At the end, I would like to make one critical remark concerning the figures. They are not only published in black and white but also in very poor quality, which regrettably has a negative impact on the reception of this valuable volume.

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Erich Pucher / Fritz Eckart Barth / Robert Seemann (†) / Franz Brandstätter, Bronzezeitliche Fleischverarbeitung im Salzbergtal bei Hallstatt. Mitteilungen der Prähistorischen Kommission, volume 80. Österreichische Akademie der Wissenschaften, Wien 2013. € 62.00. ISBN 978-3-7001-7261-1. 155 pages with 33 figures, 22 tables and 27 plates.

The Late Bronze Age finds presented in this volume illustrate prehistoric meat processing and preservation. They are related to salt mining in Hallstatt – a lakeside village in the Salzkammergut (Austria) – the eponymous site of the Hallstatt culture spanning the Late Bronze and Early Iron Ages in Central Europe. Its renowned salt mines had been regularly exploited from time to time since the Neolithic.

A curious set of findings from the Salzberg may be indicative of specialised meat processing. In this volume the treatment of pork was tested using various lines of evidence. In addition to the Introduction and Summary, the results are presented in four complementary studies. The authors discuss Late Bronze Age animal bones from the 1939 and 1993/1994 excavations, timber structures recovered at the site during the 19th century and the sulphurous substance recently identified on copper and bronze objects from the site.

The volume begins with a high-resolution analysis of animal remains by Erich Pucher, who follows the best tradition of Central European archaeozoology. Archaeology as a "science" has long suffered from the impossibility of reproducing sites that are inevitably destroyed during the course of excavations. Minute descriptive studies of this type are the possibly closest solution to direct, first hand observation. In this chapter every detail is provided to support various aspects of the argument that meat processing must have taken place at the site. Valuable tabulated bone measurements (rarely published in print nowadays) are appended to the study to benefit specialists working with similar problems.

The composition of animal bone material brought to light at the Salzberg markedly differs from bone refuse from contemporaneous Bronze and Iron Age rural settlements characterised by a more agricultural orientation. Several methods of quantification, both direct (number of identifiable specimens, NISP; bone weight) and derived (minimum number of individuals, MNI) point to the unambiguous dominance of pig remains at the site, exceeding 60 % of the ten thousand identifiable fragments. Although taphonomy is not explicitly discussed, the calculations show a commendable effort to estimate the rate of bone loss using the aforementioned three parameters in combination with each other. Under ordinary circumstances I have increasingly resented MNI calculations vastly overexploited in the reconstruction of putative herd management strategies. In this case, however, their more sophisticated use is justified in an effort to reconstruct "dead animal units", the commingled remains of carcasses designated for preservation.

The contribution of bones from bovids, large and small, is far less significant than the share of pig in the find material. Beef and mutton seem to have been of minor importance in comparison with pork at this site. The remains of horse, dog and large game are practically missing: they make

up a mere 2 % of the bone fragments. In contrast with the aforementioned agrarian settlements, the high percentage of pig remains observed at the Salzberg site is likewise characteristic of salt and copper mining sites in the East Alpine region.

In addition to the usual comparisons between species (NISP, MNI, weight), quantitative analyses included the distribution of relative bone weights, i. e. skeletal representation in the cases of cattle, sheep and pig. The weights of various skeletal elements in complete reference skeletons (100 %) were taken as standards (H. Reichstein, Die Säugetiere und Vögel aus der frühgeschichtlichen Wurt Elisenhof. Stud. Küstenarch. Schleswig-Holstein Ser. A, Elisenhof 6 [Frankfurt am Main 1994]), to which the weights of excavated bone were compared species by species. Reichstein's method is rarely used in the English language literature, although it can be instrumental in quantifying the outcome of specialised practices, such as the industrial processing of animals (L. Bartosiewicz, Skin and bones. Journal of Taphonomy 7, 2009, 95–111). One of the reservations often voiced is the general argument that the specific weight of excavated bone varies widely depending on preservation, ranging from leaching by percolating water in the deposit to fossilisation when minerals replace lighter organic components in dead bone. Personally, I support the circumspect analysis of bone weights in homogeneously preserved and conscientiously cleaned assemblages as they provide non-derived values related to meat exploitation thanks to the strong biological correlation between bone and muscle that varies by body region. In the well-preserved Salzberg material it may be presumed that differential mineralisation did not bias comparisons between the resulting weights, as diagenetic processes in the deposit acted uniformly. The evaluation of relative bone weights indicated that in comparison with bovid remains the pig assemblage showed a considerable under-representation of axial elements (the calvarium and vertebrae, ribs). Extremity bones, on the other hand, yielded weights far higher than expected. Moreover, there were high proportions of complete long bones among the Salzberg pig remains. While these were mostly metapodia in the case of bovids, in pig they originated from proximally located extremity segments (stylo- and zygopodium), corresponding to cuts commercially termed "shoulder", "ham" and "shanks". Representing the latter category, a startling 39 % of radii and 42 % of tibiae were found in full length. This marked patterning seems to be indicative of specialised carcass treatment. It may include transport of pork from settlements in the neighbouring valleys to the Salzberg, a site wedged between steep foothills and the lakeshore where viable animal keeping would have been very difficult if at all possible.

