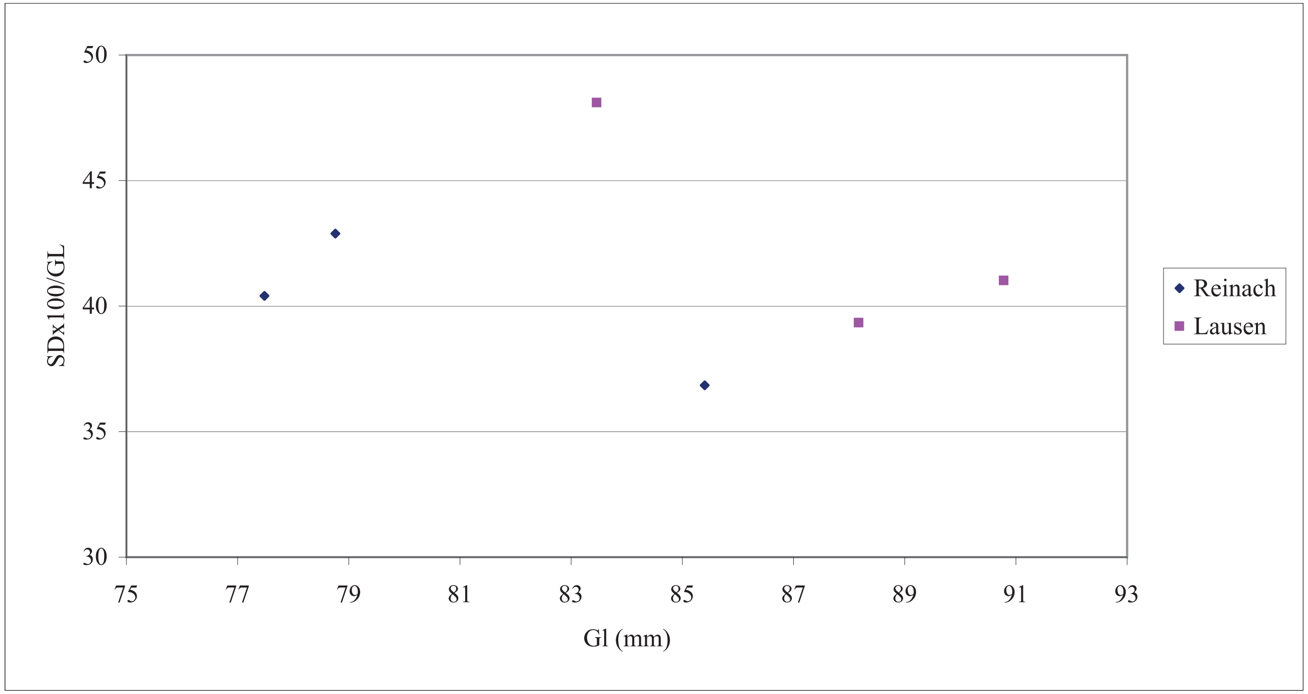


Fig 6.5.3-5; Equid first Phalanx measurements as an indicator of size

	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	Eq sample	%Path
Lausen	0	3	6	1	3	13	199	6.53%
Kaiseraugst	0	0	0	2	0	2	52	3.85%
Reinach	0	0	0	1	0	1	57	1.75%
Total	0	3	6	4	3	16	308	5.19%

Table 6.5.4-1; Table showing the proportion of pathologies recorded in the equid population

Equus	Skull/mandible	Forelimb	Trunk	Hindlimb	Phalanx	Total	
Developmental						0	0.00%
Infectious/inflammation		2			2	4	36.36%
Trauma						0	0.00%
Arthropathy			6	1		7	63.64%
Dental						0	0.00%
Total	0	2	6	1	9	11	

Table 6.5.4-2; Types of pathology found in equids at Lausen

Fig. 6.5.4-3; Possible pathology due to riding. Two views of the fusing of the lumbar vertebrae although the joint surface is still patent. The ossification of the ligaments are often observed and designated as injury caused by riding. Scale 1 major caliper unit = 10 mm.

Fig.6.5.4-4; Pathological horse pelvis from 10th Century Lausen in three views; clockwise from top left, acetabulum view shows the large amount of remodelled bone on the pubic part of the acetabular joint surface ad thickening of the *os pubis*; pubic-illial border again showing vast amounts of remodelled bone; the complete fragment showing the pathology as a whole. Scale: 1 major caliper unit =10mm

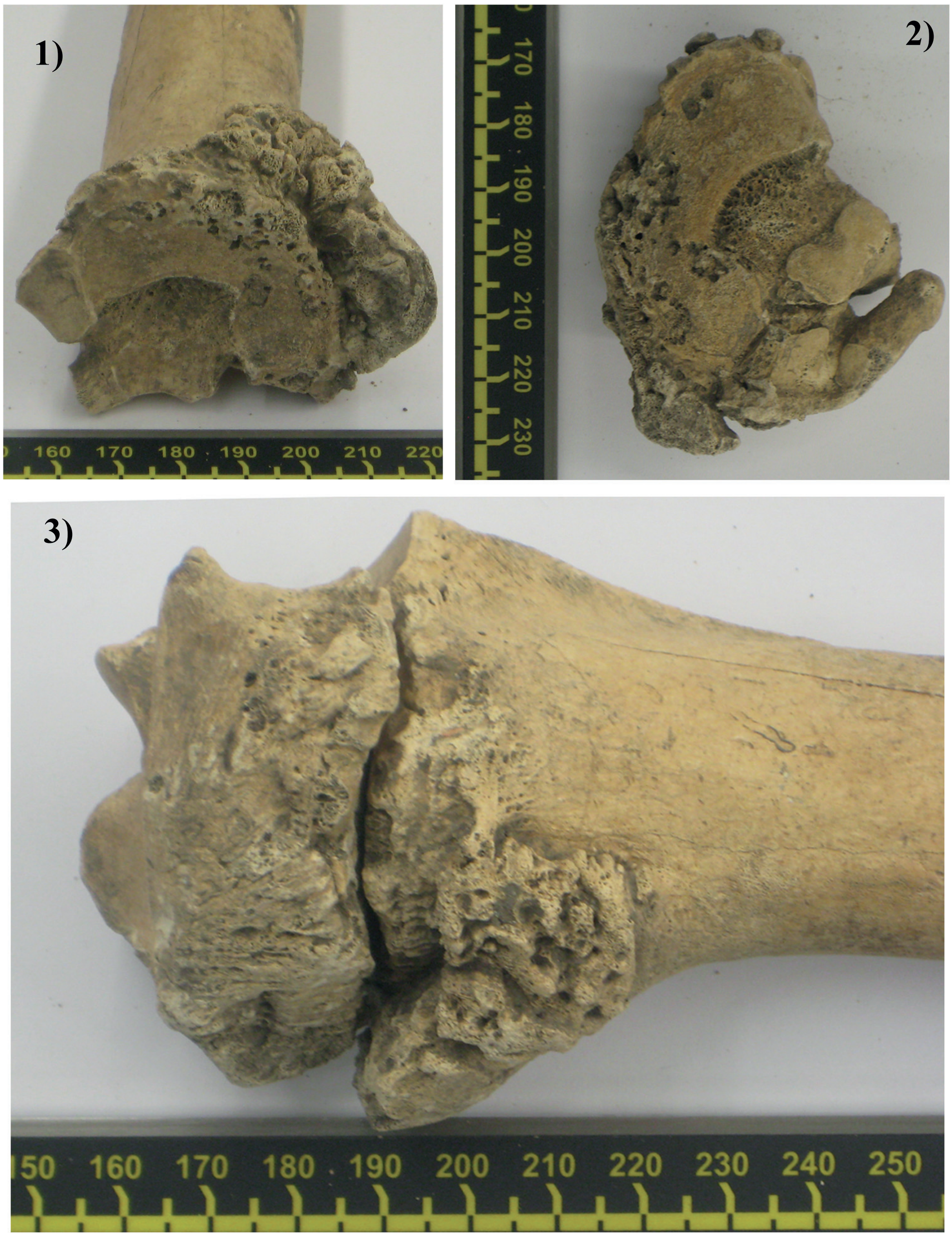


Figure 6.5.4-5; An Equid tarsal and metapodial displaying signs of pathological change. 1) A superior view of the metatarsal and the pitting of the anterior and lateral portion of the proximal articulation alongside the new bone growth on the lateral portion of the proximal diaphysis. 2) An inferior view of the tarsal to show the corresponding pitting as observed in 1). 3) Antero-Lateral view of the articulating bones to show the extent of the pathological change to the joint. In all pictures, Scale: 1 major division equates to 10 mm.

Excavation	Area	Date	Element	Age
Reinach	AB	7thC	femur	>1.5yrs
Reinach	GMZ	9thC	humerus	>1yr
Reinach	sth	12thC	ulna	infant or juvenile
Kaiseraugst	Jak	5th-late 6thC	metacarpal 5	>8mths
Kaiseraugst	Jak	beg. 7thC	metacarpal 4	<6mths
Kaiseraugst	Adl	12thC	humerus	not adult
Lausen	grube 56	Late 6th-late 7thC	radius	>1yr
Lausen	grube 56	Late 6th-late 7thC	radius	>1yr
Lausen	grube 28	c. 9thC	tibia	not adult
Lausen	grube 28	c. 9thC	femur	not adult
Lausen	grube 11	early 11thC	metacarpal 2	>8mths

Table 6.6.1-1; Age data for dogs at all three sites split by date
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Reinach Gemeindezentrum
sth- Reinach Stadthof, AB- Reinach Altebrauerei

Excavation	Area	Date	Element	SLC	GLP	LG	BG
Kaiseraugst	Jak	beg. 7thC	scapula	28.03	32.03	22.01	17.73

Excavation	Area	Date	Element	Bp	Bd	BT
Reinach	GMZ	n/a	humerus	32.88	37.30	24.20
Kaiseraugst	Adl	mid 5 - late 6thC	humerus		31.63	
Kaiseraugst	Adl	12thC	humerus		24.27	

Excavation	Area	Date	Element	Bp	Bd
Lausen	grube 56	Late 6-late 7thC	radius	17.70	22.74
Lausen	grube 56	Late 6-late 7thC	radius		14.36

Excavation	Area	Date	Element	BPC
Reinach	Stadthof	n/a	Ulna	7.79
Reinach	Stadthof	n/a	Ulna	15.69

Excavation	Area	Date	Element	Bd	GL
Lausen	grube 11	Early 11thC	metacarpal 2	5.99	41.00

Excavation	Area	Date	Element	Bd	GL
Kaiseraugst	Jak	5th-late 6thC	metacarpal 5	8.50	40.44

Table 6.6.3-1; Raw Metrical data for dogs from all three sites, measurements in mm
all measurements codes follow those of von den Driesch (1976)
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Gemeindezentrum

Kaiseraugst	mid 4thC		4-6thC		5-6thC		6thC*		beg 7thC*		12thC*	
Adult	7	100.00%	37	72.55%	34	73.91%	28	96.55%	7	77.78%	1	33.33%
Non adult	0	0.00%	14	27.45%	12	26.09%	1	3.45%	2	22.22%	2	66.67%
Total	7		51		46		29		9		3	

Table 6.7.1.1-1; Age data from Kaiseraugst split by date to show the proportuions of mature against immature individuals
* denotes small samples

Kaiseraugst	Jak*	% Jak	Adl*	% Adl	Total
Adult	21	75.00%	13	72.22%	34
non adult	7	25.00%	5	27.78%	12
Total	28		18		46

Table 6.7.1.1-2; Age data from 5 to 6thC Kaiseraugst split by area to show the proportuions of mature against immature individuals
* denotes small samples; Jak- Jakobli-Haus, Adl- Gasthof Adler

Lausen	6-7thC*	6-7thC*	8thC*	8thC*	9thC	9thC	10thC*	10thC*	11thC*	11thC*	12thC*	12thC*
Adult	4	57.14%	0		19	55.88%	9	52.94%	12	66.67%	0	0.00%
Non adult	3	42.86%	0		15	44.12%	8	47.06%	6	33.33%	3	100.00%
Total	7		0		34		17		18		3	

Table 6.7.1.2-1; Age data from Lausen split by date to show the proportuions of mature against immature individuals
* denotes small samples

	6thC*	6thC*	7thC*	7thC*	8thC*	8thC*	9thC*	9thC*	10thC*	10thC*	11thC*	11thC*	12thC*	12thC*
Adult	2	100.00%	7	58.33%	11	84.62%	18	94.74%	1	50.00%	4	66.67%	6	46.15%
Non adult	0	0.00%	5	41.67%	2	15.38%	1	5.26%	1	50.00%	2	33.33%	7	53.85%
Total	2		12		13		19		2		6		13	

Table 6.7.1.3-1; Age data from Reinach split by date to show the proportuions of mature against immature individuals
* denotes small samples

Site	Date	element	Mass	Factor	Index	Sex
Jak	undated	Coracoid	55.16	2.00	**110.32**	male
Jak	undated	Ulna	61.07	1.58	96.49	female
Jak	undated	Cmc	34.81	2.85	99.21	female
Jak	undated	Humerus	72.63	1.54	**111.85**	male
Jak	undated	Tmt*	79.58	1.45	**115.39**	male
Jak	4-6th	Coracoid	45.57	2.00	91.14	female
Jak	4-6th	Humerus	64.77	1.54	99.75	female
Jak	4-6th	Humerus	64.12	1.54	98.74	female
Jak	4-6th	Tmt	60.57	1.45	87.83	female
Jak	4-6th	Cmc	38.23	2.85	**108.96**	male
Jak	4-6th	Femur	67.37	1.37	92.30	female
Jak	5-late6th	Coracoid	55.28	2.00	**110.56**	male
Jak	5-late6th	Coracoid	50.3	2.00	100.60	female
Jak	5-late6th	Coracoid	59.98	2.00	**119.96**	male
Jak	5-late6th	Humerus	65.45	1.54	100.79	female
Jak	5-late6th	Humerus	65.39	1.54	100.70	female
Jak	5-late6th	Radius	52.41	1.73	90.67	female
Jak	5-late6th	Ulna	60.15	1.58	95.04	female
Jak	undated	Femur	80.75	1.37	**110.63**	male
Jak	5-late6th	Femur	72.39	1.37	99.17	female
Jak	5-late6th	Tibiotarsus	95.72	0.96	91.89	female
Jak	undated	Tmt	70.4	1.45	102.08	female
Jak	6th	Humerus	77.47	1.54	**119.30**	male
Jak	6th	Ulna	62.05	1.58	98.04	female
Jak	6th	Ulna	63.14	1.58	99.76	female
Jak	6th	Femur	71.13	1.37	97.45	female
Jak	6th	Tibiotarsus	95.12	0.96	91.32	female
Jak	6th	Tmt*	78.1	1.45	**113.25**	male
Jak	6th	Tmt	69.4	1.45	100.63	female
Jak	6th	Tmt*	80.4	1.45	**116.58**	male
Jak	6th	Tmt	65.08	1.45	94.37	female
Jak	6th	Tmt	67.83	1.45	98.35	female
Jak	beg. 7th	Ulna	59.32	1.58	93.73	female
Adl	mid 5 - late 6th	Humerus	69.96	1.54	**107.74**	male
Adl	mid 5 - late 6th	Humerus	62.1	1.54	95.63	female
Adl	mid 5 - late 6th	Radius	53.59	1.73	92.71	female
Adl	mid 5 - late 6th	Radius	58.23	1.73	100.74	female
Adl	mid 5 - late 6th	Radius	57.89	1.73	100.15	female
Adl	mid 5 - late 6th	Radius	64.39	1.73	**111.39**	male
Adl	mid 5 - late 6th	Ulna	63.29	1.58	100.00	female
Adl	mid 5 - late 6th	Ulna	59.68	1.58	94.29	female
Adl	mid 5 - late 6th	Ulna	69.05	1.58	**109.10**	male
Adl	mid 5 - late 6th	Femur	70.72	1.37	96.89	female
Adl	12th	Femur	73.72	1.37	101.00	female
Adl	12th	Femur	80.84	1.37	**110.75**	male

Jak.	n.	min.	max.	mean	med.
Female	30	87.83	119.96	99.81	99.75
Male	18	90.67	119.96	108.19	110.56
Adl.	n.	min.	max.	mean	med.
Female	7	92.71	101.00	97.79	100.00
Male	4	107.74	111.39	109.75	109.92
Total	n.	min.	max.	mean	med.
Female	37	87.83	119.96	99.43	99.76
Male	22	90.67	119.96	108.47	110.56

Table 6.7.2-1; Sex assignation to the fowl bones using the factors designed by Lepetz (1996)
* denotes spur present, Jak.- Kaiseraugst Jakobli-Haus, Adl- KaiseraugstGasthof Adler

Site	Date	element	Mass	Factor	Index	Sex
Reinach	8-9thC	Coracoid	46.24	2.00	92.48	female
Reinach	8-9thC	Coracoid	48.72	2.00	97.44	female
Reinach	8-9thC	Coracoid	58.02	2.00	**116.04**	female
Reinach	8-9thC	Coracoid	47.31	2.00	94.62	female
Reinach		Coracoid	48.59	2.00	97.18	female
Reinach		Coracoid	54.69	2.00	**109.38**	female
Reinach		Coracoid	49.47	2.00	98.94	male
Reinach	6-7thC	Femur	69.80	1.37	95.63	female
Reinach	6-7thC	Femur	55.42	1.37	75.93	female
Reinach	8-9thC	Femur	67.05	1.37	91.86	male
Reinach	8-9thC	Humerus	60.55	1.54	93.25	female
Reinach	8-9thC	Humerus	64.50	1.54	99.33	female
Reinach	8-9thC	Humerus	67.16	1.54	103.43	female
Reinach	6-7thC	Radius	53.84	1.73	93.14	female
Reinach	8-9thC	Radius	40.18	1.73	69.51	female
Reinach		Radius	54.86	1.73	94.91	female
Reinach	8-9thC	Radius	56.50	1.73	97.75	female
Reinach	n.d.	Radius	57.62	1.73	99.68	female
Reinach		Tmt	65.36	1.45	94.77	female
Reinach		Tmt	71.28	1.45	103.36	female
Reinach	6-7thC	Tibiotarsus	98.08	0.96	94.16	female
Reinach	8-9thC	Tibiotarsus	94.95	0.96	91.15	female
Reinach	8-9thC	Tibiotarsus	91.96	0.96	88.28	female
Reinach		Tibiotarsus	92.89	0.96	89.17	female
Reinach	8-9thC	Ulna	44.63	1.58	70.52	female
Lausen	c. 10th	Humerus	73.75	1.54	**113.58**	male
Lausen	c. 10th	Radius	68.2	1.73	**117.99**	male
Lausen	c. 10th	Coracoid	47.84	2.00	95.68	female
Lausen	c. 9th	Humerus	63.78	1.54	98.22	female
Lausen	c. 9th	Femur	74.76	1.37	102.42	female
Lausen	c. 9th	Tmt*	64.54	1.45	**93.58**	male
Lausen	c. 9th	Femur	68.98	1.37	94.50	female

Reinach	n.	min.	max.	mean	med.
Female	23	69.51	103.43	92.46	94.62
Male	2	109.38	116.04	112.71	112.71

Lausen	n.	min.	max.	mean	med.
Female	4	94.50	102.42	97.71	96.95
Male	3	93.58	117.99	108.38	113.58

Table 6.7.2-1; contd

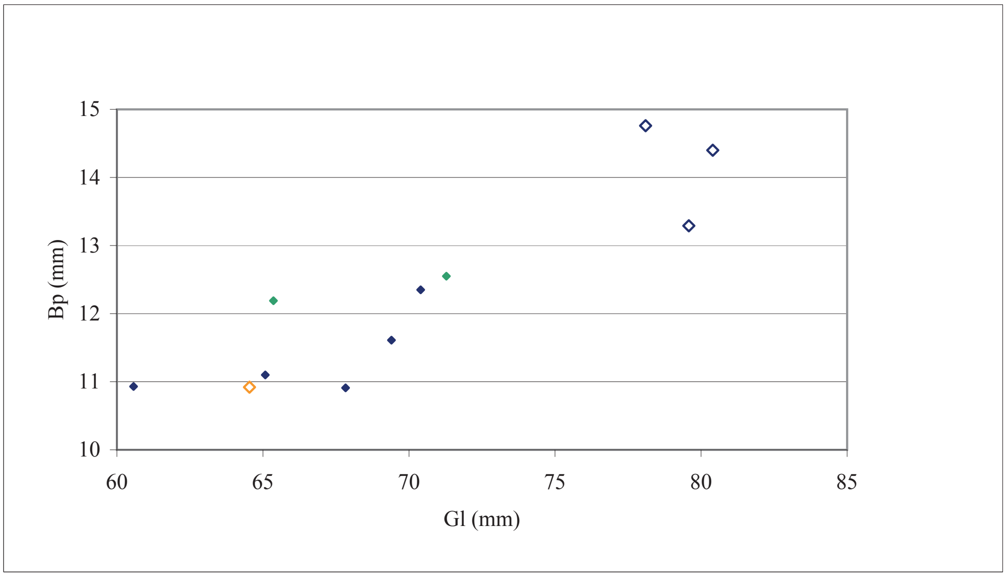
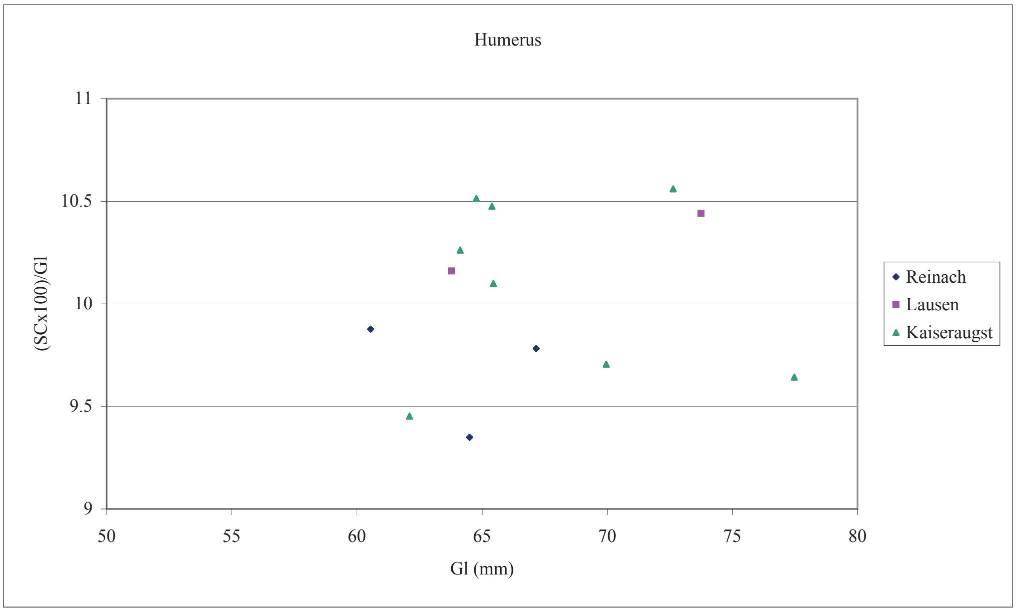
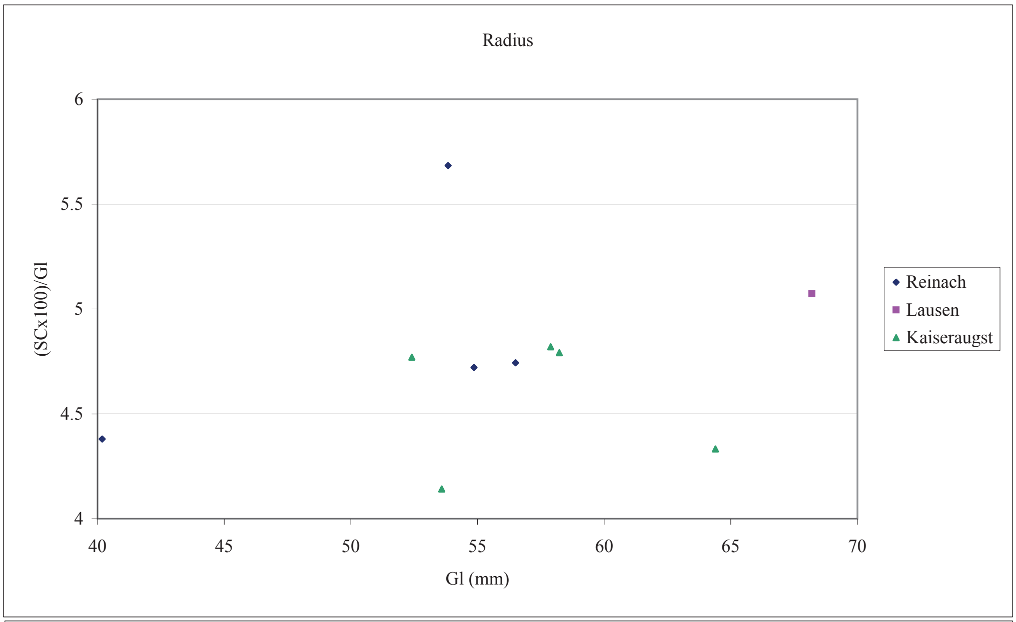


