

LAKE DWELLINGS AFTER ROBERT MUNRO

PROCEEDINGS FROM THE MUNRO INTERNATIONAL SEMINAR:
THE LAKE DWELLINGS OF EUROPE 22ND AND 23RD OCTOBER 2010,
UNIVERSITY OF EDINBURGH

EDITED BY
MAGDALENA S. MIDGLEY & JEFF SANDERS

This is a digital offprint from:

Midgley, M.S. & J. Sanders (eds) 2012: *Lake Dwellings after Robert Munro. Proceedings from the Munro International Seminar: The Lake Dwellings of Europe 22nd and 23rd October 2010, University of Edinburgh*. Leiden: Sidestone Press



Sidestone Press

A new generation of Publishing

This is a free offprint, read the entire book at the Sidestone e-library!

You can find the full version of this book at the Sidestone e-library. Here most of our publications are fully accessible for free. For access to more free books visit:
www.sidestone.com/library

Download Full PDF

Visit the Sidestone e-library to download most of our e-books for only € 4,50. For this minimal fee you will receive a fully functional PDF and by doing so, you help to keep our library running.

www.sidestone.com/library



© 2012 Individual Authors

Published by Sidestone Press, Leiden

www.sidestone.com

Sidestone registration number: SSP121870001

ISBN 978-90-8890-092-1

Illustration cover: “Lake Village with Blue Mountain” by Ernest Grisct (1844-1907);

Lubbock family archives (reproduced with permission of the Lubbock family.

Cover design: K. Wentink, Sidestone Press

Lay-out: F. Stevens & P.C. van Woerdekom, Sidestone Press

Contents

Acknowledgments	7
List of contributors	9
List of figures	11
Preface	15
1 Munro and the emergence of archaeology <i>Magdalena S. Midgley and Jeff Sanders</i>	17
2 A man changed by Darwin <i>David Clarke</i>	37
3 Research on Neolithic and Early Bronze Age wetland sites on the north European plain <i>Johannes Müller</i>	55
4 All in good tradition? some thoughts on cultural markers in a late Neolithic lakeside dwelling from Switzerland <i>Thomas Doppler, Sandra Pichler, Brigitte Röder, Jörg Schibler</i>	93
5 Copper artefacts of the Mondsee group and their possible sources <i>Carolin Frank and Ernst Pernicka</i>	113
6 Forging a chronological framework for Scottish crannogs; the radiocarbon and dendrochronological evidence <i>Anne Crone</i>	139
7 Crannogs as buildings: the evolution of interpretation 1882 - 2011 <i>Graeme Cavers</i>	169

ALL IN GOOD TRADITION? SOME THOUGHTS ON CULTURAL MARKERS IN A LATE NEOLITHIC LAKESIDE DWELLING FROM SWITZERLAND

*Thomas Doppler, Sandra Pichler,
Brigitte Röder, Jörg Schibler¹*

Abstract

With its Neolithic and Bronze Age wetland sites, Switzerland offers an incomparable source of information on prehistoric dwellings. The exceptional preservation of wooden construction elements, along with the advances in dendrochronology allow not only identification and dating of individual houses to the year, but also understanding of a settlement's evolution and comparison of material assemblages between individual houses. Such an approach was taken on the late Neolithic lakeside dwelling Arbon Bleiche 3, where coexistence of a local and an immigrant population group is attested. The hypothesis put forward is that animal food remains are more stable and lasting indicators of cultural traditions than ceramics.

Keywords: Neolithic, Switzerland, wetland archaeology, social archaeology, archaeozoology, ceramics

1 IPAS, Institute for Prehistory and Archaeological Science, Basel University, Spalenring 145, 4055 Basel (Switzerland), thomas.doppler@unibas.ch; sandra.pichler@unibas.ch; brigitte.roeder@unibas.ch; joerg.schibler@unibas.ch