Anatomical observation is also supported by the age and sex distributions of pig remains. Juvenile bones and those from very old individuals are missing: animals in prime age were slaughtered. A set of 70 sexable skeletal elements from pigs also indicates an under-representation of females relative to possible castrates. No remains were assigned to boars. Such clearly skewed age and sex distributions would not be evident in the food refuse from contemporaneous rural settlements where there was a readily available supply of a various individuals in the herds kept locally.

In addition to analysing the overwhelming importance of pork, the sudden Late Bronze Age occurrence of small-sized cattle is also discussed in the archaeozoological chapter. The remains of such small animals, traditionally associated with the brachyceros cranial type, have been known during the Iron Age in the entire region, including Slovenia and Hungary. However, their interpretations have varied over a century of archaeozoological research. The small-sized cattle reconstructed at this Late Bronze Age settlement differs considerably from the previous, large-framed cattle of the Aeneolithic and earlier Bronze Age. As similar size diminution was not observed in caprines and pig, a systemic environmental effect may be ruled out. Pigs in fact were fairly large in the Salzberg material while sporadically occurring horse bones show random size variation.

Typological features in cattle are also indicative of a qualitatively new form, although I would refrain from calling it a breed. A breed, whether plant or animal, is the product of conscious and targeted breeding that cannot be proven in the case of Late Bronze Age cattle. However, a preference for such animals may have resulted in their propagation and gradual distribution from West to East. In addition to small size, six of the 33 complete metacarpals of the Salzberg cattle show considerable torsion (sometimes 30°) along the long axis of the bone regardless of the sex of the animal. The author raises the question what the advantage of such small animals may have been? While traditional interpretations often quote dairy specialisation on the basis of similarly gracile contemporary breeds, jumping on this conclusion would be speculative in the absence of direct supporting evidence.

Although the next chapter by Erich Pucher is very short, it places his own work on the bone assemblage from the 1993/1994 excavations in historical perspective. The current results are compared to two far smaller sets of bones kept in the Museum of Hallstatt and published by J. W. Amschler (Ur- und frühgeschichtliche Haustierfunde aus Österreich. Arch. Austriaca 3, 1949, 1–70). First of all, even these relatively small find materials belong to the correct documentation of the site. They also offer an opportunity to the author to briefly review the history of archaeozoology in Austria within the framework of 19th–20th century mental history. This is an extremely interesting summary that focuses on the development of a discipline rooted in rigid typological categorisation concerned with the origins of domestic breeds toward an economically educated study of animal bones from archaeological sites, exemplified by the current analysis of the Salzberg material itself.