Figure 6.7.2-2; Biometrical differentiation of the sexes using gallus tarsometatarsals, open and large symbols are males indicated by medial spurs, blue symbols - Kaiseraugst, green - Reinach and orange - Lausen, data taken from table 6.7.3-1





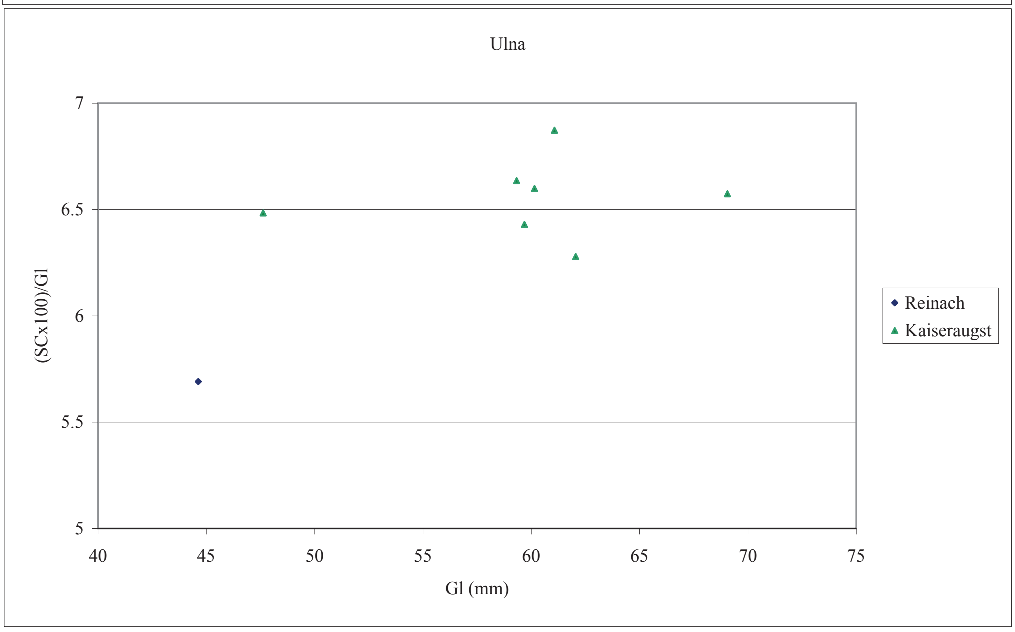
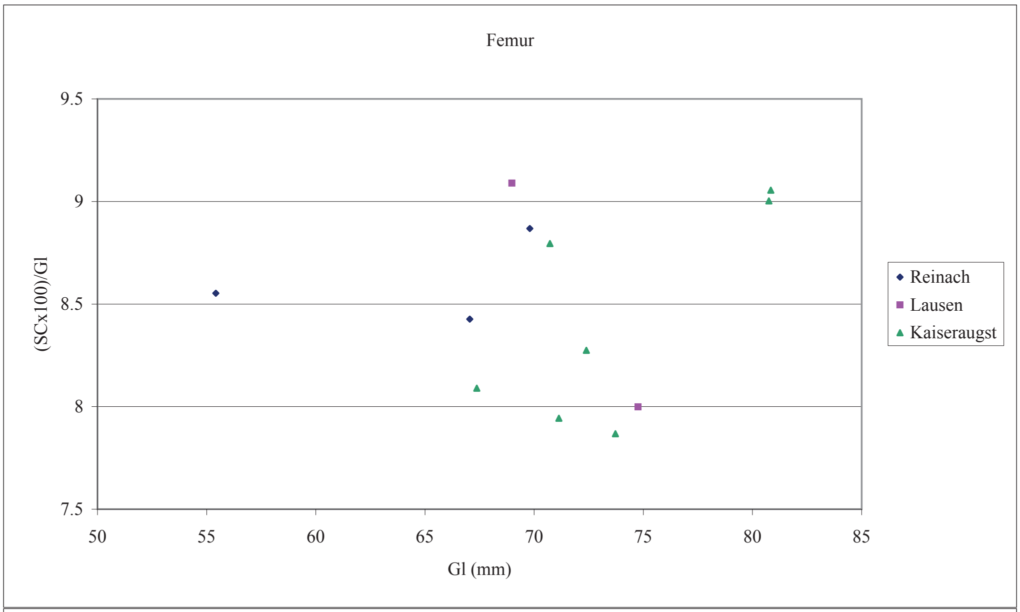
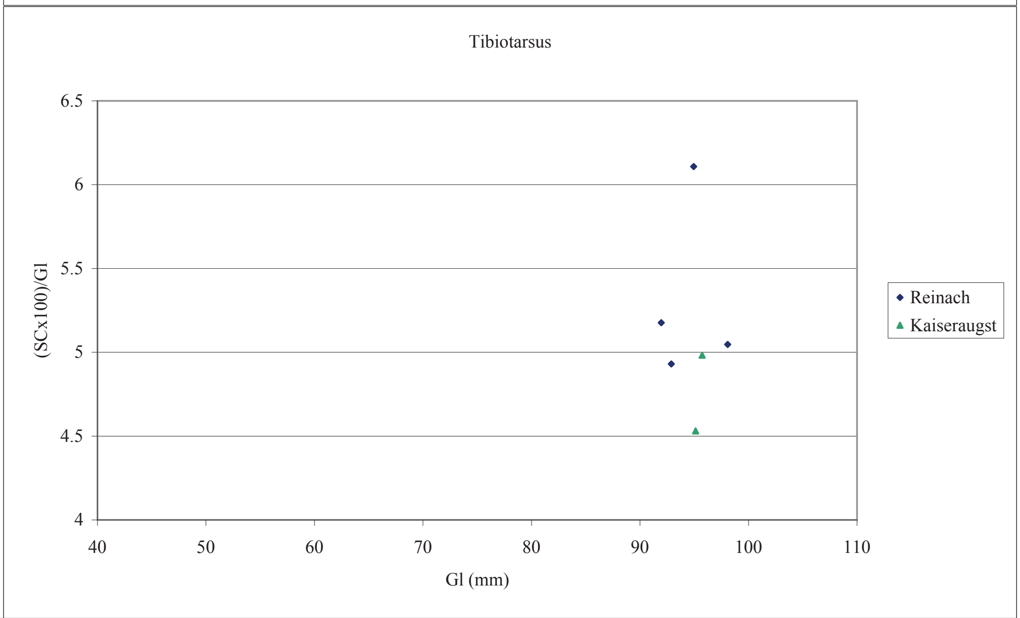


Fig. 6.7.2-3a; Greatest long bone length of forelimb elements against the shaft index to show sexual dimorphism, open symbols indicate males with a medial spur; all measurements taken from table 6.7.3-1





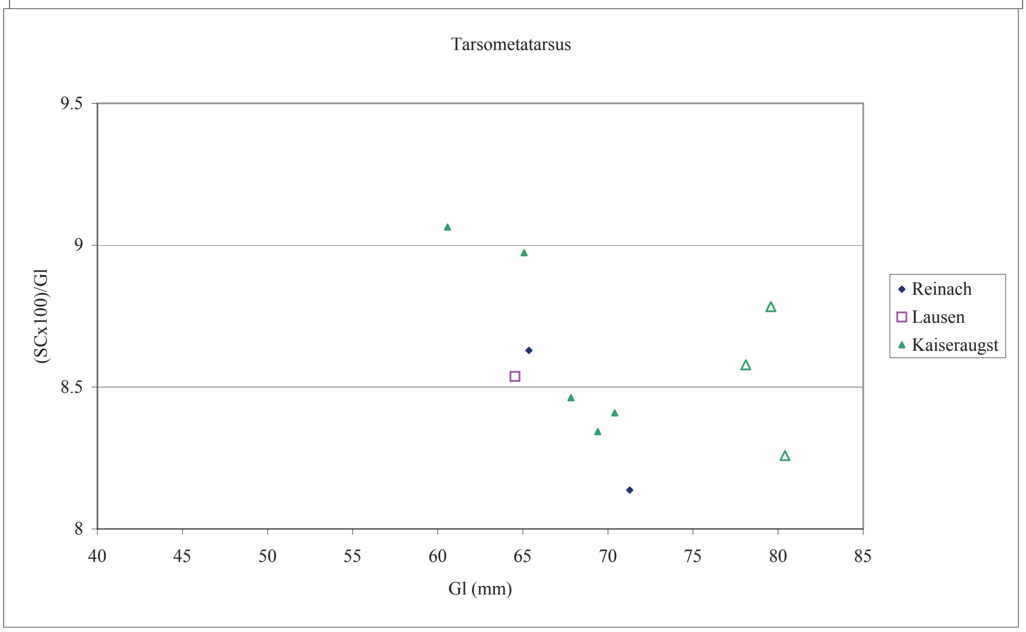


Fig. 6.7.2-3b; Greatest long bone length of hindlimb elements against the shaft index to show sexual dimorphism, open symbols indicate males with a medial spur; all measurements taken from table 6.7.3-1

Dating	Site	Element	MASS1	MASS2	MASS3	MASS4	MASS5
5th-late 6th	Jak	carpometacarpus		8.23			
4-6thC	Jak	carpometacarpus	10.36	7.25		34.81	32.74
4-6thC	Jak	carpometacarpus	11.16	7.73		38.23	35.55

Dating	Site	Element	GL	Lm	Bb	BF
4-6thC	Jak	coracoid			11.64	9.18
beg. 7thC	Jak	coracoid		46.91		
4-6thC	Jak	coracoid	45.57	43.50	12.00	10.21
5th-late 6th	Jak	coracoid	55.28	52.95		10.76
5th-late 6th	Jak	coracoid	50.30	47.79	14.13	11.44
5th-late 6th	Jak	coracoid	59.98	57.81		13.71
4-6thC	Jak	coracoid	55.16	52.95	15.96	13.00
c. 11th	Lausen	coracoid	47.84	45.63	12.85	10.73
12thC	Stadthof	coracoid	54.69			
8thC	GMZ	coracoid	47.31	44.89		11.23
9thC	GMZ	coracoid	46.24	44.27	11.17	10.37
8thC	GMZ	coracoid	58.02	45.14		11.47
Early 7thC	Stadthof	coracoid	48.59	46.64	10.20	9.34
9thC	GMZ	coracoid	48.72	46.21	11.59	10.65
12thC	Stadthof	coracoid	49.47	48.03	12.62	11.16

Dating	Site	Element	Bp	SC	Bd	GL	Lm	Dp	Dd	SCx100/GL
Mid 4thC	Adl	femur	17.45	7.32	15.48	80.84	75.30	12.63		9.05
4-6thC	Jak	femur			13.44				10.37	
4-6thC	Jak	femur	12.65	5.45	11.97	67.37	64.48	11.58	10.18	8.09
4-6thC	Jak	femur	16.33	7.27	16.37	80.75	76.64			9.00
450-early 500	Adl	femur	14.47	5.80	14.14	73.72	67.86	9.70	11.83	7.87
5th-late 6th	Jak	femur	12.96					9.86		
5th-late 6th	Jak	femur	15.51					12.22		
5th-late 6th	Jak	femur	14.20	5.99	13.91	72.39	68.90	14.41	11.46	8.27
mid 5 - late 6thC	Adl	femur	13.94	6.22	13.30	70.72	66.57	11.29	12.05	8.80
6thC	Jak	femur			16.48					
6thC	Jak	femur	14.92					8.97		
6thC	Jak	femur			16.04				12.67	
6thC	Jak	femur	16.45					15.33		

Table 6.7.3-1; Raw metrical data for Gallus domesticus from all three sites and according to date, Measurement codes follow those of Cohen and Sejearentson (1996); All measurements in mm, Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Gemeindezentrum

Dating	Site	Element	Bp	SC	Bd	GL	Lm	Dp	Dd	SCx100/GL
6thC	Jak	femur	13.66	5.65	13.44	71.13	67.64	10.06	10.71	7.94
beg. 7thC	Jak	femur			15.75				13.44	
c. 10th	Lausen	femur	15.64					11.57		
c. 11th	Lausen	femur	16.52	5.98	13.94	74.76	72.69	11.09	11.33	8.00
c. 9th	Lausen	femur	14.63	6.27	13.41	68.98	62.81	8.85	10.85	9.09
9thC	GMZ	femur			9.19				8.05	
9thC	GMZ	femur			12.31				9.92	
9thC	GMZ	femur			13.45				11.23	
12thC	GMZ	femur	10.46	4.74	10.92	55.42	52.30	6.37		8.55
9thC	GMZ	femur	13.60	5.65	12.62	67.05	63.98	11.88	10.40	8.43
6thC	GMZ	femur	14.03	6.19	13.00	69.80	65.86	11.27	11.49	8.87

Dating	Site	Element	Bp	SC	Bd	GL	SCx100/GL
mid 5 - late 6thC	Adl	humerus			14.65		
Mid 4thC	Adl	humerus	18.48				
mid 5 - late 6thC	Adl	humerus	20.65				
6thC	Jak	humerus			13.18		
N/A	Jak	humerus			13.32		
6thC	Jak	humerus			13.41		
6thC	Jak	humerus			14.48		
5th-late 6th	Jak	humerus			15.39		
4-6thC	Jak	humerus			15.44		
4-6thC	Jak	humerus			16.28		
4-6thC	Jak	humerus	20.54		16.19		
mid 5 - late 6thC	Adl	humerus	16.32	5.87	13.07	62.10	9.45
6thC	Jak	humerus	21.67	7.47	16.96	77.47	9.64
mid 5 - late 6thC	Adl	humerus	20.07	6.79	14.73	69.96	9.71
5th-late 6th	Jak	humerus	18.31	6.61	14.57	65.45	10.10
4-6thC	Jak	humerus	18.47	6.58	13.99	64.12	10.26
5th-late 6th	Jak	humerus	17.91	6.85	13.05	65.39	10.48
4-6thC	Jak	humerus	17.85	6.81	13.85	64.77	10.51

Table 6.7.3-1;contd

Dating	Site	Element	Bp	SC	Bd	GL	SCx100/GL
4-6thC	Jak	humerus	20.47	7.67	15.64	72.63	10.56
c. 10th	Lausen	humerus			12.74		
c. 11th	Lausen	humerus			13.78		
c. 11th	Lausen	humerus			14.81		
c. 11th	Lausen	humerus	17.21				
Late 7th-late 8th	Lausen	humerus	17.83	6.48	13.19	63.78	10.16
Late 6th-late 7th	Lausen	humerus	20.35	7.70	15.31	73.75	10.44
c. 9th	Lausen	humerus	16.45				
Early 7thC	Stadthof	humerus			9.11		
8thC	GMZ	humerus			13.16		
11thC	Stadthof	humerus			14.03		
9thC	GMZ	humerus	16.08	5.98	12.32	60.55	9.88
9thC	GMZ	humerus	18.22	6.03	13.53	64.50	9.35
8thC	GMZ	humerus	17.02	6.57	13.32	67.16	9.78

Dating	Site	Element	SC	Bd	GL	SCx100/GL
Mid 4thC	Adl	radius		6.08		
N/A	Jak	radius			57.30	
450-early 500	Adl	radius	2.22	6.21	53.59	4.14
Mid 4thC	Adl	radius	2.79	7.34	64.39	4.33
5th-late 6th	Jak	radius	2.50	5.37	52.41	4.77
mid 5 - late 6thC	Adl	radius	2.79	6.64	58.23	4.79
mid 5 - late 6thC	Adl	radius	2.79	5.98	57.89	4.82
Late 7th-late 8th	Lausen	radius		5.13		
first1/2 11thC	Lausen	radius		6.11		
Late 7th-late 8th	Lausen	radius		6.20		
Late 7th-late 8th	Lausen	radius		6.60		
c. 11th	Lausen	radius	3.46	7.97	68.20	5.07
c. 9th	Lausen	radius		6.61		
9thC	GMZ	radius	1.76	4.67	40.18	4.38
12thC	GMZ	radius	3.06	6.32	53.84	5.68
Early 7thC	Stadthof	radius	2.59	5.86	54.86	4.72
9thC	GMZ	radius	2.68	6.35	56.50	4.74

Table 6.7.3-1; contd

Dating	Site	Element	GL	Dic
mid 5 - late 6thC	Adl	scapula		11.24
4-6thC	Jak	scapula		10.91
6thC	Jak	scapula		12.35
4-6thC	Jak	scapula		12.42
c. 9th	Lausen	scapula		12.71
12thC	Stadthof	scapula		11.15
8thC	GMZ	scapula		11.24
11thC	Stadthof	scapula		11.45
6thC	GMZ	scapula		12.17
12thC	Stadthof	scapula		12.23
12thC	Stadthof	scapula	67.08	11.50

Dating	Site	Element	Bp	SC	Bd	GL	Spur	SCx100/GL
Mid 4thC	Adl	tarsometatarsus	11.33					
4-6thC	Jak	tarsometatarsus			12.80			
5th-late 6th	Jak	tarsometatarsus			12.88			
5th-late 6th	Jak	tarsometatarsus	13.31					
6thC	Jak	tarsometatarsus			13.67			
6thC	Jak	tarsometatarsus	13.72					
4-6thC	Jak	tarsometatarsus	10.93	5.49	10.52	60.57		9.06
6thC	Jak	tarsometatarsus	11.10	5.84	11.69	65.08		8.97
6thC	Jak	tarsometatarsus	10.91	5.74	11.78	67.83		8.46
6thC	Jak	tarsometatarsus	11.61	5.79	11.89	69.40		8.34
4-6thC	Jak	tarsometatarsus	12.35	5.92	11.86	70.40		8.41
N/A	Jak	tarsometatarsus	13.29	6.99	13.62	79.58	19.87	8.78
6thC	Jak	tarsometatarsus	14.40	6.64	12.74	80.40	20.57	8.26
6thC	Jak	tarsometatarsus	14.76	6.70	12.96	78.10	14.57	8.58
2nd1/2 11-12th C	Lausen	tarsometatarsus			10.78		0.00	
c. 9th	Lausen	tarsometatarsus	11.19				0.00	
c. 9th	Lausen	tarsometatarsus	10.92	5.51	11.38	64.54	14.40	8.54

Table 6.7.3-1; contd

Dating	Site	Element	Bp	SC	Bd	GL	Spur	SCx100/GL
c. 9th	Lausen	tarsometatarsus	11.34					
9thC	GMZ	tarsometatarsus	11.33				0.00	
9thC	GMZ	tarsometatarsus			11.87		0.00	
Early 7thC	Stadthof	tarsometatarsus	14.54	7.06			0.00	
Late 7thC	Stadthof	tarsometatarsus	12.19	5.64	11.47	65.36	0.00	8.63
12thC	Stadthof	tarsometatarsus	12.55	5.80	12.86	71.28	0.00	8.14

Dating	Site	Element	Dip	SC	Bd	Dd	GL	La	SCx100/GL
12thC	Adl	tibiotarsus	11.93						
mid 5 - late 6thC	Adl	tibiotarsus			9.70	10.68			
5th-late 6th	Jak	tibiotarsus				11.09			
6thC	Jak	tibiotarsus				11.84			
4-6thC	Jak	tibiotarsus				13.17			
4-6thC	Jak	tibiotarsus	16.69						
6thC	Jak	tibiotarsus	17.75						
5th-late 6th	Jak	tibiotarsus	17.76						
4-6thC	Jak	tibiotarsus			9.05	10.74			
6thC	Jak	tibiotarsus			10.20	10.16			
5th-late 6th	Jak	tibiotarsus			9.74	10.70			
5th-late 6th	Jak	tibiotarsus	20.74						
5th-late 6th	Jak	tibiotarsus			10.74	10.92			
4-6thC	Jak	tibiotarsus			10.86	12.74			
5th-late 6th	Jak	tibiotarsus			11.38	12.45			
4-6thC	Jak	tibiotarsus			11.66	12.68			
5th-late 6th	Jak	tibiotarsus	18.32	4.77	9.62	9.88	95.72	98.70	4.98
6thC	Jak	tibiotarsus	17.90	4.31	10.41	10.79	95.12	99.04	4.53
c. 9th	Lausen	tibiotarsus			10.30	9.45			
c. 9th	Lausen	tibiotarsus			9.81	10.18			
c. 9th	Lausen	tibiotarsus				11.57			
11thC	GMZ	tibiotarsus	10.77						
8thC	GMZ	tibiotarsus	12.24	4.76	9.95	10.37	91.96	95.54	5.18
8thC	GMZ	tibiotarsus	12.46	5.80	10.38	10.05	94.95	98.11	6.11
12thC	Stadthof	tibiotarsus	18.07	4.58	10.80	10.90	92.89	96.44	4.93
6thC	GMZ	tibiotarsus	12.15	4.95	9.89	10.94	98.08	102.10	5.05

Table 6.7.3-1; contd

Dating	Site	Element	GL	Dip	Bp	SC	Did	SCx100/GL
Mid 4thC	Adl	ulna					8.64	
mid 5 - late 6thC	Adl	ulna					9.40	
4-6thC	Jak	ulna			7.75			
4-6thC	Jak	ulna					8.57	
beg. 7thC	Jak	ulna					9.62	
4-6thC	Jak	ulna					9.77	
6thC	Jak	ulna					9.96	
5th-late 6th	Jak	ulna		9.98				
6thC	Jak	ulna		10.16				
4-6thC	Jak	ulna		11.57	7.84			
6thC	Jak	ulna		11.41	8.15			
6thC	Jak	ulna		12.01	9.15			
6thC	Jak	ulna	62.05	11.83	8.58	3.69	8.42	5.95
Mid 4thC	Adl	ulna	59.68	11.12	7.15	3.71	7.55	6.22
4-6thC	Jak	ulna	47.62	9.21	6.39	2.99	6.80	6.28
mid 5 - late 6thC	Adl	ulna	69.05	13.42	9.96	4.44	9.29	6.43
5th-late 6th	Jak	ulna	60.15	10.90	7.75	3.90	8.46	6.48
beg. 7thC	Jak	ulna	59.32	10.73	7.72	3.90	7.07	6.57
N/A	Jak	ulna	61.07	9.14	8.39	4.03	8.17	6.60
6thC	Jak	ulna	63.14	11.44	7.58	4.19	8.69	6.64
Mid 4thC	Adl	ulna	63.29	12.10	8.50	4.35	7.84	6.87
c. 10th	Lausen	ulna			7.80			
c. 10th	Lausen	ulna					8.08	
first1/2 11thC	Lausen	ulna					9.53	
mid 12th C	Lausen	ulna					9.82	
2nd1/2 11-12th C	Lausen	ulna		11.67	8.29			
c. 11th	Lausen	ulna		12.32	8.60			
c. 9th	Lausen	ulna			8.32		8.52	
c. 9th	Lausen	ulna			7.53			
9thC	GMZ	ulna					7.86	
9thC	GMZ	ulna	44.63	8.53	6.35	2.54	6.32	5.69