Introduction

Archaeological sites around moors, coastlines and lake sides, which already fascinated Robert Munro, are of particular importance due to their exceptional preservation. Indeed, wooden construction elements are generally preserved well enough to be dated to the year based on tree rings. As a result, the layout of individual houses and their exact year of construction can be determined. This, in turn, enables archaeologists to reconstruct the development of the entire settlements, permitting detailed insights otherwise unattainable. This potential of information, described as a “treasurehouse of knowledge” by Andrew Sherratt (2004, 269), is characteristic of Switzerland, with its numerous Neolithic and Bronze Age lakeside dwellings. The wetland site discussed here dates from the 34th century BC. In the Swiss chronology, this corresponds to the early Late Neolithic, where a generalized and continuous transition from the Pfyn to the Horgen culture took place. Not only does this site lie at a transition period, but it also represents a timespan for which few sites are known. Further, it is a period which is marked by an increasing influence from the East (e.g. Köninger et al. 2001).

Arbon Bleiche 3: glimpse into a sparsely known period

The settlement of Arbon Bleiche 3 is located on the southern shore of Lake Constance (Figure 4.1). It was excavated from 1993 to 1995 by the Archaeological Service of Thurgau (Amt für Archäologie Thurgau). Due to the waterlogged, hermetically sealed archaeological sediments, organic remains as well as finds and features were very well preserved. Over a surface of about 1100 m² a total of 27 house plans were identified (Figure 4.2). It is thought to represent a third, or even half, of the original settlement surface (Leuzinger 2000, 15-17, 173). Compared to other lakeside dwellings, the excavated area is remarkable and the results of its analysis can be considered representative. The uncovered houses are quite uniform, with an average size of 4 x 8 metres. Only two small buildings appear square in plan measuring 2 x 2 metres (house 17 and 25) and are exceptions to this regularity. The houses are lined up in rows which are separated by narrow lanes. Dendrochronological analyses enabled the establishment of the year of construction for every house, thus allowing the reconstruction of the settlement history and its dynamics in the excavated area. It has been shown that the settlement came into existence in 3384 BC and had to be abandoned, due to a devastating fire, in 3370 BC (Leuzinger 2000, 51-87). The fact that no other settlement phase was found before or after the