Reading this elucidating chapter, one cannot help but think of the variegated effect the Wiener Kreis of logical empiricism has had in interdisciplinary studies such as archaeozoology. This group of philosophers and scientists operated between the two world wars and has exerted a fundamental influence on the philosophy of science during the 20th century, also providing inspiration to New Archaeology. This is partially reflected in the analysis of the 1993/1994 finds. The zoological precision and scientific rigor by which bones have been recorded and presented are all aimed at providing solid evidence in support of the meat preservation hypothesis. However, the author himself calls this problem an equation with too many unknowns. While this justifies prudent interpretations, the spinoff of this approach is that no detail of the complex hypothesis put forward in this volume is formally tested in terms of statistical probabilities. One example is the comparison between the compositions of the three bone assemblages available from the Salzberg site that vary in size by two orders of magnitude (184, 232 and 10,635 NISP). The similarity between the contributions of cattle, caprines and pig can be easily measured using a Chi^2 test, which shows these sets being significantly different from each other. One may safely conclude, however, that the surviving museum assemblages may be simply too small to be representative in comparison with the major body of data amassed by Pucher, as is shown by the high percentage of the dominant species, pig, in all three collections. Less massive contributions by small and large bovids are more prone to random variation in the smaller samples.

The next chapter, written by Fritz Eckart Barth, is devoted to the functional interpretation of the timber structures. To further test the hypothesis regarding the importation of choice cuts of pork to the site, traditional butchering methods were observed during repeated slaughtering experiments conducted on the Salzberg. As a combination of practicality and living heritage, many features of carcass partitioning by local butchers fall in line with phenomena observed in the archaeological material. The distribution of cut marks and the transportability of carcass from domestic pigs of approximately 50 kg fall in line with the import of pork, rather than live pigs to the site. One question, however, remains open. Given the conspicuous absence of heads from the carcasses

brought to the Salzberg, the question is why the jaws of pigs were not removed? Barth suggested that perhaps the carcass was first eviscerated with the mandible retained as a hook or handle used in transport. Indubitably, the sizeable masseter muscle, associated tongue and even the marrow content of the mandible represent food value (L. H. J. van Wijngaarden-Bakker, Replication of butchering marks on pig mandibles. In: D. E. Robinson [ed.], Experimentation and Reconstruction in Environmental Archaeology [Oxford 1990] 167–174). This in itself, however, may not have justified the retention of jaws when the rest of the head was consistently removed from the carcasses: calvarium fragments were rare. Perhaps the brain, a delicacy in many cultures including that of present-day Austria (L. Bartosiewicz, This little piggy went to market... Journal European Arch. 5, 1997, 170–182), would not have preserved well and was already eaten at the kill-site. Otherwise the meat content of the head is relatively small.

In addition to the analysis of animal bones, the authors of the volume explore the associated economic structures and logistics of pork processing. The animal bone assemblage was recovered from the vicinity of sunken timber structures. They were discovered and documented in the proximity of the current excavation already in 1877 and 1939. These frequently quoted finds and features are published here in detail for the first time by Barth. Such 5 by 5 m large structures have been interpreted as basins used in curing quantities of pork in salt brine. This is a first step in meat preservation, followed by drying, smoking or heat-treatment before the ware is ready for storage and shipment. The microclimate of prehistoric salt mines must have been excellent for air-drying meat. This observation supports the research hypothesis discussed in relation to the analysis of animal remains.

The last paper by Robert Seemann and Franz Brandstätter focuses on a third dimension of the meat processing problem. It seems that the bones were boiled in graphite-containing ceramic vessels until the resulting condensed gel became concentrated enough to be dried. A special feature of copper and bronze objects recovered from the timber structures was the formation of covellite, a sulphurous compound on the surface of these artefacts. The copper sulfide coating seems to have been at least in part caused by the cumulative concentration of meat in the deposit whose natural sulphur content contributed to the surface alteration of metal objects.

The volume is written in a clear, straightforward language and is in general well-illustrated. The original drawings of the 1877 excavation shown in ten full colour pages stand out as a splendid example of professional archaeological field documentation. While the archaeological artefacts depicted in the illustrations are accompanied by scales (or the ratio of picture is mentioned in the caption), no such aid is provided with the photograph of animal bones. A similar problem occurs in a more abstract sense in Diagrams 4 and 5: numerous sites are compared by percentages, no "scales", in this case the NISP, are provided for comparison. Although these data could be sought after in the well-referenced original articles, including them in the graphs would have helped instantly appraising differences between assemblage sizes.

In summary, this volume is a classic in many respects. It represents important research in a region with a long tradition of state-of-the-art archaeological inquiry duly acknowledged by the authors. Its methods and materials are firmly rooted in this tradition. It is the representative material, continuity in the consistent documentation of original data and multidisciplinary endeavour in piecing the resulting details together that make this contribution important.

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