Table 6.7.3-1; contd

Site	Area	Dating	Element	n.	weight (g)	Age	Mass		
Reinach	Stadthof	Late 7thC	mandible	1	2.8				
Reinach	Sth	Late 7thC	mandible	1	1.9				
Reinach	GMZ	7thC	humerus	1	5.9				
Reinach	GMZ	9thC	ulna	1	1.1				
Reinach	Stadthof	Late 7thC	humerus	1	2.8				
Reinach	Stadthof	Late 7thC	lumbar	1	1.1				
Reinach	Stadthof	Late 7thC	metatarsal 4	1	0.4				
Reinach	Stadthof	Late 7thC	tibia	1	5.3				
Lausen	n/a	c. 10th	humerus	1	1.4	juvenile; less than 18 mths			
Lausen	n/a	c. 11th	mandible	1	1.7	adult			
Lausen	n/a	mid 12th C	mandible	1	0.4	juvenile			
Lausen	n/a	c. 9th	radius	1	1.2	indet.	LAR	SB	SH
Kaiseraugst	Jak	6thC	pelvis	1	7.7		12.55	5.7	12.36
Kaiseraugst	adl	mid 5 - late 6thC	femur	1	3.3				
Kaiseraugst	Fbk	12thC	rib	1	0.1				

Table 6.8.1-1; Cat finds, including ags assignation where possible, at the three sites studied
All measurements in mm, Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus, GMZ- Gemeindezentrum
fbk- Kaiseraugst Fabrikstrasse

								Mass			
Site	Structure	Dating	element	n.	weight (g)	Age	Butchery	Bp	SC	Bd	GL
Adl	n/a	Mid 4thC	tarsometatarsus	1	6.9	adult		18.98	8.1	20.8	86.86
jak	n/a	6thC	tarsometatarsus	1	1.2	juvenile		9.48	4.31	9.14	45.16
jak	n/a	6thC	coracoid	1	2.9	adult					
jak	n/a	5th-late 6th	femur	1	2.3	adult					
jak	n/a	6thC	femur	1	3.5	adult					
Adl	n/a	12thC	phalanx indet post	1	0.6	adult					
jak	n/a	5th-late 6th	tibia	1	5.9	adult					
jak	n/a	6thC	tibia	1	2.8	indet.					
								Bd			
Lausen	grube 54	c. 10th	carpometacarpus	2	3	Adult		11.94			
Lausen	grube 28	c. 9th	carpometacarpus	1	2	indet.					
Lausen	grube 28	c. 9th	carpometacarpus	1	3.1	Adult					
								BF			
Lausen	grube 54	c. 10th	coracoid	1	3.1	Adult	knf ser	28.27			
Lausen	grube 28	c. 9th	coracoid	1	2.2	Adult					
Lausen	grube 54	c. 10th	femur	1	1.6	indet.					
Lausen	grube 11	first1/2 11thC	femur	1	2.2	indet.					
								Bd			
Lausen	grube 38	mid 12th C	humerus	1	2.6	Adult		22.91			
Lausen	grube 54	c. 10th	humerus	1	8.9	indet.	knf ser				
Lausen	grube 54	c. 10th	mandible	1	0.8	indet.					
Lausen	grube 54	c. 10th	phalanx 1 ant	1	1	indet.					
Lausen	grube 54	c. 10th	phalanx 1 ant	2	0.8	Adult					
Lausen	grube19/52	c. 11th	phalanx 1 post	1	0.4	Adult					
Lausen	grube 54	c. 10th	rib	1	0.2	indet.					
Lausen	grube 54	c. 10th	scapula	1	0.8	indet.					
Lausen	grube 54	c. 10th	skull	1	0.8	indet.					
Lausen	grube 54	c. 10th	sternum	1	0.5	indet.					
Lausen	grube19/52	c. 11th	sternum	1	0.2	indet.					
								Bd			
Lausen	grube 54	c. 10th	tarsometatarsus	1	1.9	Adult		19.21			
Lausen	grube 28	c. 9th	tarsometatarsus	1	2.4	Adult		15.86			
Lausen	grube 28	c. 9th	tarsometatarsus	1	2.1	Adult					

Table 6.8.2-1; Data for the goose elements recorded in the study split by site, area, structure and date, including age assignation and butchery
All measurements in mm and correspond to those codes in Cohen and Seargantson (1996)
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakoblihaus, GMZ- Reinach Gemeindezentrum, sth - Reinach Stadthof, knf ser - repeated knife marks

Site	Structure	Dating	element	n.	weight (g)	Age	Butchery	Mass			
								Dip	SC	Bd	Dd
Lausen	grube 54	c. 10th	tibiotarsus	1	7.6	Adult	knf ser	16.23	6.05	16.54	11.19
Lausen	grube 45	c. 11th	tibiotarsus	1	1.3	indet.					
Lausen	grube 28	c. 9th	tibiotarsus	1	2.3	indet.					
Lausen	grube 28	c. 9th	tibiotarsus	1	2.1	indet.					
Lausen	grube 28	c. 9th	tibiotarsus	1	2.9	indet.					
Lausen	grube 28	c. 9th	tibiotarsus	1	0.9	not adult					
								Bp	Did		
Lausen	grube 28	c. 9th	ulna	1	8.4	Adult		15.44	15.25		
Lausen	grube 54	c. 10th	ulna	1	1.9	Adult					
Lausen	grube 28	c. 9th	ulna	1	3.7	indet.					
								Bp	Did	GL	L II
GMZ	Grubenhaus G7	8thC	carpometacarpus	1	4.5	Adult		22.03	10.88	89.66	89.25
Sth	Grubenhaus H	12thC	carpometacarpus	1	2.9	Adult		17.92			
Sth	Grubenhaus E	11thC	femur	1	1.9	juvenile					
Sth	Grubenhaus H	12thC	femur	1	1.2	juvenile					
Sth	Grubenhaus H	12thC	femur	1	0.9	juvenile					
AB	Grubenhaus B1	7thC	femur	1	0.8	juvenile					
GMZ	Gruben G23	12thC	pelvis	1	0.4	indet.					
Sth	Grubenhaus H	12thC	pelvis	1	0.5	juvenile					
								Bd			
Sth	Pfostenbau IV	Early 7thC	radius	1	0.9	indet.		11.99			
Sth	Grubenhaus J	12thC	radius	1	1.6	indet.					
Sth	Grubenhaus A	Early 7thC	sternum	1	2.5	indet.					
GMZ	Gruben G23	12thC	tibia	1	2.7	indet.					
Sth	Grubenhaus E	11thC	tibia	1	0.7	juvenile					
Sth	Grubenhaus J	12thC	ulna	1	1.7	indet.					

Table 6.8.2-1; Contd

Area	Dating	Element	n.	Weight (g)	Age	Butchery	Mass					
jak	5-late 6thC	humerus	1	0.9	adult							
							Dip					
jak	5-late 6thC	tibia	1	1	adult		7.12					
							Did					
jak	5-late 6thC	ulna	1	0.7	adult		7.46					
							Bd	Dd				
Adl	mid 5 - late 6thC	tibia	1	0.7	adult		6.81	5.92				
							Bp	SC	Bd	Lm	Dp	Dd
jak	6thC	femur	1	0.6	adult		9.8	3.63	8.55	43.88	5.56	6.99
							Bd	Dd				
Adl	12thC	tibia	1	0.4	adult		6.45	6.39				

Table 6.8.3-1; Data for the dove elements recorded at Kaiseraugst split by area and date, including age assignation and butchery
All measurements in mm and correspond to those codes in Cohen and Seargantson (1996)
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakoblihaus,

Location	Date	Element	n.	weight (g.)	Age	Sex	Mass			
KA-Adl	mid 5 - late 6thC	antler	1	150	adult	0				
KA-Adl	mid 5 - late 6thC	antler	1	233.8	adult	0				
KA-Adl	mid 5 - late 6thC	antler	1	55.5	indet.	0				
KA-Jak	6thC	antler	6	262.5	indet.	0				
KA-Jak	6thC	antler	2	91.7	indet.	0				
KA-Jak	6thC	antler	2	82.3	indet.	0				
KA-Jak	6thC	antler	4	604	indet.	0				
KA-Jak	6thC	antler	1	16.8	indet.	0				
KA-Jak	beg. 7thC	antler	1	6.8	indet.	0				
KA-Jak	beg. 7thC	antler	1	49.1	indet.	0				
KA-Jak	beg. 7thC	antler	1	44	indet.	0				
KA-Jak	beg. 7thC	antler	1	81.1	indet.	0				
KA-Jak	N/A	antler	1	35.3	indet.	0				
Lausen-G45	c. 11th	antler	10	23.4	indet.	0				
Lausen-G11	first1/2 11thC	antler	1	3.4	indet.	0				
KA-Adl	Mid 4thC	astragalus	1	40.5	indet.	0	BFcr			
KA-Jak	6thC	atlas	1	37.9	indet.	0	68.23			
KA-Jak	4-6thC	axis	1	37	indet.	0				
KA-Jak	4-6thC	axis	1	31.7	indet.	0	BFcr	SBV	BPacd	LCDe
KA-Jak	5th-late 6th	axis	1	132.9	adult	0	74.08	48.23	0	118.3
Lausen-G11	first1/2 11thC	axis	1	6.2	indet.	0				
KA-Adl	Mid 4thC	calcaneus	1	55	indet.	0	GL			
KA-Jak	6thC	calcaneus	1	60.4	indet.	0	114.11			
KA-Adl	mid 5 - late 6thC	cevical	1	35.1	adult	0				
KA-Adl	mid 5 - late 6thC	cevical	1	51.9	indet.	0				
KA-Adl	mid 5 - late 6thC	cevical	1	27.8	indet.	0				
KA-Jak	5th-late 6th	cevical	1	41.8	old adult	0				
KA-Jak	6thC	cevical	1	50	adult	0				
KA-Jak	6thC	cevical	1	142.6	adult	0				
KA-Jak	6thC	cevical	1	76.9	indet.	0				
Lausen-G45	c. 11th	cevical	1	3.4	indet.	0				
Lausen-G11	first1/2 11thC	cevical	1	1.8	indet.	0				

Table 7.1.1-1; Raw data fromRed Deer split by site, area and date, age and sex assignations are also represented
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakoblihaus, GMZ- Gemeindezentrum, sth - Stadthof
AB- Altebrauerei

Location	Date	Element	n.	weight (g.)	Age	Sex	Mass	
Reinach-GMZ	8thC	cevical	1	5.7	indet.	0		
KA-Adl	Mid 4thC	femur	1	77.5	indet.	0	Bp	DC
KA-Jak	6thC	femur	1	100.5	adult	0	88.43	36.7
KA-Jak	6thC	femur	1	90.2	adult	0		
KA-Jak	6thC	femur	1	44.3	indet.	0		
KA-Jak	beg. 7thC	femur	1	10.6	indet.	0	Bd	BT
KA-Jak	5th-late 6th	humerus	1	108.1	indet.	0	56.84	50.75
KA-Jak	6thC	humerus	1	63.7	adult	0	0	49.07
KA-Jak	6thC	humerus	1	249.9	adult	0	55.06	49.34
Lausen-G45	c. 11th	humerus	1	48	indet.	0		
Lausen-G50	Late 6th-late 7th	lower tooth	1	2.8	not adult	0	GL	GB
Lausen-G36	c. 11th	lower tooth	1	5.3	indet.	0	21.46	14.21
Reinach-GMZ	10thC	lower tooth	1	1	indet.	0		
Reinach.AB	8thC	lower tooth	1	1.2	indet.	0		
KA-Jak	4-6thC	lumbar	1	39.9	indet.	0		
Lausen-G54	c. 10th	mandible	1	15.3	indet.	0		
Reinach-GMZ	8thC	maxilla	1	32.6	adult	0		
KA-Jak	5th-late 6th	metacarpal 3+4	1	29.4	adult	0		
Lausen-G8	c. 8/9th C	metacarpal 3+4	1	4.6	indet.	0		
Lausen-G28	c. 9th	metapodial	1	5.9	indet.	0		
KA-Adl	12thC	metatarsal 3+4	1	25.6	indet.	0		
KA-Adl	mid 5 - late 6thC	metatarsal 3+4	1	124	adult	0		

Table 7.1.1-1; Raw data fromRed Deer split by site, area and date, age and sex assignations are also represented

Location	Date	Element	n.	weight (g.)	Age	Sex	Mass		
KA-Adl	mid 5 - late 6thC	metatarsal 3+4	1	98	not adult	0			
Lausen-G50	Late 6th-late 7th	metatarsal 3+4	1	49.6	indet.	0			
Lausen-G50	Late 6th-late 7th	metatarsal 3+4	1	9	indet.	0			
Lausen-G19/52	c. 11th	metatarsal 3+4	1	4.8	indet.	0			
Reinach-GMZ	7thC	metatarsal 3+4	1	18.9	indet.	0			
Reinach-GMZ	9thC	metatarsal 3+4	1	11.8	indet.	0			
Reinach-GMZ	9thC	metatarsal 3+4	1	44	indet.	0			
Reinach-GMZ	11thC	metatarsal 3+4	4	1	indet.	0			
Reinach-Sth	Late 7thC	metatarsal 3+4	1	35.9	indet.	0			
KA-Adl	mid 5 - late 6thC	pelvis	1	65	indet.	0			
KA-Jak	4-6thC	pelvis	1	26.8	indet.	0	LA		
KA-Jak	6thC	pelvis	1	94.4	indet.	0	49.76		
KA-Jak	beg. 7thC	pelvis	1	27.7	indet.	0			
Lausen-G28	c. 9th	pelvis	1	13	indet.	prob male			
Lausen-G54	c. 10th	phalanx 1 post	1	10.5	indet.	0			
Lausen-G28	c. 9th	phalanx 2 ant/post	1	9.5	indet.	0			
Lausen-G11	first1/2 11thC	phalanx 3 ant/post	1	4.2	indet.	0			
KA-Adl	mid 5 - late 6thC	radius	1	143.6	indet.	0	Bp	BFp	
KA-Jak	5th-late 6th	radius	1	63.6	indet.	0	53.21	50.29	
Lausen-G10	c. 11th	radius	1	13.5	indet.	0			
Reinach-GMZ	6thC	radius	1	38.1	indet.	0			
Reinach.AB	7thC	radius	1	10.9	indet.	0			
Reinach.AB	7thC	radius	1	45.8	indet.	0			
KA-Adl	mid 5 - late 6thC	rib	2	20.3	indet.	0			
KA-Jak	5th-late 6th	rib	1	47.9	indet.	0			
KA-Jak	beg. 7thC	rib	1	34.9	indet.	0			
KA-Adl	mid 5 - late 6thC	scapula	1	61.5	indet.	0			
KA-Jak	5th-late 6th	scapula	1	25.2	indet.	0	GLP	LG	BG
KA-Jak	6thC	scapula	1	36.9	indet.	0	49.05	38.34	33.49
KA-Adl	mid 5 - late 6thC	skull	2	45.9	indet.	0			
KA-Jak	4-6thC	skull	1	18.5	indet.	0			
Lausen-G19/52	c. 11th	skull	1	2.2	indet.	0			

Table 7.1.1-1; contd

Location	Date	Element	n.	weight (g.)	Age	Sex	Mass			
Reinach-GMZ	8thC	skull	1	7.1	indet.	0				
Reinach-GMZ	9thC	skull	3	15.9	indet.	0				
Reinach-Sth	Late 7thC	skull	1	18.2	indet.	0	GD burr	d. circ. burr		
KA-Jak	beg. 7thC	skull and antler	1	151.5	adult	0	39.12	126.43		
Reinach-Sth	9thC	skull and antler	1	7.1	indet.	0				
Reinach-Sth	9thC	skull and antler	1	50.5	indet.	0				
KA-Jak	6thC	thoracic	1	16.8	indet.	0				
Lausen-G28	c. 9th	thoracic	1	11.3	indet.	0				
Reinach-GMZ	9thC	thoracic	1	22.5	indet.	0				
KA-Jak	5th-late 6th	tibia	1	100.7	adult	0				
KA-Jak	6thC	tibia	2	57.8	indet.	0				
Lausen-G56	Late 6th-late 7th	tibia	1	39.4	indet.	0				
Reinach-Sth	11thC	tibia	1	46.6	indet.	0	LO	BPC	DPA	SDO
KA-Jak	4-6thC	ulna	1	46.2	adult	0	68.97	28.74	49.25	48.96
Lausen-G10	c. 11th	upper tooth	1	12.2	indet.	0				
Lausen-G45	c. 11th	upper tooth	1	4.7	indet.	0	GL	GB		
Lausen-G19/52	c. 11th	upper tooth	1	14.4	adult	0	25.75	18.25		
Reinach-GMZ	7thC	upper tooth	1	7.5	adult	0				
Reinach-Sth	9thC	upper tooth	1	7.5	adult/senile	0	20.98	18.37		
Reinach-Sth	9thC	upper/lower tooth	1	0.8	indet.	0				

Table 7.1.1-1; contd

All (n.=68)	n.	n%	weight (g.)	weight %
Head*	11	16.18%	272.8	8.47%
Trunk	20	29.41%	836.8	25.99%
Stylopodium	16	23.53%	1130.3	35.10%
Zygopodium	8	11.76%	464.8	14.43%
Autopodium	13	19.12%	515.6	16.01%
Total	68		3220.3	

Table 7.1.1-2 Body area analysis with all sites and time periods conglomerated

*inc 3 skull frags with antler all other antler fragments have been removed.

All data*	n.	n.%
foetal/neonatal	0	0.00%
Infantile	0	0.00%
Infantile or Juvenile	0	0.00%
Juvenile	0	0.00%
Juvenile or subadult	0	0.00%
subadult	0	0.00%
subadult or adult	1	4.55%
not adult	2	9.09%
adult	17	77.27%
old adult	2	9.09%
Total	22	

Table 7.1.1-3 Red deer age analysis, both toothwear and epiphyseal fusion, all sites and time periods combined

Location	Date	Element	n.	g.	Age	Butchery	Mass
KA-Adl	Mid 4thC	tibia	1	24.2	indet.		
KA-Adl	mid 5 - late 6thC	femur	1	17.1	indet.		
KA-Adl	mid 5 - late 6thC	metacarpal 3+4	4	55.4	indet.		
KA-Adl	mid 5 - late 6thC	metatarsal 3+4	1	33.3	indet.		
KA-Adl	mid 5 - late 6thC	tibia	1	21.6	indet.		Bp SD Bd GLpe
KA-Jak	6 thC	phalanx 1	1	3.4	indet.		11.93 8.41 10.52 37.74
Lausen-G10	c. 11thC	metatarsal 3+4	1	3.3	indet.		
Reinach-GMZ	7thC	radius	1	2.3	indet.		
Reinach-GMZ	8thC	humerus	1	6.5	indet.		
Reinach-GMZ	9thC	metatarsal 3+4	2	2.5	indet.		

Table 7.1.1-4; Raw data for Roe deer bones at the three sites here split by area and date
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakoblihaus, GMZ- Gemeindezentrum

Location	Date	Element	n.	g.	Age	Sex	Butchery	Mass
KA-Adl	Mid 4thC	ulna	1	32.1	indet.			
KA-Adl	mid 5 - late 6thC	radius	1	29.3	indet.		Chp	GL
KA-Jak	4-6thC	calcaneus	1	45.2	indet.			105.79
KA-Jak	4-6thC	femur	1	25.9	indet.			Bd
KA-Jak	5th-late 6thC	radius	1	32.2	adult			46.07
								BPC DPA
KA-Jak	5th-late 6thC	ulna	1	61.8	indet.			26.26 49.12
KA-Jak	6 thC	lower tooth	1	27.5	indet.			
Reinach-AB	Late 6-late 7thC	femur	1	14.4	not adult			
Reinach-AB	Late 6-late 7thC	fibula	1	3.7	subadult			
Reinach-AB	Late 6-late 7thC	metacarpal 4	1	6.7				
Reinach-AB	Late 6-late 7thC	skull	1	~700	adult	male		
Reinach-AB	Late 6-late 7thC	upper tooth	1	4.6				
Reinach-AB	n.d.	mandible	1	30.8	adult	female		L cheekt. Row; L m row; L P2-P4; H mand. M1; H mand. M3
Reinach-AB	n.d.	mandible	1	199.6	adult	prob. male		128.21; 83.73; 41.43; 45.67; 58.15
Lausen-G54	c. 10thC	skull	2	21	indet.			

Table 7.1.2-1; Wild boar data from the sites studied here spilt by area and date
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakoblihaus

Location	Date	Element	n.	g.	Age	Butchery	Mass			
KA-Jak	4-6thC	femur	1	0.6	indet.					
KA-Jak	4-6thC	tibia	1	1.3	indet.					
KA-Jak	4-6thC	ulna	1	0.5	indet.					
KA-Jak	4-6thC	humerus	1	0.4	indet.		Bd			
KA-Jak	4-6thC	radius	1	1.3	indet.		11.41			
KA-Jak	5th-late 6thC	tibia	1	2.7	indet.					
KA-Jak	5th-late 6thC	tibia	1	3.8	indet.	Knf ser				
KA-Jak	5th-late 6thC	ulna	1	0.8	indet.		Bp	SD	Bd	GL
KA-Jak	beg. 7thC	phalanx 1 post	1	0.5	indet.		6.43	3.39	4.71	26.55
Lausen-G50	Late 6th-late 7th	femur	1	1.3	indet.		Bp			
Lausen-G28	c. 9th	tibia	1	8.5	adult		20.66			
Lausen-G28	c. 9th	tibia	1	1.8	indet					
Lausen-G28	c. 9th	fibula	1	1.3	indet.					
Lausen-G11	Early 11thC	humerus	1	0.8	indet.					
Lausen-G11	Early 11thC	radius	1	0.4	indet.					
Lausen-G10	c. 11thC	pelvis	1	0.8	indet.					
Lausen-G19/52	c. 11thC	calcaneus	1	1.3	indet.					
Lausen-G19/52	c. 11thC	tibia	1	0.7	indet.					