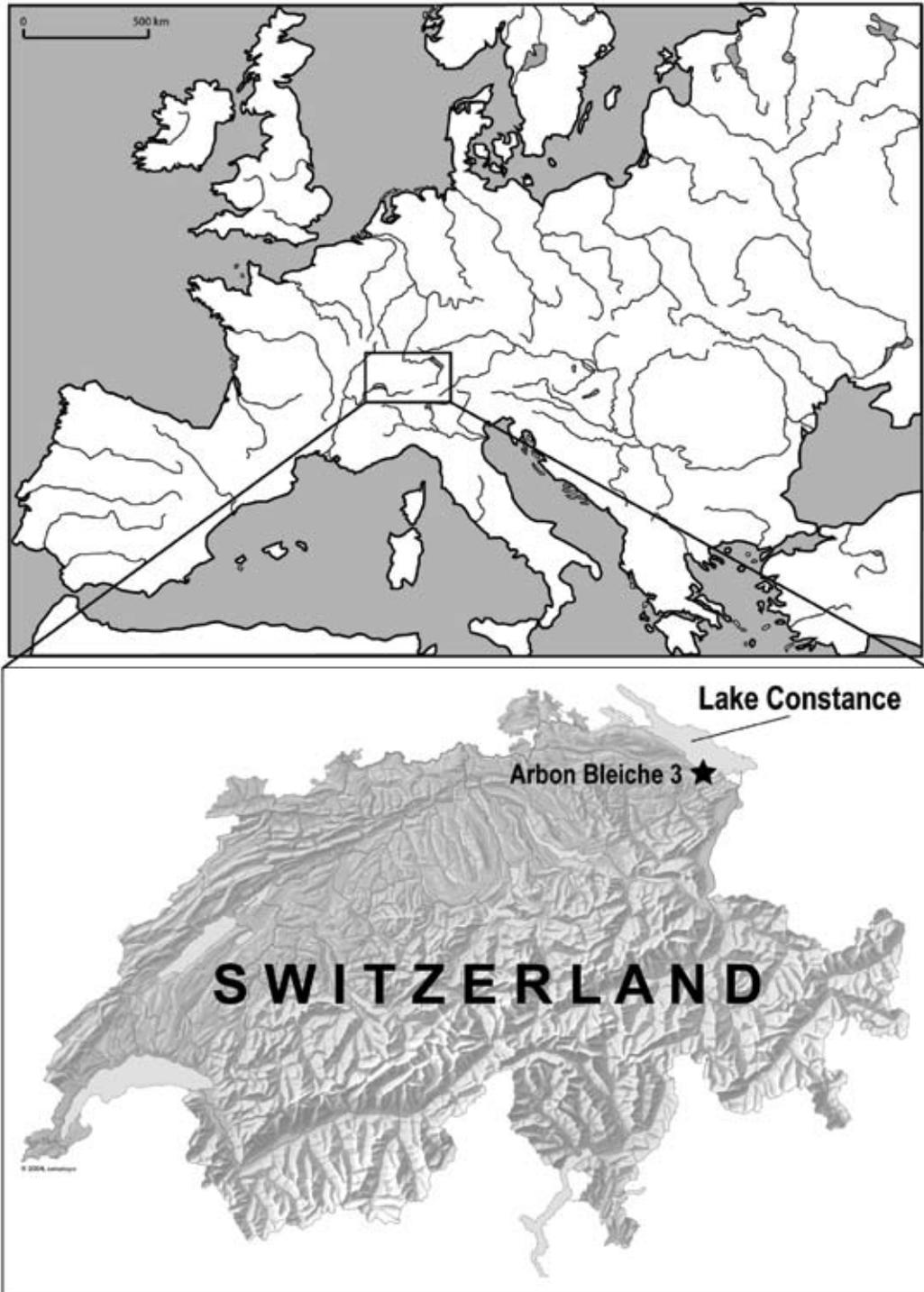


Figure 4.1 Location of the Neolithic lakeside settlement of Arbon Bleiche 3.



Figure 4.2 Dendrochronologically dated house plans with year of construction (modified after de Capitani et al. 2002, 21, Fig. 10).

documented occupation excludes a mixing up of different layers and periods. Even within the short and single-phased occupation, hardly any horizontal and vertical mixing took place which was revealed by several interdisciplinary analyses of the layer formation processes (Brombacher and Hadorn 2004, Deschler-Erb and Marti-Grädel 2004a, Haas and Magny 2004, Ismail-Meyer and Rentzel 2004, Thew 2004). The settlement is therefore particularly well suited

to studying spatial patterns of material remains, both in individual houses and in the settlement as a whole. It is the most intensively analyzed Neolithic wetland site in Switzerland and all results have been published in three volumes (Leuzinger 2000, de Capitani et al. 2002, Jacomet et al. 2004a).

Different ceramic traditions within one settlement

Besides local ceramics which – as the settlement is positioned in a chronological transition phase – show characteristics of both Pfyn and Horgen traditions, there is evidence of vessels attributed to the Baden culture and, to a lesser extent, to the Altheim culture



Figure 4.3 The ceramic found in Arbon Bleiche 3 could be attributed to different cultures. Above: pottery with characteristics of both Pfyn and Horgen traditions. Below, left: Baden pottery. Below, right: Altheim pottery (modified after de Capitani 2002, 146, Fig. 198; 210, Fig. 311; 218, Fig. 319 – all photographs by Amt für Archäologie Thurgau, D. Steiner).

(de Capitani 2002, 222; Figure 4.3). The ceramics found in Arbon Bleiche 3 belonging to the Baden Culture correspond mostly to the early Baden period, also called the Boleráz group. Its core lies in east Austria, west Hungary, southwestern Slovakia and Moravia. Bohemia, Silesia, Little Poland and the northeastern part of old Yugoslavia form the periphery of the Boleráz group (de Capitani 2002, 210). Concerning the pottery belonging to the Altheim culture, parallels could be drawn with Bavaria (de Capitani 2002, 219). Since this foreign pottery is not just represented by single finds but appears on a regular basis (34 vessels attributed to the Baden culture and 11 vessels attributed to the Altheim culture; de Capitani 2002, 216, 219), it is thought that they are not imported objects. This is supported by the fact that the foreign pottery has been manufactured with clay found around the site and which therefore is of local origin (Bonzon 2004, 312). As a result, it is believed that, since the ceramic objects were not exchange goods, people from the Baden and Altheim culture areas came to Lake Constance, bringing with them their technological know-how, and integrated with already established local inhabitants. This would explain the coexistence of distinct ceramic traditions present at Arbon Bleiche 3. In accordance with the pottery, there are other elements pointing towards an eastern influence. This is the case with plant remains where flax and emmer increase in frequency. The same is true for clay spindle whorls, and the increasing amount of cattle remains, which could be linked to the advent of draught animals (Jacomet et al. 2004b, 410-411), although the latter may also be due to specific subsistence strategies and dietary habits.