Table 7.1.3-1; Hare bones identifed here, age assignation by both tooth wear and epiphyseal fusion
Adl- Kaiseraugst Gasthof Adler, Jak- Kaiseraugst Jakobli-Haus

Species	location	Date	Element	n.	g.	Age	Butchery
Vulpes vulpes	Lausen-G28	c. 9th	mandible	1	7.8	adult	knf mks
Canis lupus	Lausen-G45	c. 11th	lower tooth	1	3.9		
Ursus arctos	Lausen-G36	c. 11th	metatarsal 2	1	5.6		
Mustela erminea/nivalis	Lausen-G11	first half 11thC	metatarsal 3	1	0.1		
Mustela erminea/nivalis	Lausen-G11	first half 11thC	phalanx 1 ant/post	1	0		

Table 7.1.4-1; Other mammals recorded in the study split by site and date, alsp showing age and butchery data
knf mks - knife marks

Site/area	Structure	Dating	Species	Element	n.
Lausen	grube 56	Late 6th-late 7th	*Arvicola terrestris*	upper/lower tooth	1
Lausen	grube 50	Late 6th-late 7th	*Talpa europaeus*	skull	1
Lausen	grube 20	c. 11th	*Sciurus vulgaris*	tibia	1
Lausen	grube 36	c. 11th	*Talpa europaeus*	skull	1
Lausen	grube 10	c. 11th	*Arvicola terrestris*	mandible	1
Lausen	grube 10	c. 11th	*Microtus spp*	femur	1
Lausen	grube19/52	c. 11th	*Apodemus spp*	femur	1
Lausen	grube 20	c. 11th	*Rattus spp*	femur	1
Lausen	grube 45	c. 11th	*Microtus spp*	femur	1
Lausen	grube 11	Early 11thC	*Apodemus flavicollis*	mandible	1
Lausen	grube 11	Early 11thC	*Apodemus spp*	tibia	1
Reinach Sth	S2	c. 600 AD	*Gliridae*	femur	1
Reinach-Sth	Pfostengrube	Early 7thC	*Talpa europaeus*	scapula	1
Reinach.AB	B1	7thC	*Talpa europaeus*	mandible	3
Reinach GMZ	G2*	Late 6th-late 7th	*Rodentia indet.*	long bones and skull	50
Reinach GMZ	G2*	Late 6th-late 7th	*microtus spp.*	maxilla	3
Reinach GMZ	G2*	Late 6th-late 7th	*microtus avarlis*	teeth	6
Reinach GMZ	G2*	Late 6th-late 7th	*Apodimus sylvaticus*	teeth	5
Reinach GMZ	G2*	Late 6th-late 7th	*Microtus agretis*	teeth	1
Reinach GMZ	G2*	Late 6th-late 7th	*Apodemus flavicollis*	teeth	2
Reinach GMZ	G2*	Late 6th-late 7th	*Mus musculus*	teeth	2
				Total	85

Table 7.2-1; The rodent populations recorded in the sites here, * denotes elements recorded in the seived remains; Sth- Stadthof, GMZ- Gemeindezentrum, AB- Altebrauerei

Figure 7.3.1-1; A selection of the stock bones found in the ninth Cetury infilling of ‘grube 28’ from Lausen. The three uppermost long bones are all ulnae followed by a juvenile tibiotarsus and give the MNI of 4, below these is a first anterior phalange and the lowest fragment is the front portion of the beak. Scale one major divison on the scale represents 10mm.

Site	Area	Dating	Species	Element	n.	(g.)
KA	Jakobli-Haus	4-6thC	Passeriformes	coracoid	1	0.1
KA	Jakobli-Haus	4-6thC	Passeriformes	femur	1	0.1
KA	Jakobli-Haus	4-6thC	Passeriformes	mandible	1	0.1
KA	Jakobli-Haus	4-6thC	Passeriformes	radius	1	0.0
KA	Jakobli-Haus	4-6thC	Passeriformes	tarsometatarsus	1	0.0
KA	Jakobli-Haus	4-6thC	Passeriformes	tarsometatarsus	1	0.0
KA	Jakobli-Haus	4-6thC	Passeriformes	tibiotarsus	1	0.1
KA	Jakobli-Haus	4-6thC	Picoides spec.	coracoid	1	0.1
KA	Jakobli-Haus	4-6thC	Turdidae	tarsometatarsus	1	0.1
Lausen	grube 45	c. 11th	*Garrulus glandarius*	ulna	1	0.3
KA	Jakobli-Haus	6thC	*Garrulus glandarius*	tibiotarsus	1	0.2
KA	Jakobli-Haus	5th-late 6th	*Garrulus glandarius*	tarsometatarsus	1	0.4
KA	Jakobli-Haus	4-6thC	*Garrulus glandarius*	carpometacarpus	1	0.2
KA	Jakobli-Haus	5-late 6th	*Perdix perdix*	tibia	1	0.9
KA	Jakobli-Haus	4-6thC	*Perdix perdix*	coracoid	1	0.6
KA	Jakobli-Haus	4-6thC	*Perdix perdix*	scapula	1	0.2
				Total	16	3.4

Table 7.3.2-1; Small birds found at the studied sites split by site area and date, KA- Kaiseraugst

Site	Area	Dating	Species	Element	n.	(g.)
KA	Jakobli-Haus	4-6thC	Corvidae	coracoid	1	0
KA	Jakobli-Haus	4-6thC	Corvidae	coracoid	1	0.1
KA	Jakobli-Haus	4-6thC	Corvidae	humerus	2	0.5
KA	Jakobli-Haus	4-6thC	Corvidae	tibiotarsus	1	0.2
KA	Jakobli-Haus	4-6thC	Corvidae	ulna	4	0.5
Lausen	grube 65	Late 7- 8thC	Corvus spec.	tarsometatarsus	1	0.6
Reinach	Stadthof	12thC	Corvus spec.	femur	1	0.3
KA	Jakobli-Haus	4-6thC	*Corvus c.c./cornix*	mandible	1	0.1
KA	Jakobli-Haus	4-6thC	*Corvus c.c./cornix*	tarsometatarsus	1	0.1
KA	Jakobli-Haus	5-late 6th	*Corvus c.c./cornix*	humerus	1	0.7
Lausen	grube28	c. 9thC	*Corvus c.c./cornix*	tarsometatarsus	1	0.3
Lausen	grube 11	early 11thC	*Corvus c.c./cornix*	ulna	1	2.1
Reinach	GMZ	12thC	*Corvus c.c./cornix*	tarsometatarsus	1	0.4
Reinach	GMZ	12thC	*Corvus c.c./cornix*	tibiotarsus	1	0.2
KA	JAK	4-6thC	*Corvus corone*	radius	1	0.1
				Total	19	6.2

Table 7.3.3.2-1; Corvid remains indentified by site area and date, KA- Kaiseraugst, GMZ-Gemeindezentrum

Site	Area	Dating	Species	Element	age	n.	(g.)
KA	Jakobli-Haus	4-6thC	Anas spec.	tibiotarsus	indet.	1	0.9
KA	Jakobli-Haus	6thC	Anas spec.	tarsometatarsus	adult	1	1
KA	Adl	12thC	Anas spec.	radius	adult	1	0.7
Lausen	grube 65	Late 7-8th	Anas spec.	carpometacarpus	adult	1	0.8
Lausen	grube 28	c. 9th	Anas spec.	ulna	adult	1	0.8
Lausen	grube 54	c. 10th	Anas spec.	tarsometatarsus	indet.	1	0.6

Table 7.3.4-1; Duck remains indentified by site area and date, KA- Kaiseraugst, Adl- Gasthof Adler

Site	Area	Dating	Species	Element	n.	(g.)
Reinach	Stadthof	Late 7thC	*Buteo Buteo*	carpometacarpus	1	1.4
Reinach	Stadthof	Late 7thC	*Buteo Buteo*	phalanx 1 ant	1	0.5
Lausen	grube 56	Late 6-late 7th	*Strix aluco*	scapula	1	0.4

Table 7.3.5-1; Birds of prey identified by site area and date

Site	Structure	Date	Species	Element	Count	Weight (g)	Size (cm)
KA Jak	oberstes spätrömanishes Bodenniveau	4-6thC	*Barbus barbus*	First fin ray	1	0.3	
KA Jak	oberstes spätrömanishes Bodenniveau	4-6thC	*Pisces Indet*	Rib	2	0.1	
KA Jak	ziegelschutthorizont	5-late 6th	*Barbus barbus*	Cleithrum	1	1.9	~60-70
KA Jak	ziegelschutthorizont	5-late 6th	*Salmo salar/trutta*	Vertebra precaudal	1	1.2	~80
KA Jak	unterer humusbereich	6thC	*Barbus barbus*	First fin ray	1	0.6	
Reinach GMZ	G2	late 6thC	*Salmo salar/trutta*	Vertebra	1	0.3	~80
Reinach GMZ	G2*	late 6thC	*Pisces Indet*	Indet.	250	25	
Lausen	G28	c 9thC	*Esox lucius*	back or anal finspine	2	<0.1	

Table 7.4-1; Fish remains identified from the faunal material studied here, KA Jak- Kaiseraugst Jakoblihaus, GMZ Gemeindezentrum

* - denotes identified within the sieved remains

Site/area	Structure	Dating	Species	Element	n.	Weight (g.)
Lausen	grube 56	Late 6-late 7thC	*Amphibia*	tibia and fibula	1	0.0
Lausen	grube 56	Late 6-late 7thC	*Bufo spp*	tibia and fibula	1	0.1
Lausen	grube 50	Late 6-late 7thC	*Rana temporaria*	tibia and fibula	1	0.1
Lausen	grube 65	Late 7-late 8thC	*Bufo bufo*	femur	1	0.1
Lausen	grube 65	Late 7-late 8thC	*Bufo Calamita*	femur	1	0.1
Lausen	grube 28	c. 9thC	*Bufo spp*	femur	1	0.2
Lausen	grube 28	c. 9thC	*Bufo spp*	femur	1	0.1
Lausen	grube 28	c. 9thC	*Bufo spp*	tibia and fibula	1	0.2
Lausen	grube 28	c. 9thC	*Rana spp*	tibia and fibula	1	0.1
Lausen	grube 28	c. 9thC	*Rana spp*	tibia and fibula	1	0.0
Lausen	grube 54	c. 10thC	*Rana esculenta*	tibia and fibula	1	0.1
Lausen	grube 54	c. 10thC	*Rana spp*	tibia and fibula	1	0.1
Lausen	grube 54	c. 10thC	*Rana temporaria*	tibia and fibula	1	0.1
Lausen	grube19/52	c. 11thC	*Bufo bufo*	pelvis	2	0.3
Lausen	grube19/52	c. 11thC	*Bufo Calamita*	femur	1	0.1
Lausen	grube 57	c. 11thC	*Bufo Calamita*	femur	1	0.1
Lausen	grube19/52	c. 11thC	*Rana temporaria*	radius and ulna	1	0.1
Lausen	grube 11	Early 11thC	*Bufo bufo*	radius and ulna	1	0.1
Lausen	grube 11	Early 11thC	*Bufo bufo*	tibia and fibula	2	0.0
Lausen	grube 11	Early 11thC	*Rana spp*	humerus	1	0.0
Reinach AB	Grubenhaus B1	Late 6-late 7thC	*Amphibia*	femur	1	0.1
Reinach AB	Grubenhaus B1	Late 6-late 7thC	*Bufo spp*	femur	1	0.1
Reinach AB	Grubenhaus B3	Late 7-late 8thC	*Amphibia*	tibia and fibula	1	0.0
Reinach AB	Grubenhaus B3	Late 7-late 8thC	*Rana temporaria*	tibia and fibula	1	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Amphibia*	long bone	1	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Amphibia*	tibia and fibula	1	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Bufo bufo*	femur	1	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Bufo bufo*	femur	1	0.1
Reinach AB	Grubenhaus A502	Early 8thC	*Bufo spp*	femur	2	0.1
Reinach AB	Grubenhaus A502	Early 8thC	*Rana spp*	tibia and fibula	5	0.2
Reinach AB	Grubenhaus A502	Early 8thC	*Rana spp*	femur	2	0.1
Reinach AB	Grubenhaus A502	Early 8thC	*Rana spp*	humerus	1	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Rana spp*	tibia and fibula	2	0.0
Reinach AB	Grubenhaus A502	Early 8thC	*Rana temporaria*	tibia and fibula	3	0.2
Reinach AB	Grubenhaus A502	Early 8thC	*Rana temporaria*	pelvis	2	0.1
Reinach AB	Grubenhaus A502	Early 8thC	*Rana temporaria*	tibia and fibula	1	0.1
Reinach GMZ	Grubenhaus G7	8thC	*Bufo spp*	pelvis	1	0.2
Reinach Sth	Grubenhaus K1	Early 11thC	*Rana spp*	humerus	1	0.5
Reinach Sth	Grubenhaus K1	Early 11thC	*Rana spp*	phalanx 1 post	1	0.0
Reinach Sth	Grubenhaus K1	Early 11thC	*Rana spp*	radius and ulna	1	0.1
Reinach Sth	Grubenhaus K1	Early 11thC	*Rana spp*	tibia and fibula	1	0.2
Reinach Sth	Grubenhaus K1	Early 11thC	*Rana spp*	femur	1	0.4
Reinach Sth	Grubenhaus S10	Early/mid 12thC	*Amphibia*	tibia and fibula	2	0.2
KA Jak	spätröm. Bodenniveau	4-6 thC	Amphibia	pelvis	1	0.2

Table 7.5-1; Amphibian remains from the sites studied here according to structure, AB- Altebrauerei, GMZ- Gemeindezentrum, Sth- Stadthof, KA Jak- Kaiseraugst Jakobli-Haus

Reinach	n.	n.%	weight g.	g.%
Rana spp.	22	64.71%	1.9	70.37%
Bufo spp.	6	17.65%	0.5	18.52%
indet.	6	17.65%	0.3	11.11%
Total Reinach	34		2.70	

Lausen	n.	n.%	weight g.	g.%
Rana spp.	8	36.36%	0.6	22.22%
Bufo spp.	13	59.09%	1.4	51.85%
indet.	1	4.55%	0.0	0.00%
Total Lausen	22		2.00	

Table 7.5-2; Summarised results of the proportions of frog and toad species by number of fragments and weight at Reinach and Lausen,

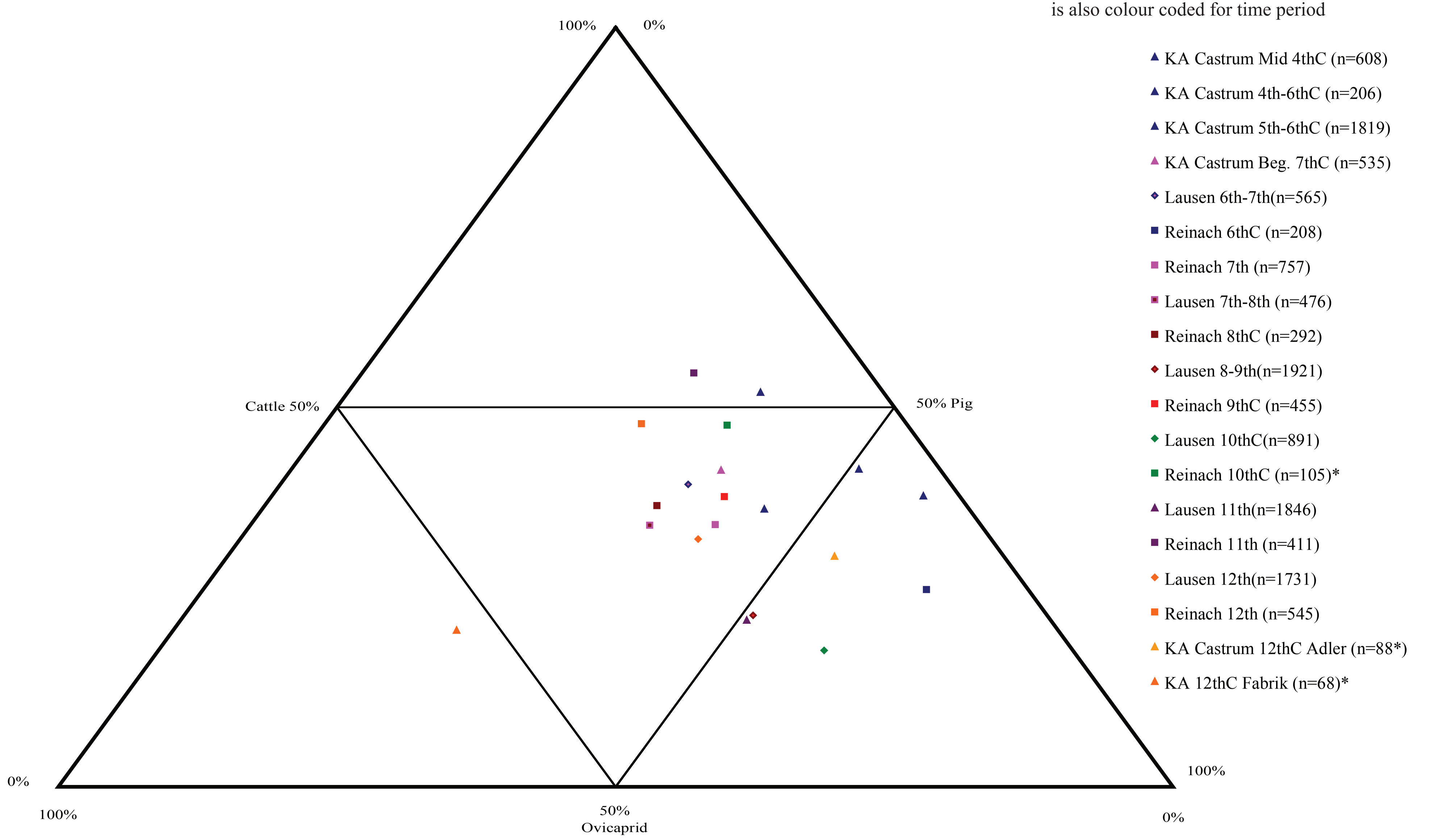


Fig. 8.1.4-1; Triangle plot to show the proportions of the three main domestic species at each period of each site (Kaiseraugst-triangle, Lausen-diamond, Reinach-square); the diagram is also colour coded for time period

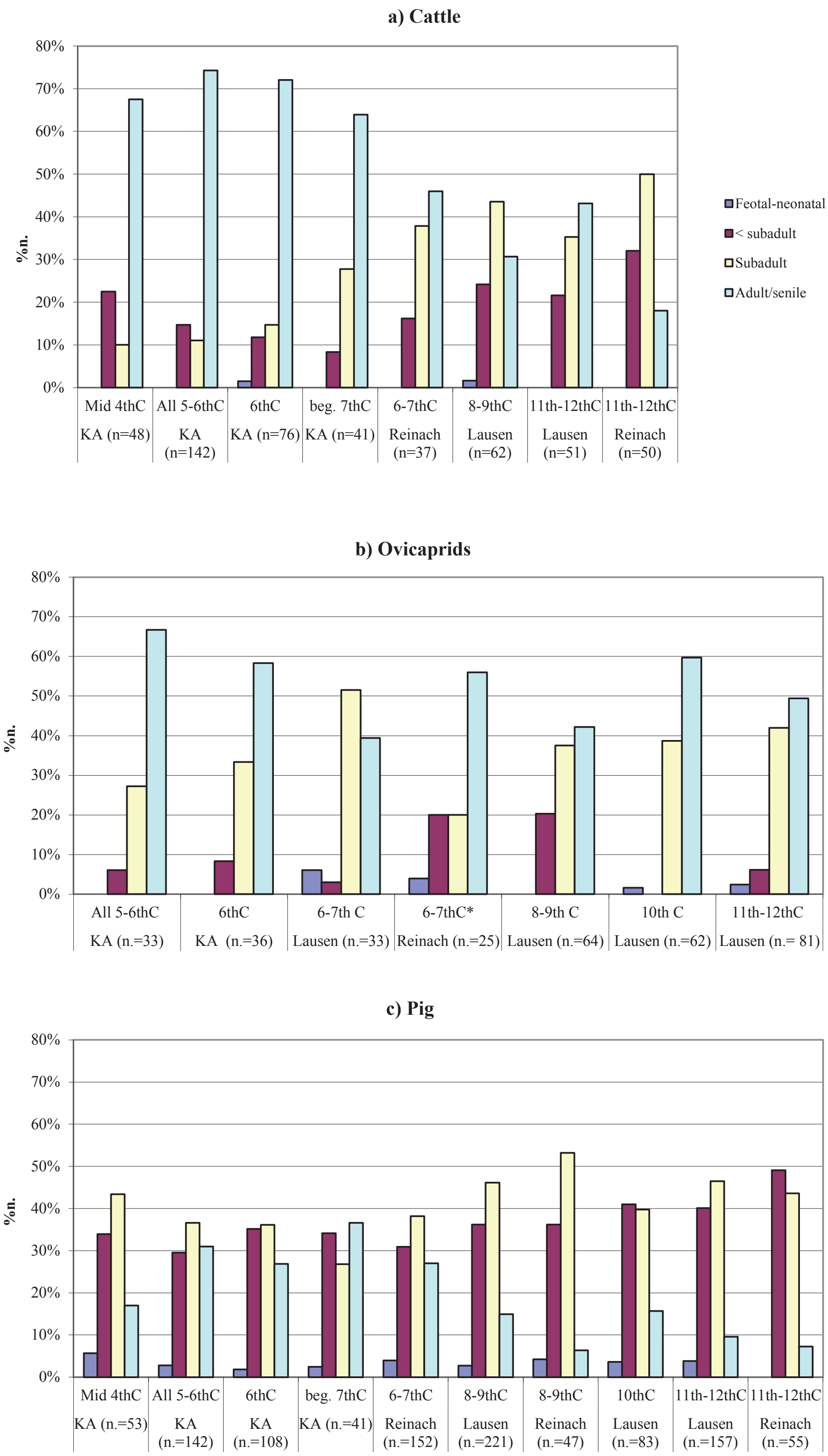


Fig. 8.1.4-2; The comparative age structures of the three main species a) cattle, b) ovicaprids and c) pigs
The periods shown here are those that are statisically large, those that are small are indicated by an *
KA - Kaiseraugst

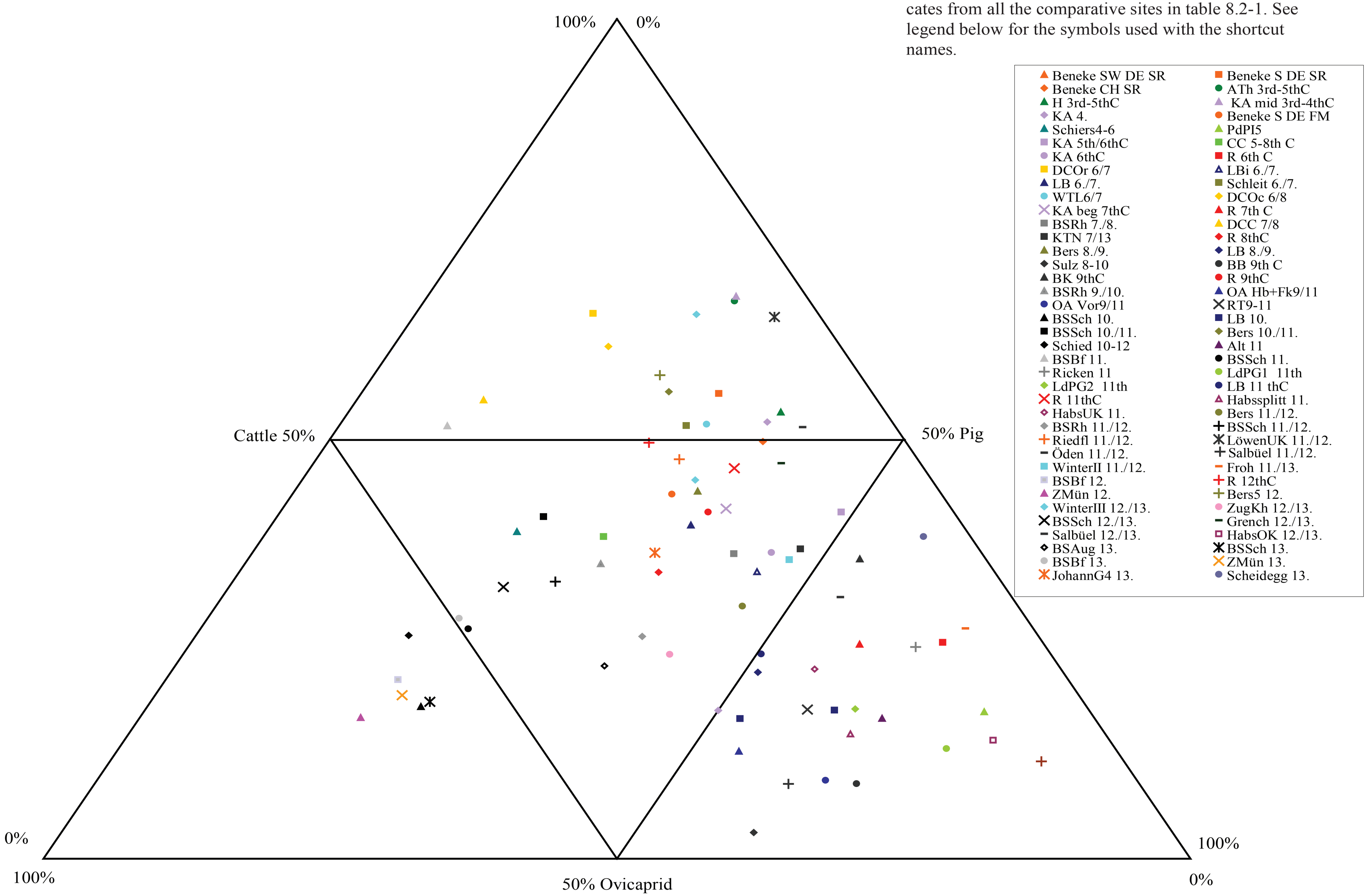
Site	Shortcut name	Settlement Type	Period	Dating	Location	total n.	n. Domestic	% Domestic	n.Wild species	% Wild species	Wild species diversity	n.% Cattle	n.% O/C	n.% Pig	n.% Equids	n.% Dog	n.% Cat	n.% Chicken	n.% Goose	n.% Red deer	n.% Roe deer	n.% Wildboar	Literature
Kaiseraugst-Castrum	KA 4.	S	SR/FM	mid 4thC	JU-NW	636	631	99.21	5	0.79	3	49.80	10.55	35.43	1.42	0.00	0.00	1.73	0.16	0.47	0.16	0.16	
Schiers	Sch4-6	L	SR/FM	4-6thC	SE-GR	1225	1178	96.16	47	3.84	8	39.00	38.70	22.20	3.82	0.17	0.08	2.30	0.20	1.63	0.00	0.82	Hartmann-Frick 1975
Potiers de Portout	PdPI5	L	SR/FM	5thC	FR -Sa	530	500	94.34	30	5.66	6	16.22	8.87	66.23	0.00	0.19	0.57	9.81	0.00	0.75	0.00	0.00	Olive 1990
Kaiseraugst-Castrum	KA 5th/6thC	S	FM	5-6thC	JU-NW	1847	1811	98.05	36	1.95	6	38.48	9.35	45.19	1.21	0.38	0.05	3.02	0.11	1.15	0.38	0.16	
Courtedoux-Creugenaut	CC 5-8th C	L	FM	5-8thC	JU-NW	5601	5547	99.04	54	0.96	8	38.50	31.70	29.90	2.70	0.32	0.04	2.40	0.19	0.10	0.02	0.07	Putelat 2005
Kaiseraugst-Castrum	KA 6htC	S	FM	6th C	JU-NW	1204	1184	98.34	20	1.66	4	34.44	17.30	42.43	1.00	0.08	0.08	2.75	0.33	1.25	0.08	0.08	
Reinach	R 6th C	L	FM	6th C	JU-NW	214	214	100.00	0	0.00	0	25.23	8.88	63.08	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Develier-Courtételle ori	DCOr6-7	L	FM	6-7thC	JU-NW	2881	2873	99.72	8	0.28	4	56.82	16.97	13.85	11.14	0.59	0.00	0.35	0.00	0.07	0.00	0.03	Olive 2008
Lausen-BettenachH	LBi 6./7.	L	FM	6-7thC	JU-NW	1223	1183	96.73	40	3.27	15	30.34	18.32	39.74	2.53	0.41	0.10	5.07	0.16	0.98	0.25	0.00	Hüster-plogmann and Veszeli n.d.
Lausen-Bettenach	LB 6./7.	L	FM	6-7thC	JU-NW	393	386	98.22	7	1.78	4	37.12	21.97	34.09	3.28	0.51	0.00	0.51	0.00	1.01	0.00	0.00	
Schleitheim-Brüel SH	Schleit 6./7.	L	FM	6-7thC	MI-O	3949	3914	99.11	35	0.89	3	50.50	17.70	29.70	2.20	0.60	0.00	0.50	0.00	0.80	0.00	0.00	Rehazek 2002
Winterthur-Technikumstr.	WTL6/7	L	FM	6-7thC	MI-O	715	708	99.02	7	0.98	3	49.79	15.66	30.77	2.30	0.10	0.00	0.40	0.00	0.70	0.00	0.10	Stopp 2010
Develier-Courtételle occ	DCOc6-8	L	FM	6-8thC	JU-NW	10318	10278	99.61	40	0.39	10	58.83	19.35	18.39	2.48	0.05	0.03	0.45	0.04	0.17	0.04	0.02	Olive 2008
Kaiseraugst-Castrum	KA beg 7thC	S	FM	Beg. 7thC	JU-NW	692	687	99.28	5	0.72	2	40.00	18.80	37.00	1.30	0.30	0.00	1.50	0.00	0.75	0.00	0.00	
Reinach	R 7th C	L	FM	7th C	JU-NW	837	821	98.09	16	1.91	5	23.75	15.03	53.43	1.67	0.56	0.37	2.04	0.56	0.74	0.19	0.93	
Basel-Reischacherhof, D+E	BSReis 7./8.	S	FM	7-8thC	JU-NW	1051	1041	99.05	10	0.95	5	33.20	19.70	38.20	0.50	0.20	0.00	6.90	0.00	0.40	0.10	0.00	Morel n.d.
Develier-Courtételle Cent	DCC7-8	L	FM	7-8thC	JU-NW	736	731	99.32	5	0.68	3	49.86	30.84	10.60	7.74	0.00	0.14	0.14	0.00	0.14	0.00	0.41	Olive 2008
Karlburg Talseidlung North	KTN	L	FM/HM	7-13thC	DE-Byn	7425	7368	99.23	57	0.77	8	37.00	15.70	47.30	6.98	0.26	0.11	0.80	0.30	0.40	0.20	0.10	Kerth, Ettel & Obst 2001
Reinach	R 8thC	L	FM	8th C	JU-NW	320	315	98.44	5	1.56	2	31.25	26.56	33.44	1.56	0.00	0.00	5.31	0.31	1.25	0.31	0.00	
Berslingen, Ph2b	Bers 8./9.	L	FM	8-9thC	MI-O	671	629	93.74	42	6.26	2	39.20	18.78	31.45	0.75	0.00	0.00	3.58	0.00	5.51	0.75	0.00	Rehazek 2000
Lausen-Bettenach	LB 8./9.	L	FM	8-9thC	JU-NW	2098	2082	99.24	16	0.76	6	21.25	25.20	48.31	1.43	0.29	0.05	2.10	0.57	0.19	0.00	0.00	
Sulzbach 8-10	Sulz 8-10	B	FM	8-10thC	DE-Byn	5891	5292	89.83	599	10.17	15	3.50	36.40	60.10	0.06	0.04	0.00	3.00	1.10	2.40	0.90	1.20	Pasda 2004
Burg Bamberg	BB 9th C	B	FM	9th C	DE-Byn	928	901	97.09	27	2.91	4	8.40	22.50	59.80	1.60	0.50	0.00	4.20	0.20	1.60	0.50	0.00	Kerth, Ettel, Hartmann, and Langraf 1999
Burgkunstadt	BK 9thC	B	FM	9th C	DE-Byn	1280	1247	97.42	33	2.58	5	31.20	9.80	46.10	7.80	0.20	0.00	1.60	0.50	1.70	0.10	0.30	Kerth, Ettel, Hartmann, and Langraf 1999
Reinach	R 9thC	L	FM	9thC	JU-NW	503	491	97.61	12	2.39	2	36.58	18.89	33.00	3.58	0.40	0.20	4.97	0.00	1.99	0.40	0.00	
Basel-Reischacherhof, C	BSReis 9./10.	S	FM	9-10thC	JU-NW	192	190	98.96	2	1.04	2	32.30	30.70	28.60	0.50	0.50	0.50	5.00	0.50	0.50	0.00	0.00	Morel n.d.
Oberammertal	OA Hb+Fk	B	FM/HM	9-11thC	DE-Byn	536	516	96.27	20	3.73	6	11.94	29.96	49.25	3.36	0.37	0.00	1.49	0.19	2.34	0.19	0.37	Kerth, Ettel, Hartmann, and Langraf 1999
Oberammertal Vorburg	OA Vor9-11	B	FM/HM	9-11thC	DE-Byn	729	713	97.81	16	2.19	4	9.20	25.93	60.10	2.10	0.00	0.00	0.50	0.00	1.50	0.00	0.30	Kerth, Ettel, Hartmann, and Langraf 1999
Rosstal	RT9-11	B	FM/HM	9-11thC	DE-Byn	15011	14503	96.62	508	3.38	12	16.50	22.50	52.50	1.70	0.20	0.03	2.30	0.30	2.70	0.20	0.10	Vagedes and Peters 2001
Basel Schneidergasse 1	BSSch 10.	S	FM	10thC	JU-NW	807	804	99.63	3	0.37	2	18.00	56.00	23.90	0.40	0.00	0.10	1.20	0.00	0.00	0.00	0.00	Reich 1995
Lausen-Bettenach	LB 10.	L	FM	10thC	JU-NW	1019	1014	99.51	5	0.49	3	15.66	19.47	52.05	6.85	0.10	0.10	3.42	1.57	0.20	0.00	0.20	
Basel Schneidergasse 4	BSSch 10./11.	S	FM/HM	10-11thC	JU-NW	648	646	99.69	2	0.31	1	39.80	34.70	23.00	1.90	0.00	0.20	0.00	0.00	0.00	0.30	0.00	Reich 1995
Berslingen, Ph3b	Bers3b 10./11.	L	FM/HM	10-11thC	MI-O	357	356	99.72	1	0.28	1	48.74	15.41	23.53	0.84	0.56	0.00	10.64	0.00	0.00	0.00	0.00	Rehazek 2000
Burg Schiedberg	Schied10-12	B	FM/HM	10-12thC	SE-GR	4104	4038	98.39	66	1.61	10	26.80	54.10	19.20	0.97	0.07	0.02	0.80	0.20	0.54	0.00	0.00	Küpper 1972; Scholz 1972; von den Driesch 1973
Altenburg	Alt11	B	HM	11thC	JU-NW	21292	20573	96.62	719	3.38	9	17.00	18.80	64.30	0.01	0.04	0.03	5.70	0.80	0.90	0.38	0.25	Marti-Grädel 2008
Basel-Barfüsserkirche	BSBf 11.	S	HM	11thC	JU-NW	3778	3767	99.71	11	0.29	7	50.26	37.43	9.82	1.30	0.05	0.05	0.16	0.21	0.05	0.00	0.03	Schibler and Stopp 1987
Basel Schneidergasse 2	BSSch 11.	S	HM	11thC	JU-NW	1486	1483	99.80	3	0.20	2	26.70	47.10	23.10	0.30	0.00	0.10	2.00	0.60	0.00	0.00	0.00	Reich 1995
Burg Rickenbach	Ricken 11	B	HM	11thC	MI-O	538	497	92.38	41	7.62	5	25.40	11.70	62.80	0.60	5.23	0.00	1.30	0.40	6.32	0.00	0.19	Stampfli 1972
Lac de Paladru Gb1	LdPG1 11th	L	HM	11thC	FR-Ir	4898	4860	99.22	38	0.78	3	13.40	15.10	71.50	0.00	0.04	0.04	1.10	0.00	0.06	0.24	0.00	Olive 1993
Lac de Paladru Gb2	LdPG2 11th	L	HM	11thC	FR-Ir	4533	4482	98.87	51	1.13	3	18.10	20.50	61.40	0.07	0.09	0.04	3.50	0.00	0.00	0.00	0.00	Olive 1993
Lausen-Bettenach	LB11	L	HM	11thC	JU-NW	2093	2067	98.76	26	1.24	10	22.99	23.60	46.91	3.53	0.28	0.05	1.22	0.19	0.57	0.05	0.00	
Reinach	R 11	L	HM	11thC	JU-NW	277	274	98.92	3	1.08	2	43.68	15.52	34.66	1.08	0.00	0.00	3.25	0.72	0.72	0.00	0.00	
Habsburg Splittplanie	Habssplitt 11.	B	HM	11thC	MI-O	239	211	88.28	28	11.72	5	13.00	19.20	53.60	0.00	0.00	0.00	2.10	0.40	7.90	0.00	0.00	Schibler and Veszeli 1997
Habsburg untere Kulturschicht	HabsUK 11.	B	HM	11thC	MI-O	796	756	94.97	40	5.03	8	20.90	19.80	51.00	0.00	0.00	0.00	2.40	0.90	2.40	0.10	1.40	Schibler and Veszeli 1997

Fig.8.2-1; Comparative site results for species representation; Settlement types S-Urban, L-Rural, B-Castle; Period SR-Late Roman, FM-Early Medieval, HM- High Medieval; Location JU-NW - Jura-Northwest Switzerland, SE-GR - Southeast Switzerland Graubunden, FR-Sa - France- Savoir, MI-O - Swiss Midlands- East, DE-Byn - Germany- Bayern, FR-Ir - France- Ir?, MI-W - Swiss midlands west; n. - fragment count; na - not available

Site	Shortcut name	Type	Period	Dating	Location	total n.	n. Domestic	% Domestic	n.Wild species	% Wild species	Wild species diversity	n.% Cattle	n.% O/C	n.% Pig	n.% Equids	n.% Dog	n.% Cat	n.% Chicken	n.% Goose	n.% Red deer	n.% Roe deer	n.% Wildboar	Literature
Berslingen, Ph4	Bers4 11./12.	L	HM	11-12thC	MI-O	425	418	98.35	7	1.65	3	28.47	22.59	43.06	1.18	0.47	0.00	1.88	0.24	0.47	0.00	0.00	Rehazek 2000
Basel-Reischacherhof, A+B	BSRh11./12.	S	HM	11-12thC	JU-NW	1931	1916	99.22	15	0.78	6	25.20	32.40	36.90	0.20	0.00	0.00	4.20	0.30	0.40	0.10	0.00	Morel n.d.
Basel Schneidergasse 5	BSSch11./12.	S	HM	11-12thC	JU-NW	649	648	99.85	1	0.15	1	33.20	38.50	28.50	0.20	0.00	0.00	0.80	0.20	0.20	0.00	0.00	Reich 1995
Eptingen, Riedfluh	Riedfl 11./12.	B	HM	11-12thC	JU-NW	2136	2036	95.32	100	4.68	6	42.56	18.49	28.37	0.14	0.00	0.09	5.66	0.00	0.09	0.09	0.00	Kaufmann 1988
Löwenburg UK	LöwenUK 11./12.	B	HM	11-12thC	JU-NW	225	206	91.56	19	8.44	4	64.40	4.20	31.40	0.00	0.49	0.00	6.80	0.00	0.00	0.00	0.00	Häsler 1980
Ödenburg b. Weslingen	Öden 11./12.	B	HM	11-12thC	JU-NW	4299	4271	99.35	28	0.65	5	51.40	8.30	40.30	0.35	0.07	0.00	0.80	0.00	0.05	0.05	0.00	Kaufmann 1991; Marti-Grädel 2008
Salbüel, LU	Salbüel 11./12.	B	HM	11-12thC	MI-O	725	716	98.76	9	1.24	5	9.00	29.80	58.60	0.00	0.00	0.00	1.20	0.10	0.00	0.30	0.00	Morel 1991
Winterthur, Phase II	WinterII 11./12.	S	HM	11-12thC	MI-O	664	661	99.55	3	0.45	2	33.90	16.40	44.60	0.00	0.00	0.00	3.30	1.40	0.30	0.00	0.00	Hartmann-Frick 1994
Frohburg	Froh 11./13.	B	HM	11-13thC	JU-NW	4394	4042	91.99	352	8.01	9	27.60	6.40	66.00	0.20	0.02	0.02	na	na	5.14	0.91	0.57	Schibler 1991; Marti-Grädel 2008
Basel-Barfüsserkirche	BSBf 12.	S	HM	12thC	JU-NW	789	782	99.11	7	0.89	6	20.41	54.50	19.77	1.65	0.76	0.89	0.51	0.25	0.13	0.13	0.00	Schibler and Stopp 1987
Reinach	R 12	L	HM	12thC	JU-NW	484	481	99.38	3	0.62	1	45.04	20.25	25.62	1.24	1.24	0.00	4.34	1.65	0.00	0.00	0.00	
Zürich Münsterhof A	ZMün 12.	S	HM	12thC	MI-O	973	932	95.79	41	4.21	12	12.50	46.10	14.60	0.80	1.30	3.60	13.10	3.90	0.60	0.00	0.10	Csont 1982
Berslingen, Ph5	Bers5 12.	L	HM	late 12thC	MI-O	462	449	97.19	13	2.81	2	54.55	16.45	23.81	1.08	0.00	0.00	0.43	0.00	0.00	0.00	0.00	Rehazek 2000
Winterthur, Phase III	WinterIII 12./13.	S	HM	12-13thC	MI-O	935	926	99.04	9	0.96	3	43.70	19.90	33.20	0.90	0.00	0.00	0.90	0.50	0.20	0.00	0.50	Hartmann-Frick 1994
Zug Kaufhaus, I-III	ZugKh12./13.	S	HM	12-13thC	MI-O	473	470	99.37	3	0.63	3	23.70	31.90	41.00	0.00	0.00	0.00	2.70	0.00	0.00	0.00	0.00	Rehazek n.d.
Basel Schneidergasse 6	BSSch 12./13.	S	HM	12-13thC	JU-NW	635	635	100.00	0	0.00	0	31.80	42.20	23.80	0.80	0.20	0.00	1.10	0.20	0.00	0.00	0.00	Reich 1995
Burg Grenchen	Grench 12./13.	B	HM	12-13thC	JU-NW	1509	1453	96.29	56	3.71	6	44.20	11.50	38.10	0.10	0.00	0.00	1.70	0.70	0.90	1.50	0.50	Stampfli 1962
Salbüel, LU	Salbüel 12./13.	B	HM	12-13thC	MI-O	419	415	99.05	4	0.95	2	31.00	15.00	53.00	0.00	0.00	0.00	0.00	0.20	0.00	0.20	0.00	Morel 1991
Habsburg obere Kulturschicht	HabsOK 12./13.	B	HM	12-13thC	MI-O	1501	1350	89.94	151	10.06	21	11.90	8.80	62.00	0.00	0.10	0.00	6.50	0.60	0.90	0.00	0.70	Veszeli n.d. data from Marti-Grädel 2008
Basel- Augustinergasse	BSAug 13.	S	HM	13thC	JU-NW	1266	1260	99.53	6	0.47	3	15.60	26.40	25.30	0.60	0.10	3.80	27.10	0.20	0.20	0.00	0.10	Schibler 1996
Basel Schneidergasse 3	BSSch 13.	S	HM	13thC	JU-NW	458	454	99.13	4	0.87	3	18.10	53.70	23.80	0.20	0.00	0.00	2.80	0.40	0.20	0.00	0.00	Reich 1995
Basel-Barfüsserkirche, total	BSBf 13.	S	HM	13thC	JU-NW	3651	3631	99.45	20	0.55	15	27.14	45.93	21.14	1.18	0.14	0.14	2.93	0.58	0.03	0.08	0.11	Schibler and Stopp 1987
Zürich Münsterhof C	ZMün 13.	S	HM	13thC	MI-O	916	887	96.83	29	3.17	7	17.70	52.20	19.90	1.10	2.80	0.00	2.40	0.50	0.90	0.00	0.00	Csont 1982
SH-Stadtkirche St. Johann G4	JohannG4 13.	S	HM	13thC	MI-O	805	548	68.07	257	31.93	8	15.90	12.30	15.30	1.50	0.00	4.30	18.60	0.10	0.20	1.60	0.00	Markert 1990; Markert n.d.
Gelterkinden, Scheidegg	GKScheid13.	B	HM	13thC	JU-NW	315	269	85.40	46	14.60	6	26.98	3.17	40.00	0.00	0.00	0.00	15.24	0.00	1.90	0.95	0.32	Kaufmann 1975
Nidau-Schloss U	NidauU 13.	B	HM	13thC	MI-W	4380	4190	95.66	190	4.34	26	9.60	6.30	64.80	0.00	0.00	0.40	13.60	0.70	0.40	0.10	0.40	Büttiker and Nussbaumer 1990

Fig 8.2-1 contd; abrreviations as in previous legend

Figure 8.2.1-1; Triangle plot of the three main domesticates from all the comparative sites in table 8.2-1. See legend below for the symbols used with the shortcut names.



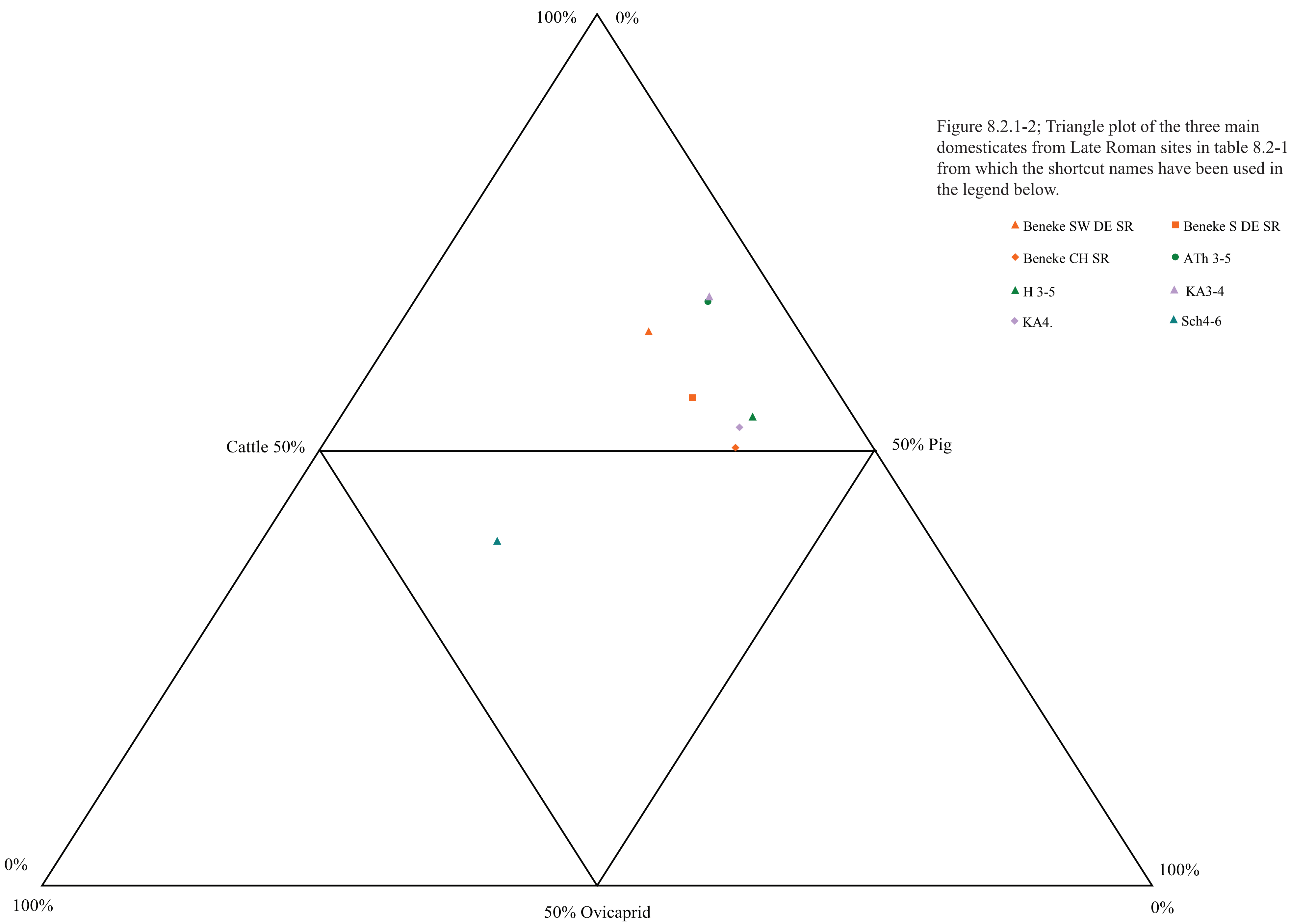


Figure 8.2.1-2; Triangle plot of the three main domesticates from Late Roman sites in table 8.2-1, from which the shortcut names have been used in the legend below.