Archaeozoological data as valuable information source

Arbon Bleiche 3 is characterized by rich and diverse material remains comprising not only archaeological artefacts but also a wealth of archaeobiological remains. Animal bones represent an especially valuable information source because they are found in almost every site and are closely connected to dietary habits – an essential element of everyday life.

The basic animal bone identification for the Arbon Bleiche 3 site was undertaken by Sabine Deschler-Erb and Elisabeth Marti-Grädel, while fish remains were studied by Heide Hüster Plogmann (Deschler-Erb and Marti-Grädel 2004b, Hüster Plogmann 2004). Their subsequent distribution analyses yielded truly remarkable results. The analysis of the rich faunal remains – about 70,000 bone fragments in total – revealed an interesting internal division of the settlement. In the northern part evidence of intense beef

consumption was found, whereas in the southern part more pork was consumed (Deschler-Erb and Marti-Grädel 2004b, 221-223; Marti-Grädel et al. 2004). Less conspicuous, but likewise significant, was the concentration of ovicaprid bones in the northern houses nos. 2, 11 and 13. This was quite clearly confirmed by our analyses (Doppler *in preparation*).

Remarkably, the difference between the two settlement halves was also visible in the fish remains; while larger amounts of fish caught near the shore were found in the northern part of the settlement, open water species prevailed in the southern half (Hüster Plogmann 2004, 272-274; Figure 4.4). Although the database for the fish – as well as for the botanical remains, which will not be discussed here (see Hosch and Jacomet 2004, Röder et al. *in preparation a*) – is somewhat limited by the restricted sampling area (Leuzinger and Jacomet 2004, 35-39), the findings nonetheless support the results obtained for the large animal bones. These are certainly valid because they were recorded, with numerous specimens recovered,

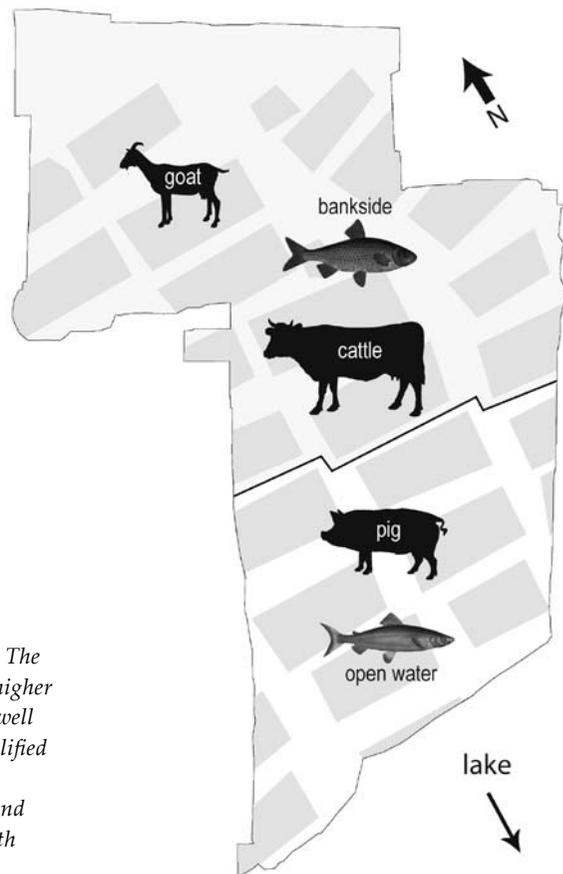


Figure 4.4 Simplified sketch of the internal division of Arbon Bleiche 3 according to archaeozoological data. The northern part is characterized by a higher amount of cattle and goat bones, as well as fish caught near the shore (exemplified here with a carp). In the southern part, a higher amount of pig bones and open water fish (exemplified here with whitefish) is to be noted.