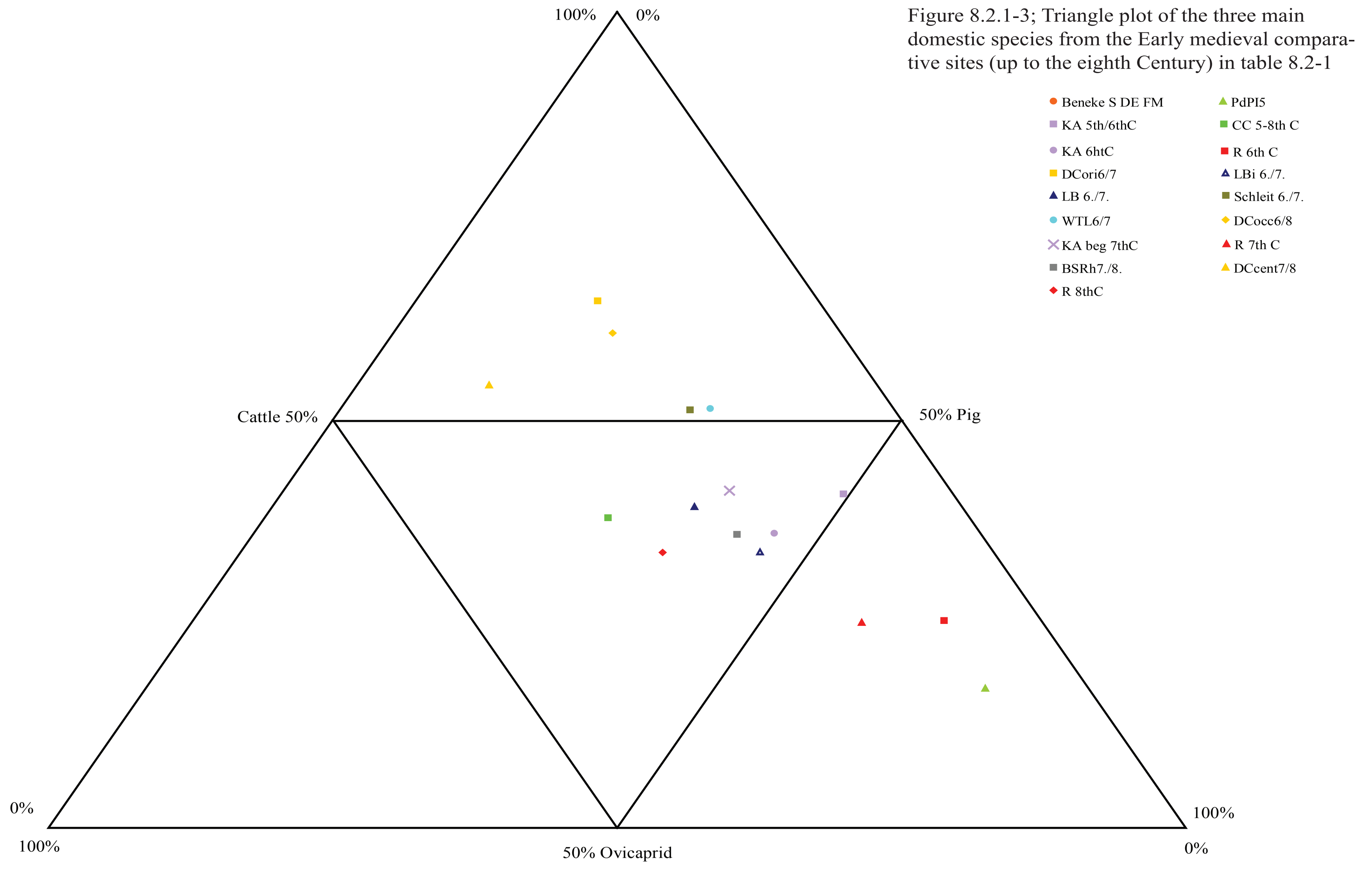


Figure 8.2.1-3; Triangle plot of the three main domestic species from the Early medieval comparative sites (up to the eighth Century) in table 8.2-1

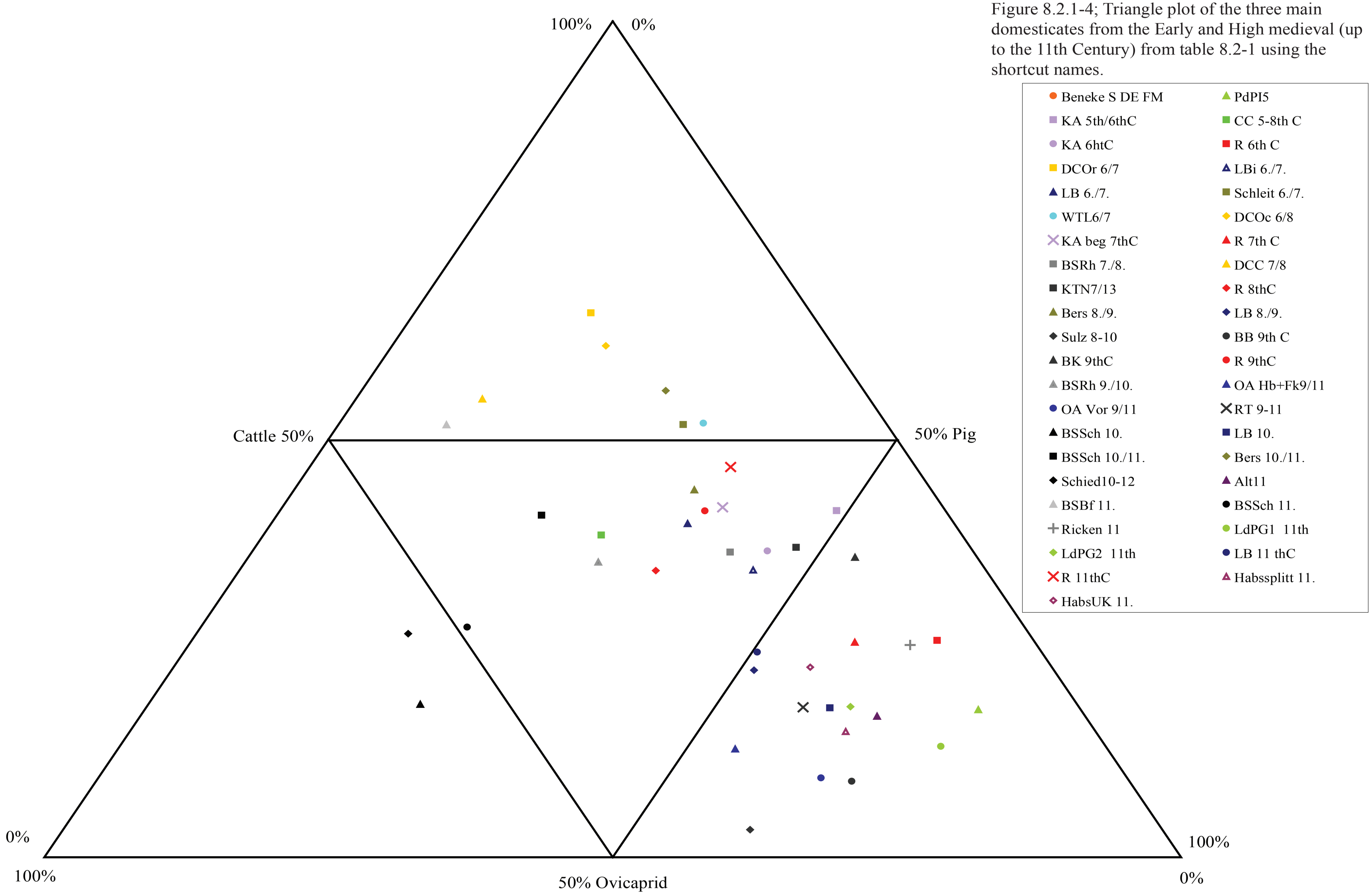


Figure 8.2.1-4; Triangle plot of the three main domesticates from the Early and High medieval (up to the 11th Century) from table 8.2-1 using the shortcut names.

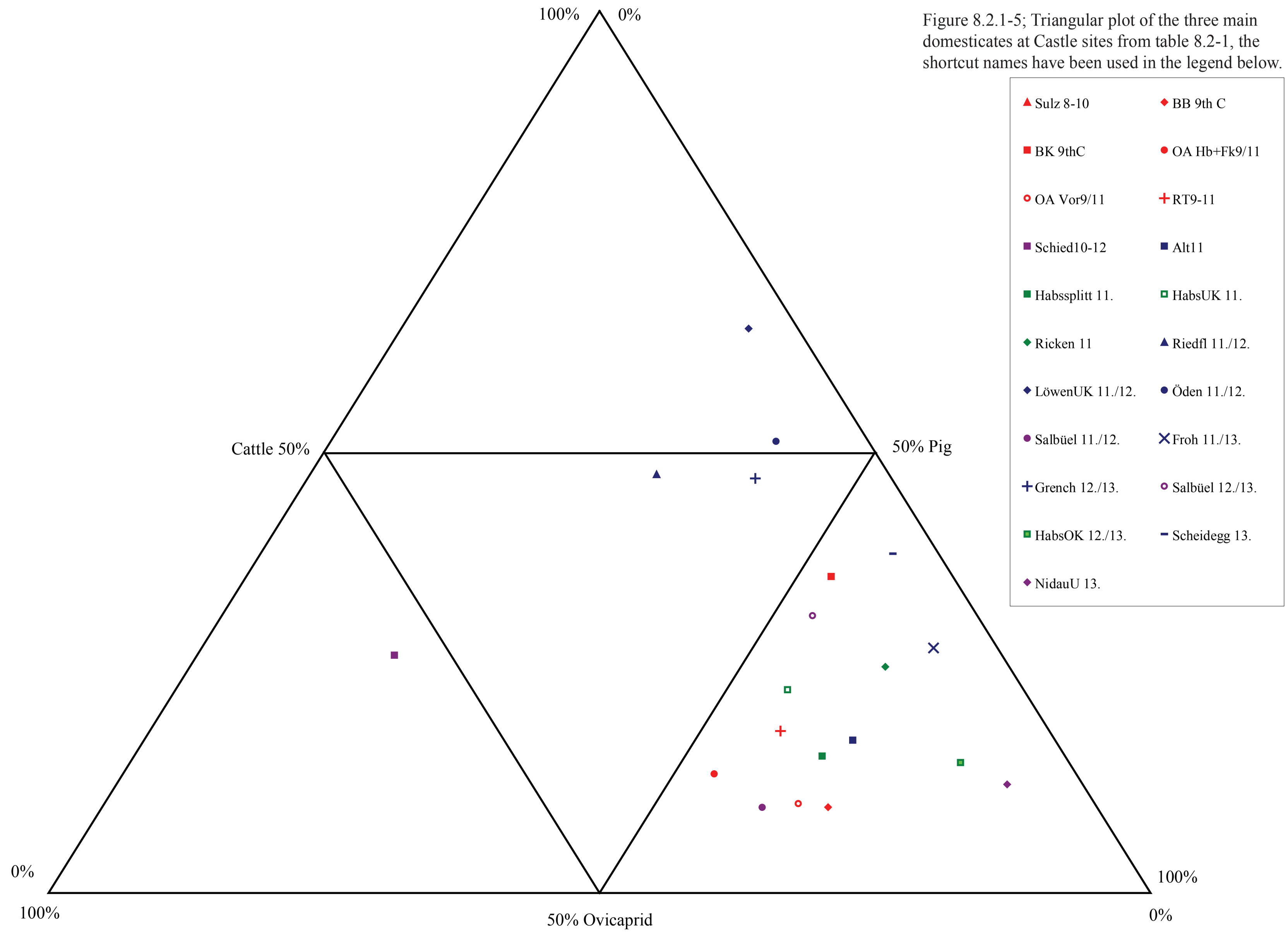
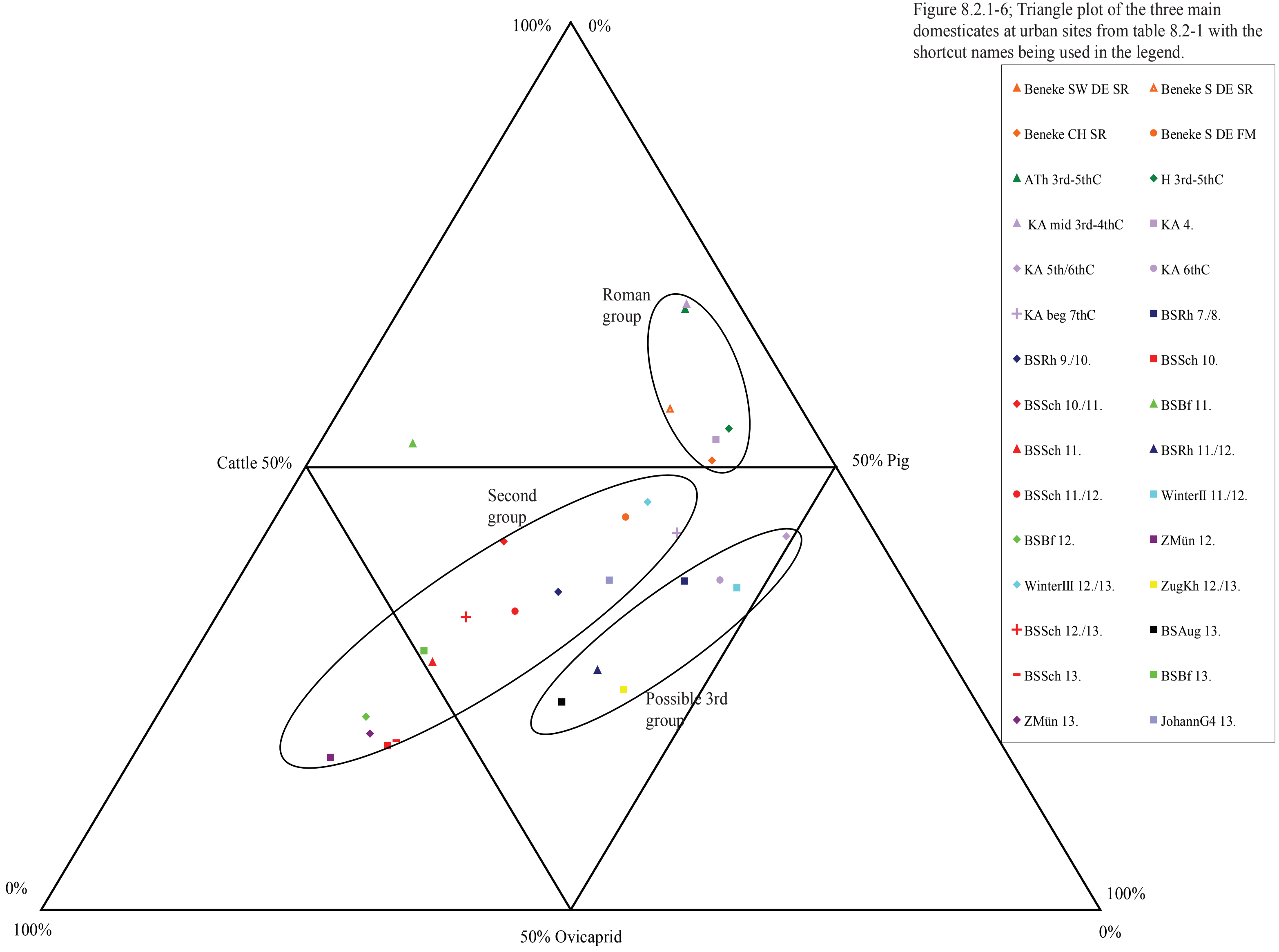


Figure 8.2.1-5; Triangular plot of the three main domesticates at Castle sites from table 8.2-1, the shortcut names have been used in the legend below.

Figure 8.2.1-6; Triangle plot of the three main domesticates at urban sites from table 8.2-1 with the shortcut names being used in the legend.



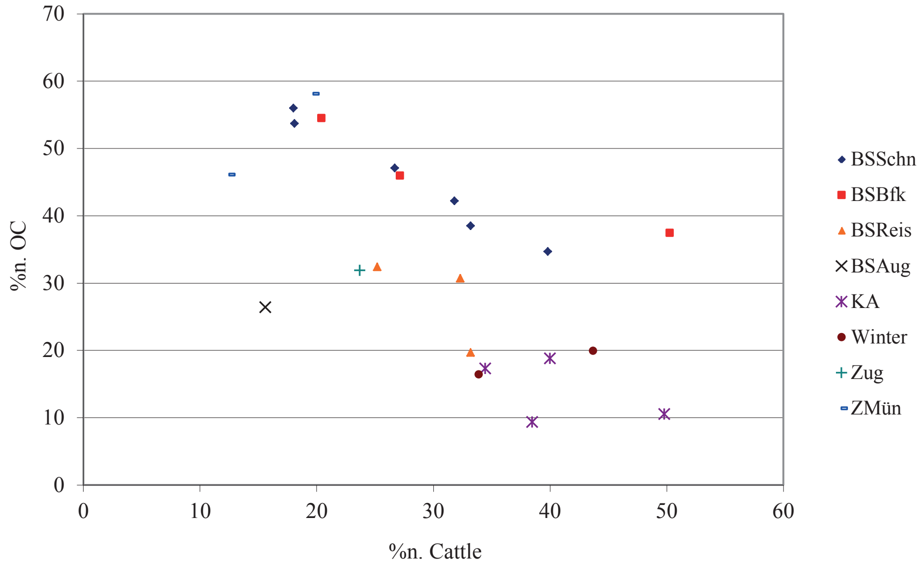


Figure 8.2.1-7; Scatterplot representing the proportions of cattle and ovicaprids from urban sites in table 8.2-1; OC - Ovicaprids

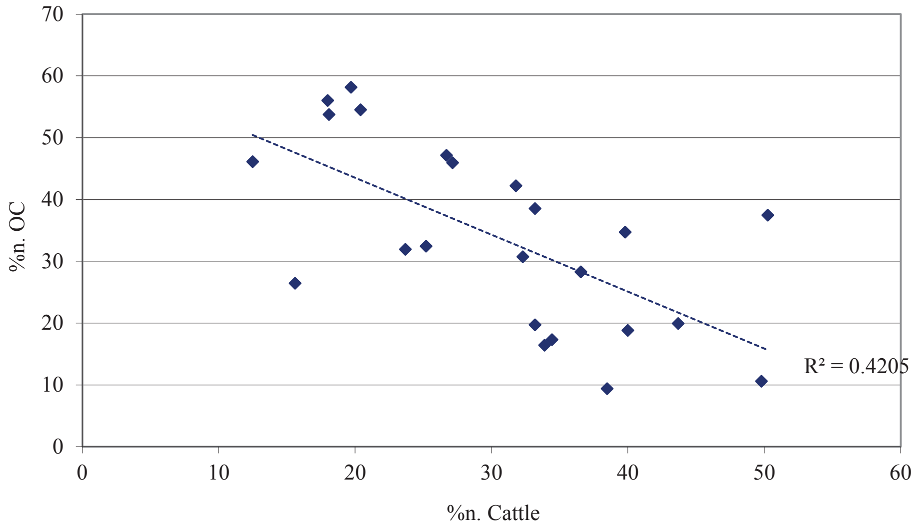


Figure 8.2.1-8; Scatterplot representing the proportions of cattle and ovicaprids from urban sites in table 8.2-1; Linear trend line added to the diagram with R-squared value; OC - Ovicaprids

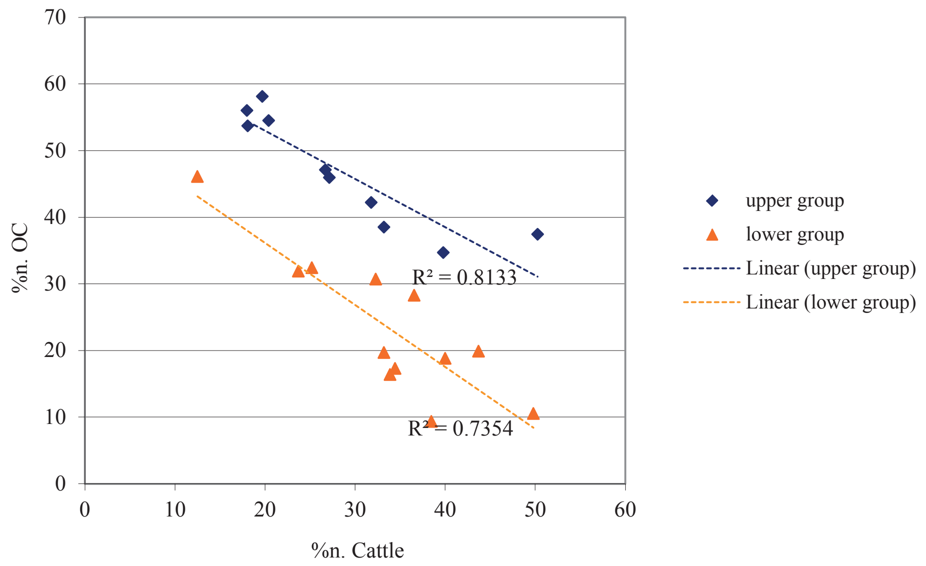


Figure 8.2.1-9; Scatterplot representing the proportions of cattle and ovicaprids from urban sites split in to the two apparent groups, Linear trend lines are added and accompanied by the R-squared value OC - Ovicaprids

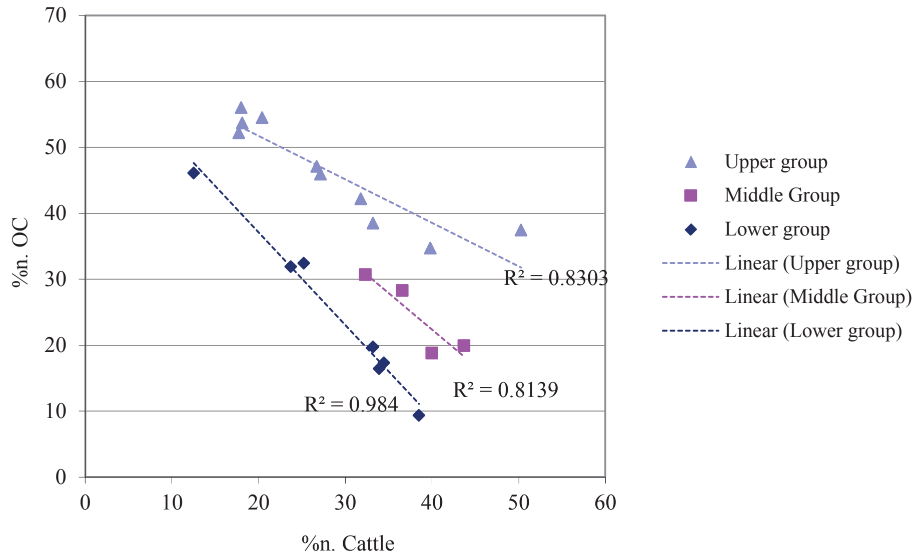


Figure 8.2.1-10; Scatterplot representing the proportions of cattle and ovicaprids from urban sites split in to the possible three groups, Linear trend lines are added and accompanied by the R-squared value OC - Ovicaprids