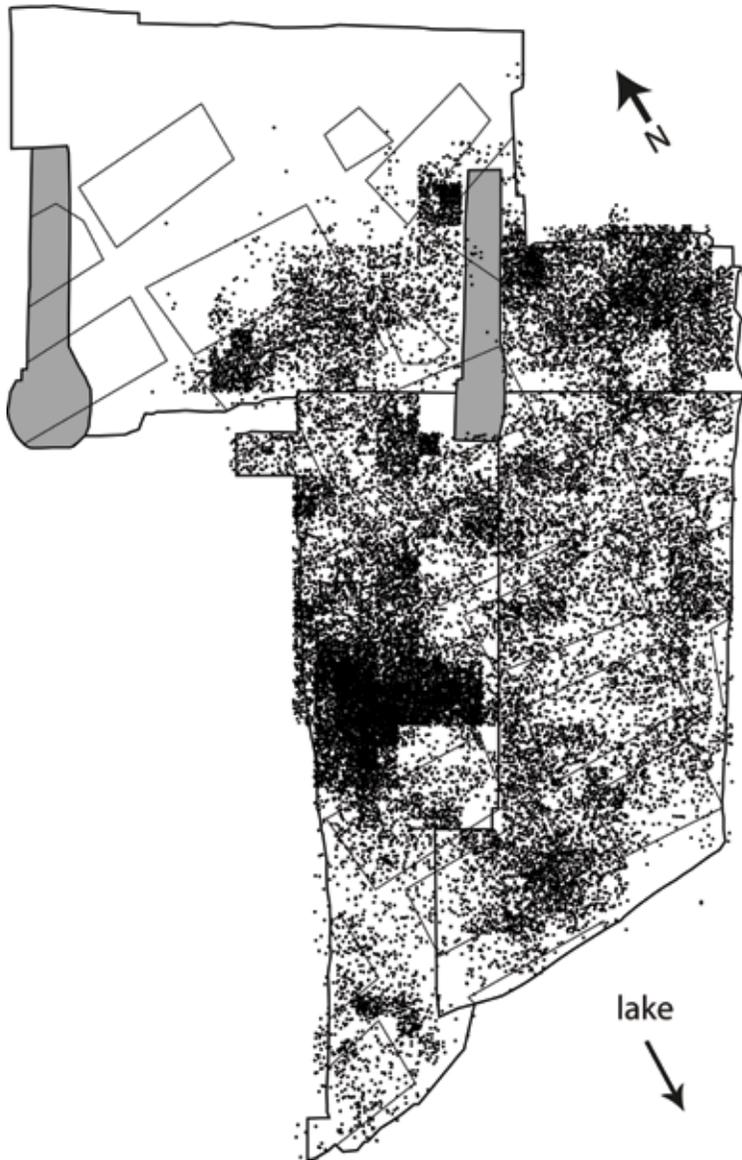


Figure 4.5 Horizontal distribution of all animal bones in the cultural layer according to fragment number (modified after Deschler-Erb and Marti Grädel 2004b, 159, Fig. 140). The northwestern part is poor in finds due to preservation issues. The grey stripes in the northern part of the settlement represent test trenches examined in 1983 which are not mapped here (Leuzinger and Jacomet 2004, 29-30).

over the whole settlement area. The only grey area remains the northwestern part of the settlement which showed poor preservation (Deschler-Erb and Marti Grädel 2004a, 93-94; Figure 4.5). Based on the marked contrast in the distribution pattern of the animal remains, the question of differences in subsistence and dietary habits arises. Indeed, this pattern may reflect, at least partially, a difference in cultural tradition, or the presence of culturally distinct groups (Marti-Grädel et al. 2004, 175).

Hybridisation of ceramic traditions? Animal bones as cultural markers?

There are only a few archaeozoological studies which have been carried out on Altheim or Baden sites and the current state of knowledge in that domain is far from satisfying. The existing data points towards cattle and small ruminants being central to the economy in both of these cultures, whereas pig seems to have been less favoured (Murray 1973, 182-184; Milisauskas and Kruk 1989, 436-437; Benecke 1994, 79, 89-90; Pucher and Schmitzberger 1999, 623; Deschler-Erb and Marti-Grädel 2004b, 251). In east Switzerland, however, pig is more ubiquitous in archaeozoological assemblages, making the high number of pig fragments in Arbon Bleiche 3 unsurprising (Schibler 2004, 2006). Thus, it would seem that the high amount of cattle and goat bones in the northern part of the dwelling reflects an actual dietary preference linked to an external cultural influence.

In light of the formulated hypothesis, based on animal remains, that cultural preferences can be observed spatially in Arbon Bleiche 3, ceramic as a cultural indicator was also considered. A first step was to concentrate on the foreign pottery (Figure 4.6). Although there are some general tendencies as to their distribution in space, there are no particular concentration spots showing a marked difference between the northern and southern parts of the settlement. The poor preservation in the northernmost part of the site, however, has to be taken into account (de Capitani 2002, 139-140). Even if the given picture is not uniformly representative, the pottery does not seem to point towards any cultural discrepancy between the northern and the southern halves of the settlement. At first sight, this may come as a disappointment when considering the promising results revealed by the archaeozoological analysis. A closer investigation of the ceramic analyses does, however, uncover some interesting aspects.

Archaeometry and archaeology indicate that an exchange of technological know-how took place. This is shown by the presence of foreign vessels manufactured using local technology (granite temper) and local vessels manufactured using foreign technology



Figure 4.6 Horizontal distribution of foreign ceramic (culture and burnt layers shown together; Baden fragments: $n = 626$, Altheim fragments: $n = 351$). Evidence for foreign ceramic is shown per square meter (black: presence, white: absence) regardless of fragmentation (modified after de Capitani 2002, 217, Fig. 317, 219, Fig. 321).

(grog temper; de Capitani 2002, 215-216; Bonzon 2004, 294). This type of evidence points towards active interchange between the inhabitants of Arbon Bleiche 3. This would possibly include the exchange of both knowledge and artefacts, leading to a uniform

spatial distribution of the different types of pottery; hence the absence of any visible spatial division of cultural groups within the settlement. Also, linked to this inter-mixture of pottery forms, are the observations made by de Capitani (2002, 169) that pottery manufactured according to the Baden technology is more common in Arbon Bleiche 3 at the beginning of the settlement. If we presume that these “foreigners” didn’t simply emigrate, then the only explanation is that they adopted local technology as well as, in time, form.

In order to develop the cultural differences hypothesis, a correspondence analysis on the available data was carried out. Correspondence analysis is widely used in archaeology but its application is mostly limited to chronological issues, particularly in connection with the seriation of grave inventories. Its potential for the detection of associations beyond chronological questions – in the sense of exploratory data analysis – has hardly been realized so far. The method offers great potential for the analysis of archaeobiological data with regard to socio-historical issues as demonstrated in first attempts by Moreno-García et al. (1996), Hüster-Plogmann et al. (1999), Valamoti (2005), Jacomet and Schibler (2006) and van der Veen (2007).

In the case of the cultural differences hypothesis specific to Arbon Bleiche 3, the potential of canonical correspondence analysis is of special interest. The methodological approach, the underlying data, and the exhaustive statistical interpretation will be explained in a forthcoming publication (Doppler *in preparation*). We will therefore not go into much detail here. It should just be noted that this variant of correspondence analysis works with ordination variables, which makes it possible to include pre-existing findings or knowledge in the analysis and to predefine the analytical structure (e.g. ter Braak 1986, Greenacre 2007). The data – the target variables – are arranged according to the specifications. From the resulting diagram, the distribution of the target variables in relation to each ordination variable, which appear as arrows on the illustration, can be deduced and interpreted. In our analysis, we chose ordination variables which are believed to be connected with the Baden culture and which can therefore be interpreted as markers for a cultural influence from the Baden culture area (Jacomet et al. 2004b, 410-411). The potential influence from the Altheim culture will not be discussed due to the paucity of the evidence. Besides the pottery, we included spindle whorls, indications for the use of draught animals and the evidence of emmer and flax as ordination variables (Figure 4.7). The result of these analyses shows that the blending of cultural traditions is especially apparent in artefacts and tool technologies (Doppler *in*