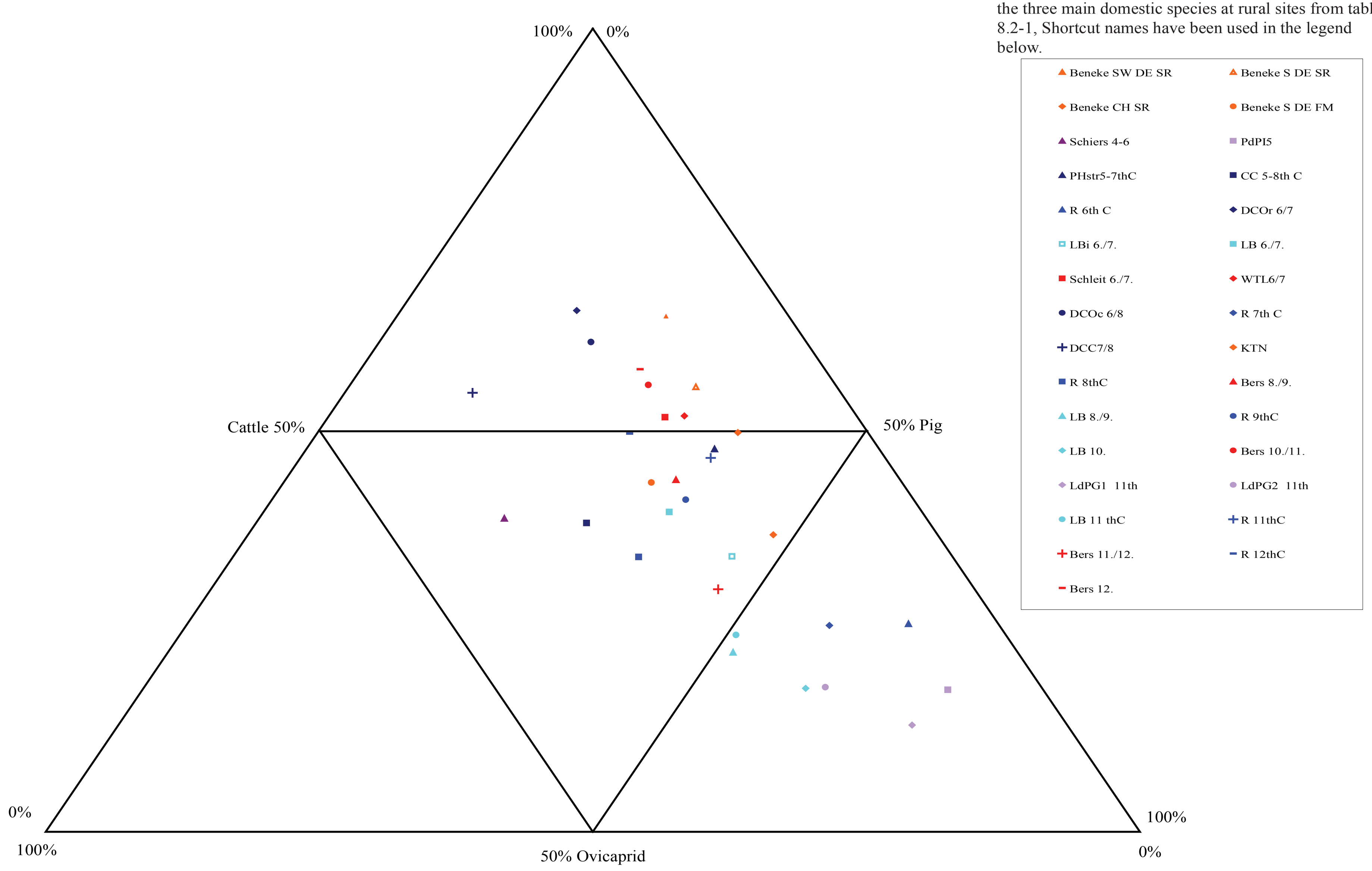


Figure 8.2.1-11; Triangle plot to show the relationship of the three main domestic species at rural sites from table 8.2-1, Shortcut names have been used in the legend below.

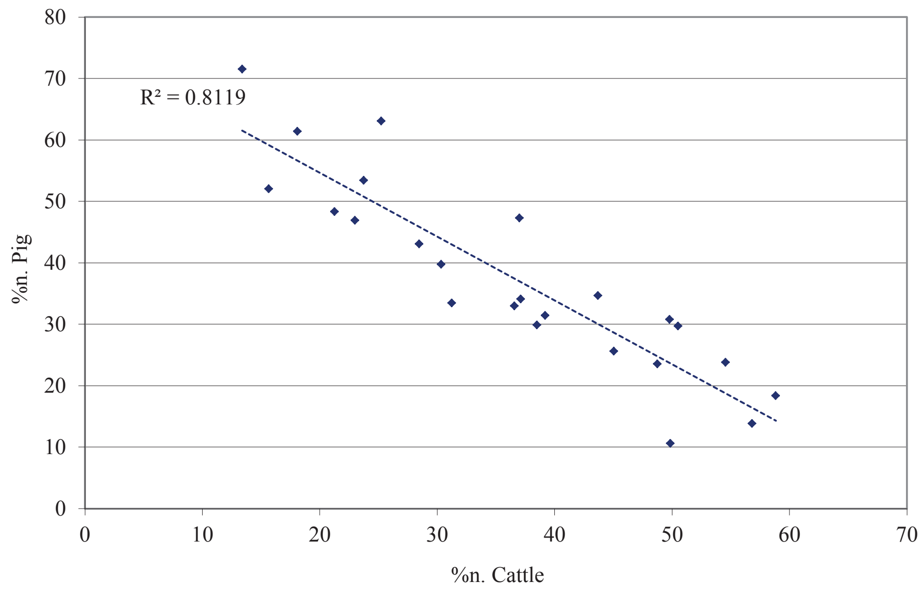


Figure 8.2.1-12; Scatterplot representing the proportions of cattle and pigs from rural sites in table 8.2-1; Linear trend line added to the diagram with R-squared value

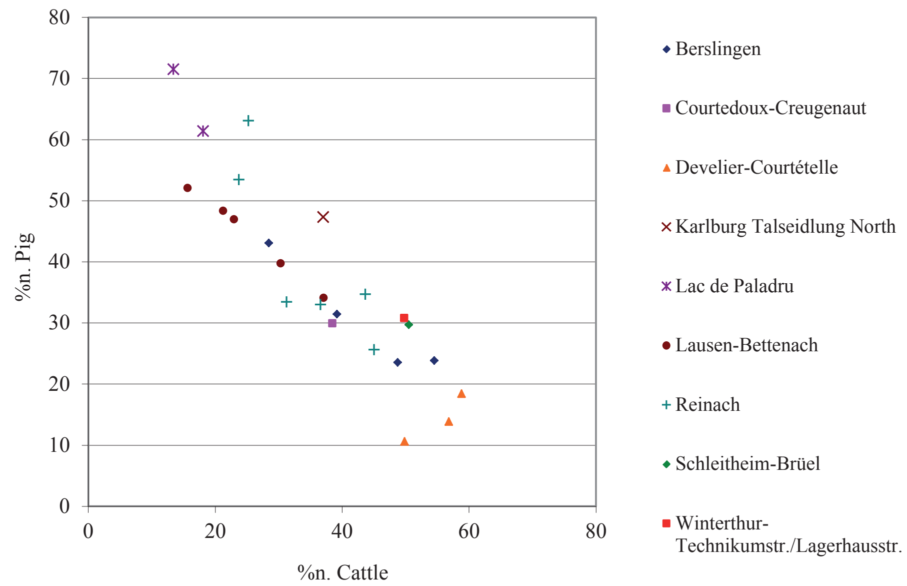


Figure 8.2.1-13; Scatterplot by site representing the proportions of cattle and pigs from rural sites in table 8.2-1

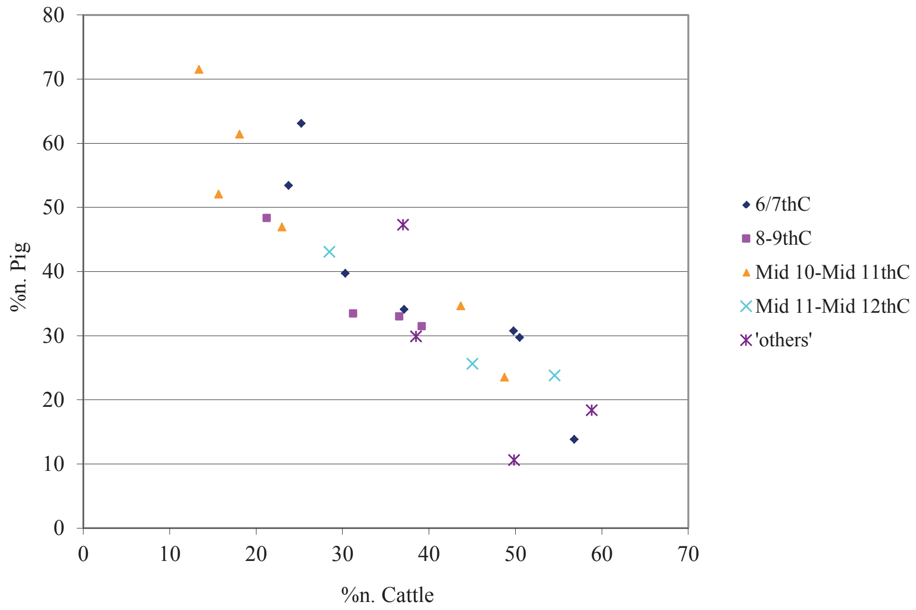


Figure 8.2.1-14; Scatterplot representing the proportions of cattle and pigs from rural sites according to date from table 8.2-1

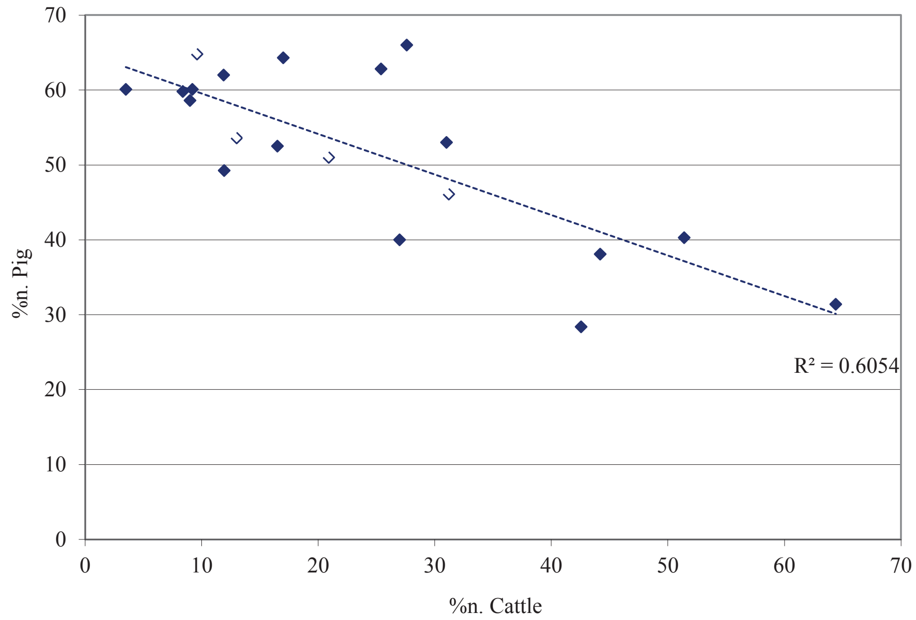


Figure 8.2.1-15; Scatterplot representing the proportions of cattle and pigs from Castle sites in table 8.2-1; Linear trend line added to the diagram with R-squared value; open symbols represent those sites with high proportions of wild animals and/or fowl.

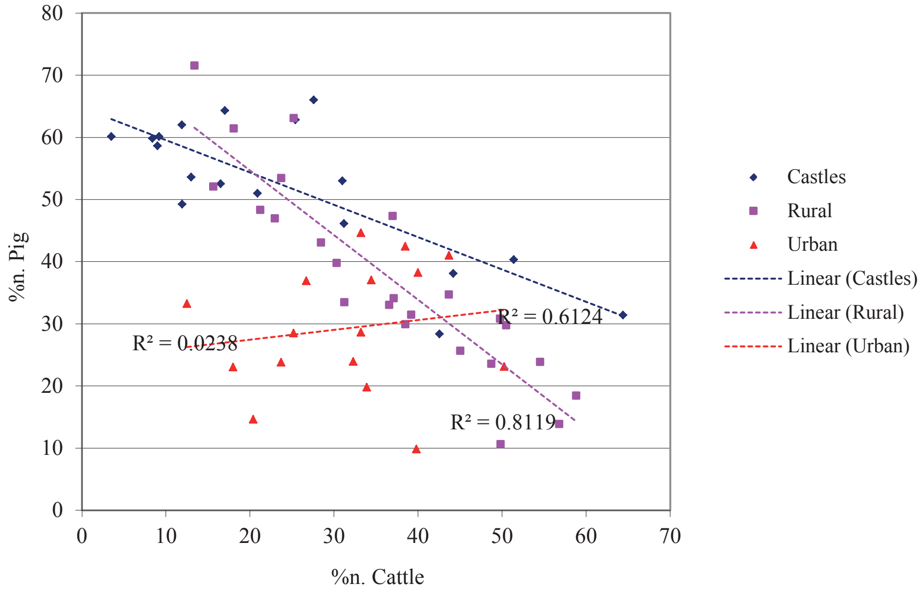


Figure 8.2.1-16; Scatterplot representing the proportions of cattle and pigs from all 3 site types in table 8.2-1; Linear trend line added to the diagram with R-squared value

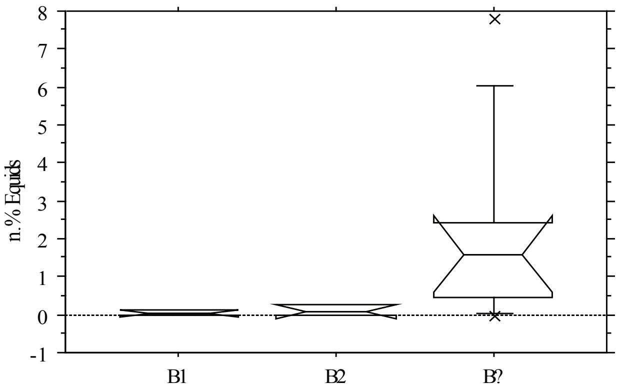


Figure 8.2.1-17; Box plot to show the range of equid proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

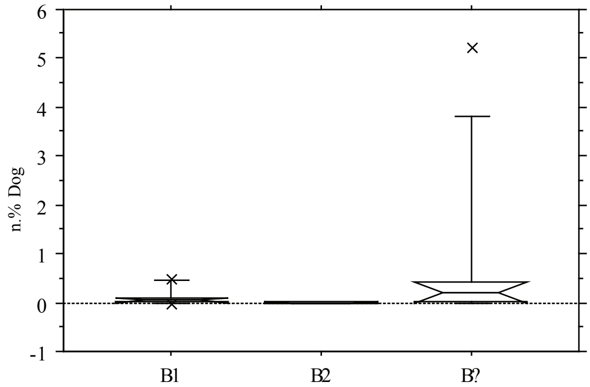


Figure 8.2.1-18; Box plot to show the range of dog proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

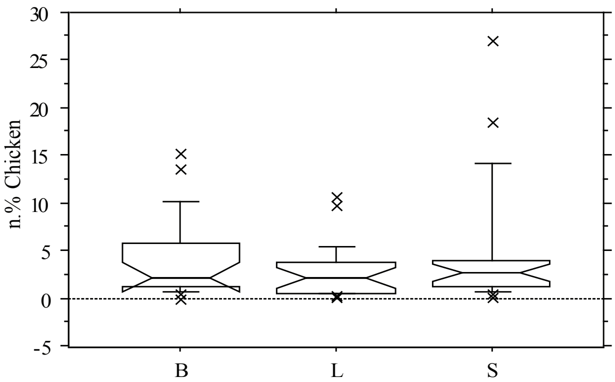


Figure 8.2.1-19; Box plot to show the range of chicken proportions at the different site types from tab. 8.2-1; B - Castle, L - Rural, S - Urban, Box plot boundries as explained in fig.6.2.3-10

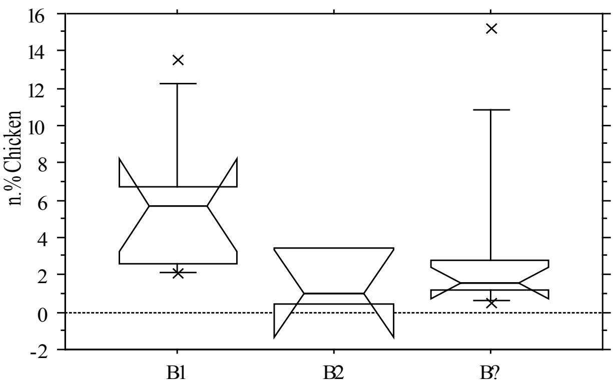


Figure 8.2.1-20; Box plot to show the range of equid proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

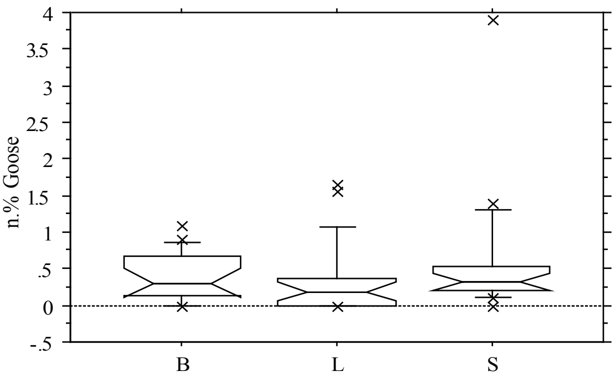


Figure 8.2.1-21; Box plot to show the range of goose proportions at the different site types from tab. 8.2-1; B - Castle, L - Rural, S - Urban, Box plot boundries as explained in fig.6.2.3-10

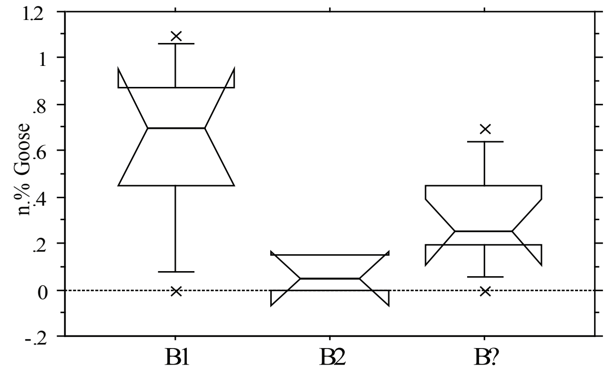


Figure 8.2.1-22; Box plot to show the range of goose proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

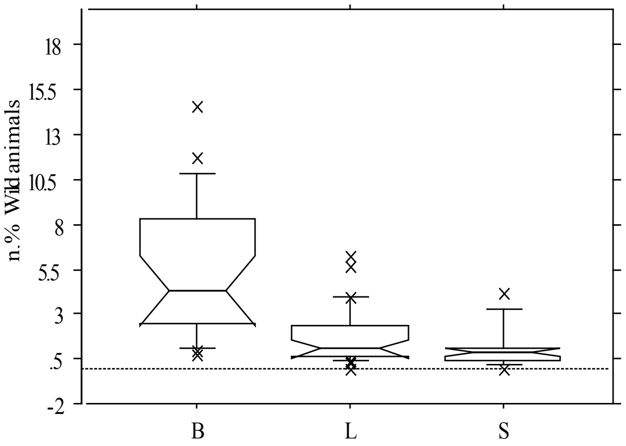


Figure 8.2.1-23; Box plot to show the range of wild species proportions at the different site types from tab. 8.2-1; B - Castle, L - Rural, S - Urban, Box plot boundries as explained in fig.6.2.3-10

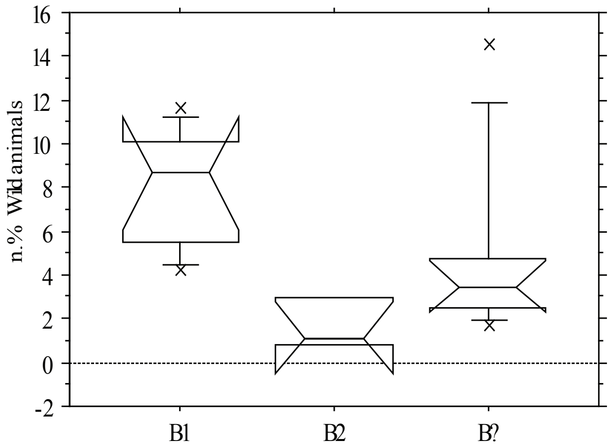


Figure 8.2.1-24; Box plot to show the range of wild species proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

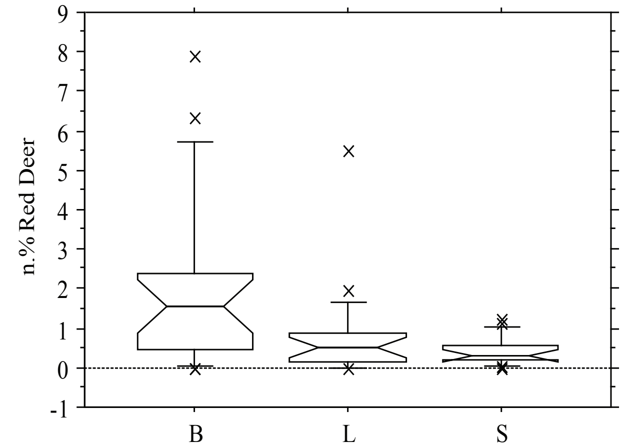


Figure 8.2.1-25; Box plot to show the range of red deer proportions at the different site types from tab. 8.2-1; B - Castle, L - Rural, S - Urban, Box plot boundries as explained in fig.6.2.3-10

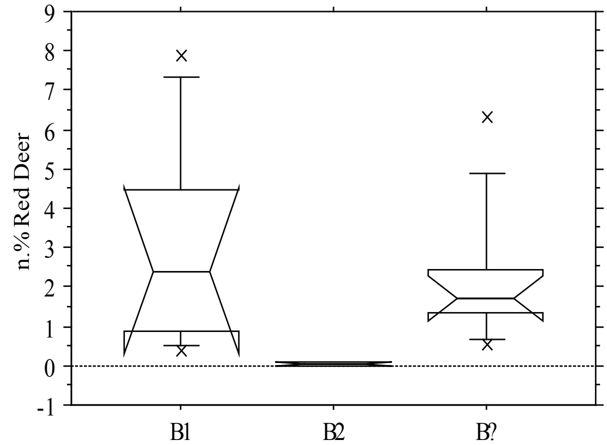


Figure 8.2.1-26; Box plot to show the range of equid proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

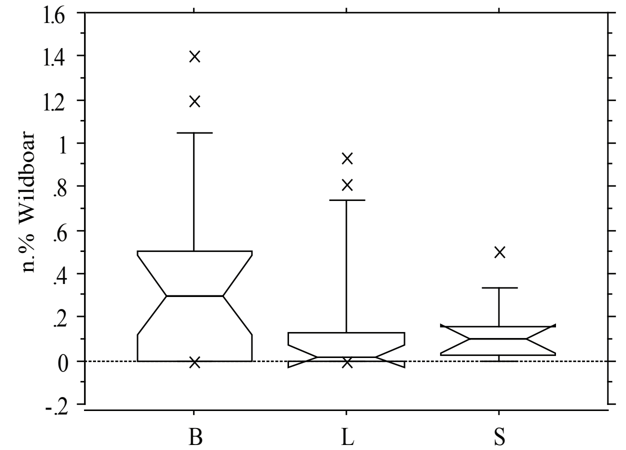


Figure 8.2.1-27; Box plot to show the range of wildboar proportions at the different site types from tab. 8.2-1; B - Castle, L - Rural, S - Urban, Box plot boundries as explained in fig.6.2.3-10

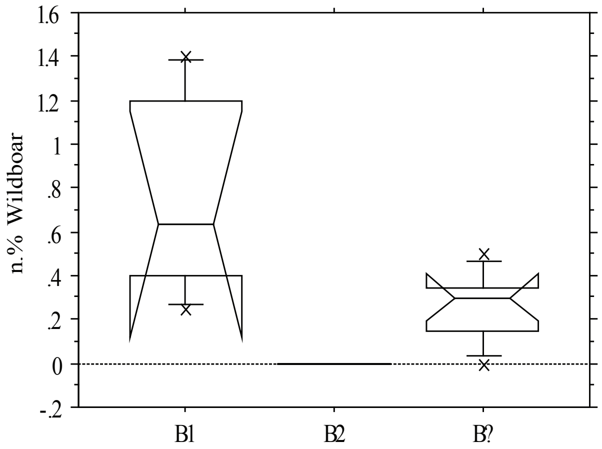


Figure 8.2.1-28; Box plot to show the range of wildboar proportions at the castle sites from tab. 8.2-1 split by status; B1 - higher status, B2 - lower status, B? - status unknown, Box plot boundries as explained in fig.6.2.3-10

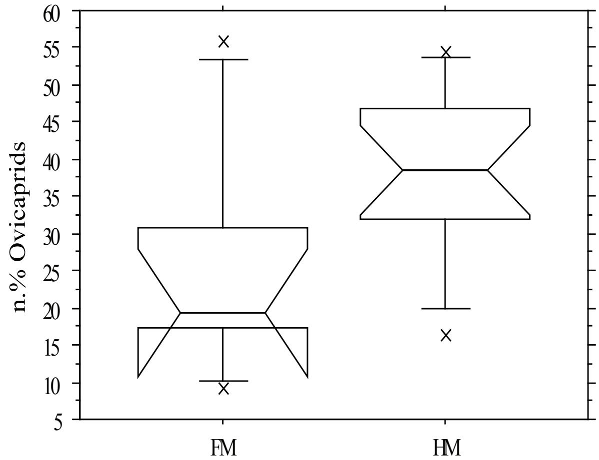


Figure 8.2.1-29; Box plot to show the range of ovicaprid proportions in the early medieval (FM) and high medieval (HM) from tab. 8.2-1; Box plot boundries as explained in fig.6.2.3-10

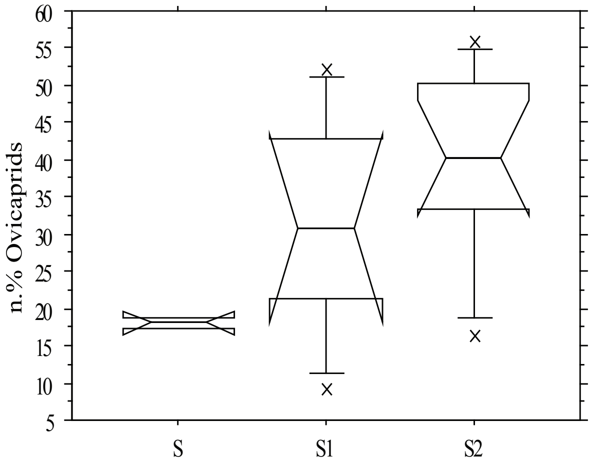


Figure 8.2.1-30; Box plot to show the range of ovicaprids proportions at the castle sites from tab. 8.2-1 split by status; S1 - higher status, S2 - lower status, S - Roman 'urban' sites, Box plot boundries as explained in fig.6.2.3-10

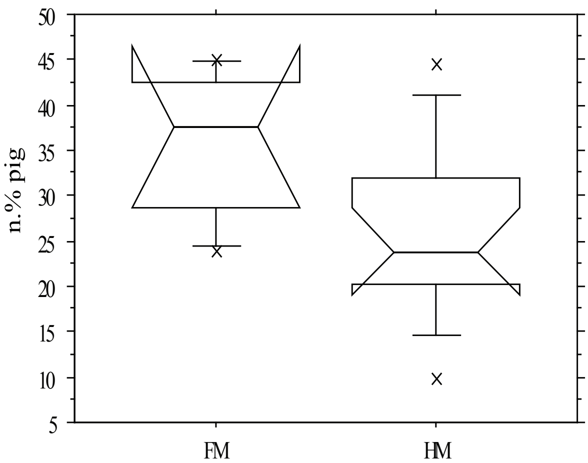


Figure 8.2.1-31; Box plot to show the range of the pig proportions in the early medieval (FM) and high medieval (HM) from tab. 8.2-1; Box plot boundries as explained in fig.6.2.3-10

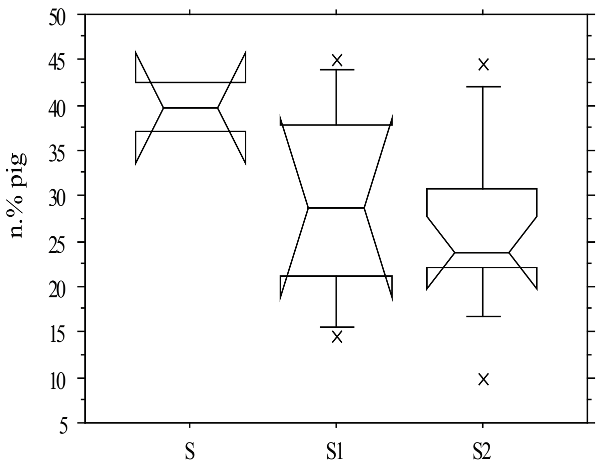


Figure 8.2.1-32; Box plot to show the range of pig proportions at the castle sites from tab. 8.2-1 split by status; S1 - higher status, S2 - lower status, S - Roman 'urban' sites, Box plot boundries as explained in fig.6.2.3-10

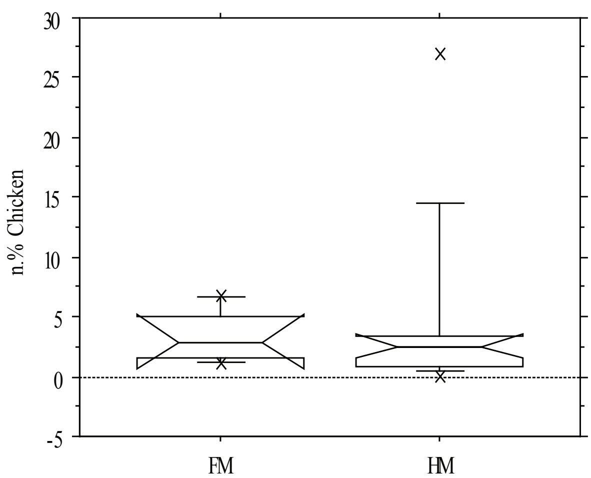


Figure 8.2.1-33; Box plot to show the range of chicken proportions in the early medieval (FM) and high medieval (HM) from tab. 8.2-1; Box plot boundries as explained in fig.6.2.3-10

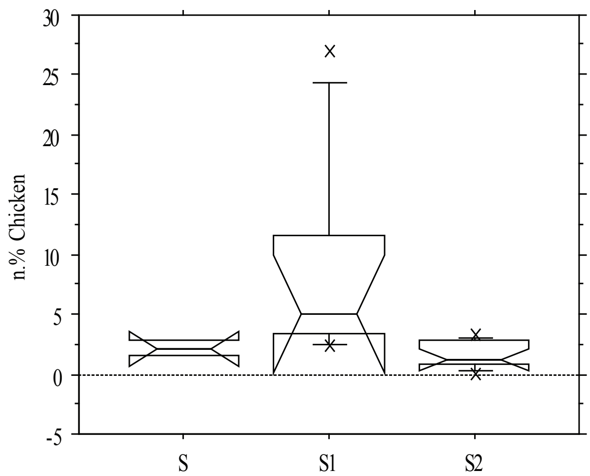


Figure 8.2.1-34; Box plot to show the range of pig proportions at the castle sites from tab. 8.2-1 split by status; S1 - higher status, S2 - lower status, S - Roman 'urban' sites, Box plot boundries as explained in fig.6.2.3-10

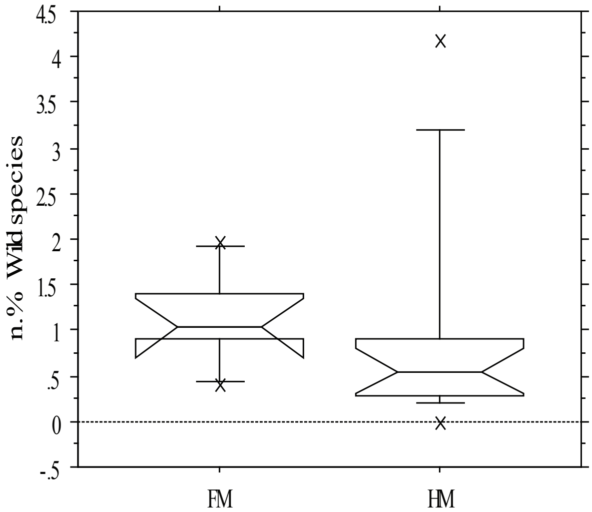


Figure 8.2.1-37; Box plot to show the range of wild species proportions in the early medieval (FM) and high medieval (HM) from tab. 8.2-1; Box plot boundries as explained in fig.6.2.3-10

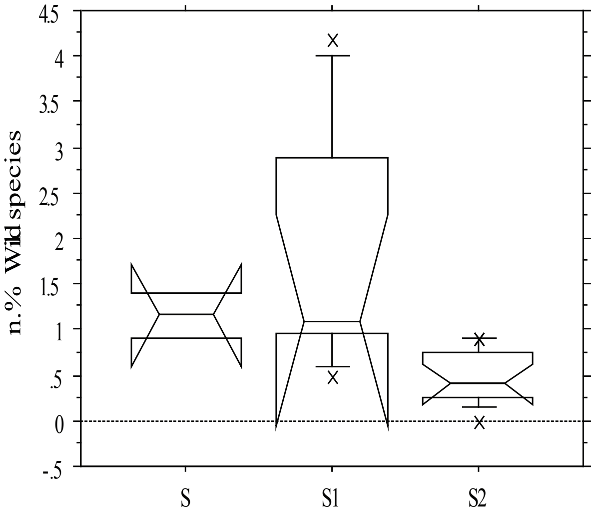


Figure 8.2.1-36; Box plot to show the range of wild species proportions at the castle sites from tab. 8.2-1 split by status; S1 - higher status, S2 - lower status, S - Roman 'urban' sites, Box plot boundries as explained in fig.6.2.3-10

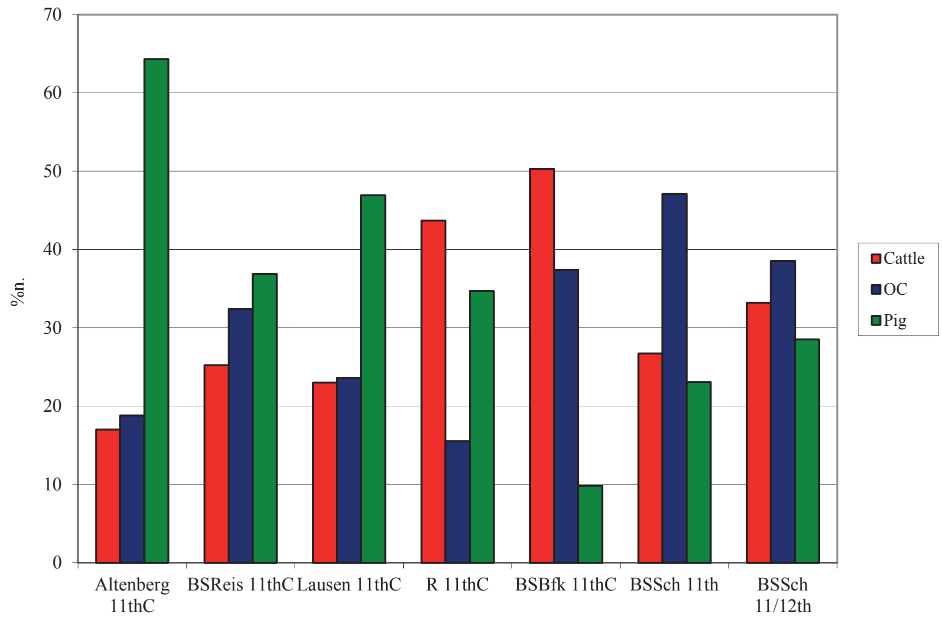


Fig 8.2.2-1; Comparison of the three main domestic species from selected sites dated to the 11thC shortcut names have been used here, see table 8.2-1; OC - Ovicaprids

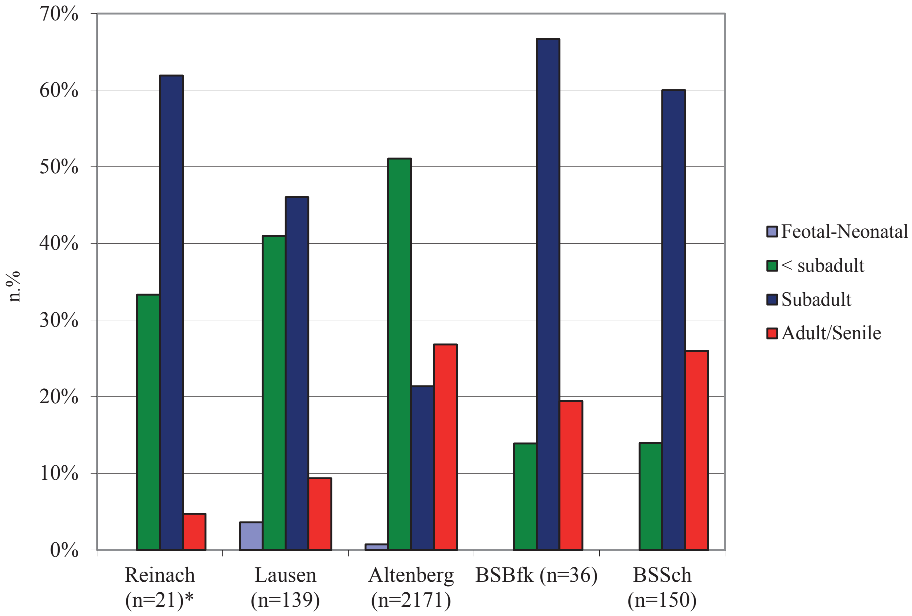


Fig 8.2.2-2; Comparison of the age profiles of pigs from selected sites dated to the 11thC
shortcut names have been used here, see table 8.2-1

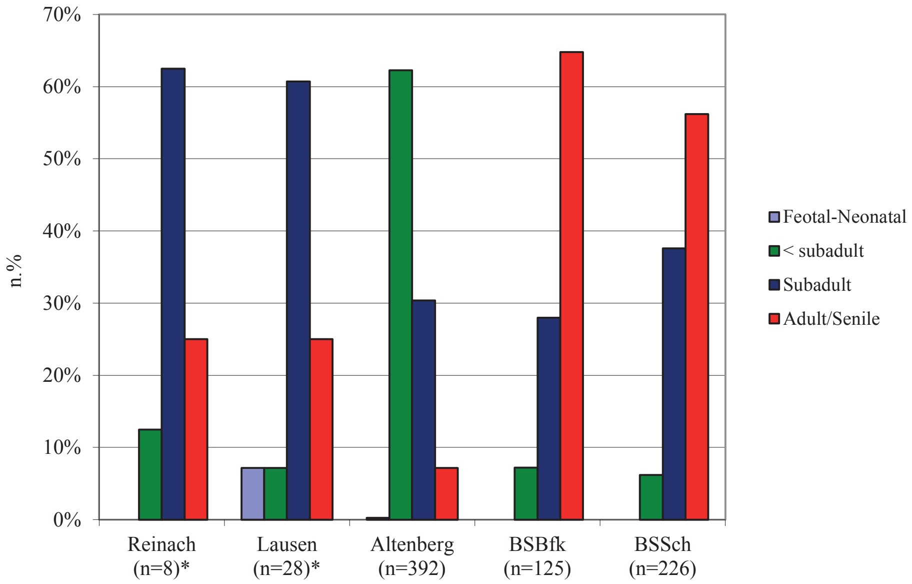


Fig 8.2.2-3; Comparison of the age profiles of ovicaprids from selected sites dated to the 11thC
shortcut names have been used here, see table 8.2-1

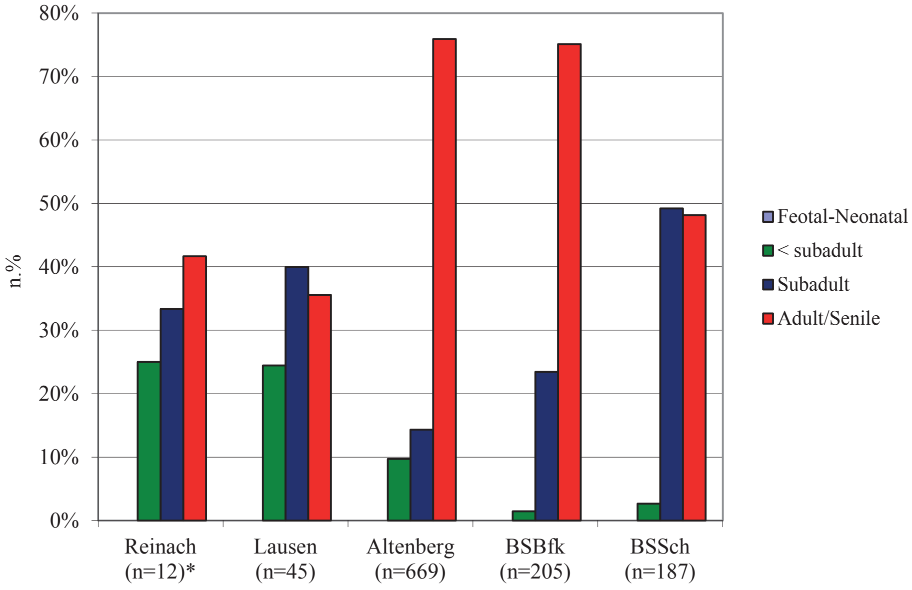


Fig 8.2.2-4; Comparison of the age profiles of cattle from selected sites dated to the 11thC
shortcut names have been used here, see table 8.2-1

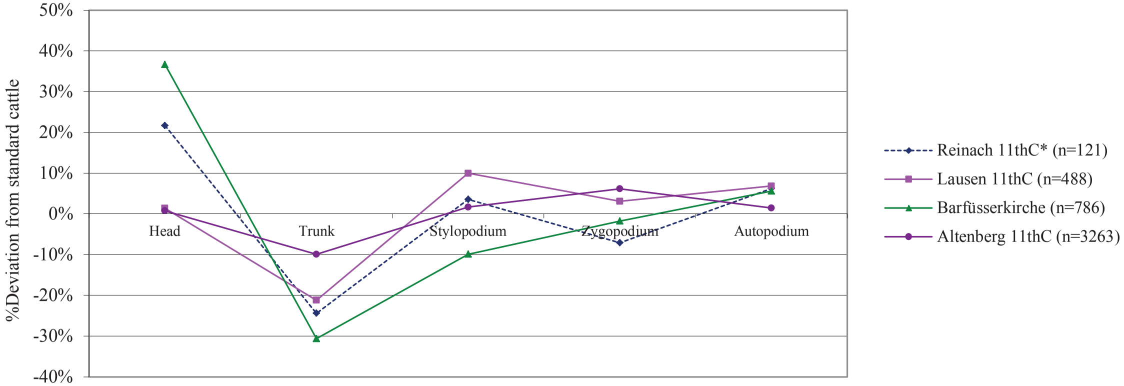


Fig. 8.2.2-5; Deviation of cattle fragments by weight from a standard cattle skeleton for sites from the 11thC,
* denotes statistically small sample

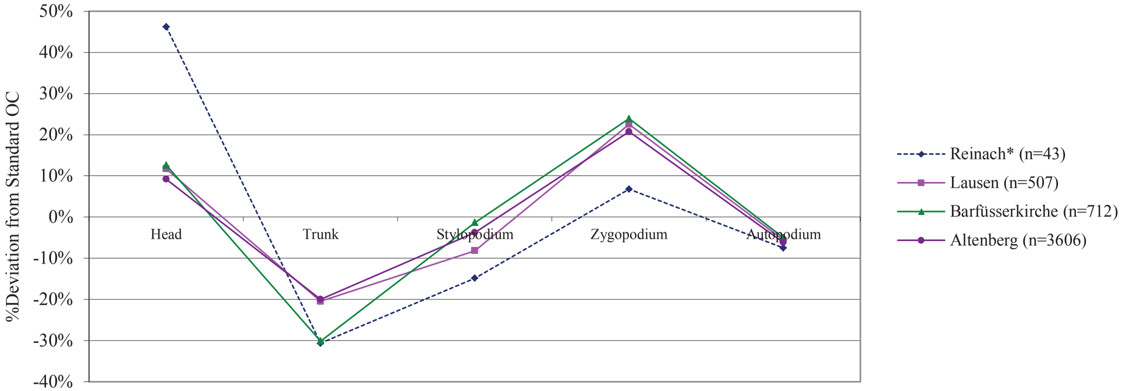


Fig. 8.2.2-6; Deviation of ovicaprid fragments by weight from a standard ovicaprid skeleton for sites from the 11thC,
* denotes statistically small sample

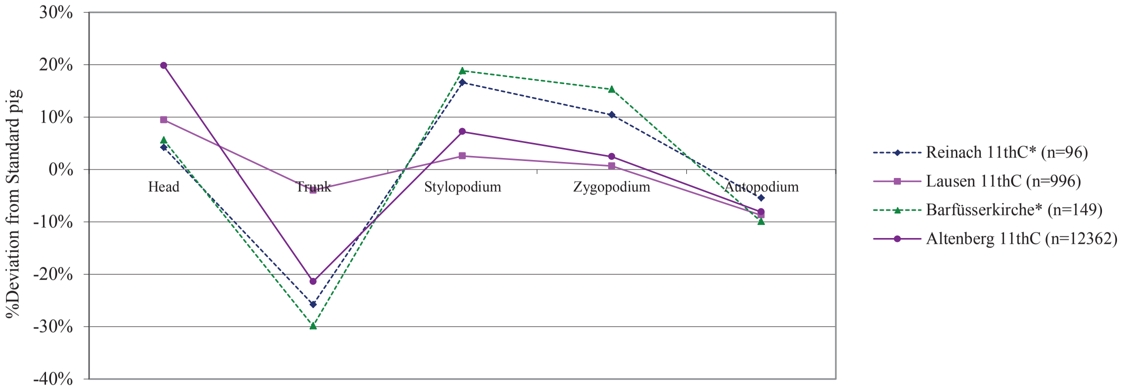


Fig. 8.2.2-7; Deviation of pig fragments by weight from a standard pig skeleton for sites from the 11thC,
* denotes statistically small sample