preparation). This corroborates our hypothesis that blending, or reciprocal influence, results in producing distribution patterns which can no longer be interpreted with regard to identifying cultural differences in the archaeological record. In spite of the blending, the presence of different cultural traditions was still fairly easy to detect in Arbon Bleiche 3 because of the conspicuous Baden and Altheim vessels. Yet, our findings clearly show that ceramics are not necessarily a strong marker of cultural identity – a statement which certainly is not entirely easy to accept in archaeology.

However, differences between the northern and southern halves of the settlement do emerge from the analysis of the animal bones. This leads us to conclude that, in our case, the animal bones, or rather the dietary habits they represent, might possibly be better cultural markers than the ceramics. In our opinion, it is therefore quite feasible to link the differences in the distribution of animal bones in Arbon Bleiche 3 to different cultural traditions. The literature clearly shows that dietary habits are determined to a high degree by cultural factors and that they represent a very stable cultural element (e.g. Messer 1984). Even if alternative interpretations for the observed differences might be considered, for instance the existence of unequal religious dietary rules or the existence of social groups based on gender or alliances, we think it likely that the increased portions of cattle and goats – and possibly the high amount of fish caught close to shore – in the northern part of the settlement are linked to eastern cultural traditions.

Conclusions

Our findings illustrate varying forms of intercultural contacts within Arbon Bleiche 3. We can state that this settlement allows the detection of dynamic processes that highlight coexistence and interaction of different cultural groups which led to reciprocal influences and hybridisation seen in the material remains. Such processes may result in the blending of distinct characteristics in material culture so that they are no longer detectable with conventional analyses. These observations are of socio-historical importance. They highlight the need to go beyond our all too often static perspectives of archaeological finds and features (e.g. Bleicher 2009, Ebersbach 2010). In our case, this is certainly made possible by the rich number of houses excavated within a large surface and dated to precise years, as well as the possibility to contrast the cultural layer with a conflagration layer (Leuzinger 2000, Doppler *in preparation*). Our conclusions indicate that we must anticipate finding developments and changes which may have occurred in a short time even though the temporality of such processes depends

on different factors (Fokkens 2008) and may not be conclusively determined. However, our results suggest that such processes occurred much faster in the case of tools and technologies than of dietary habits and the use of animal resources. The latter appear to be much more stable and lasting. This, in turn, leads us to conclude that, in our case study, the animal bones might be a more reliable indicator of cultural identity than the ceramics. It remains to be seen whether future studies will corroborate this observation.

Furthermore, the clear settlement division as shown by animal bone distribution is a remarkable contradiction to a latent premise in wetland archaeology which suggests that the commonly uniform houses in lakeside dwellings reflect cultural, social and economic uniformity. Such an assumption rules out the possible coexistence of social groups with different traditions and subsistence strategies. All houses are supposed to follow the same subsistence strategy using identical means of production and having the same dietary habits. Due to the presupposed uniform resource use and dietary habits, there should not be any substantial differences in refuse composition and inventories among the houses (Doppler et al. 2011). The fact that we see such differences between the houses in Arbon Bleiche 3 leads us to take another look at archaeological households (most fundamentally Wilk and Rathje 1982) and shows that untested research premises have to be challenged. Instead of the autarky of houses and homogenous behaviour in Neolithic lakeside settlements we must rather assume heterogeneity and the existence of complex networks of interaction and cooperation within settlements (Doppler *in preparation*). Such networking may, for example, have constituted an advantage in handling difficult situations or crises (Doppler et al. *in preparation*, Röder et al. *in preparation* b).

The fact that animal remains are the focus of this study is by no means a coincidence. Firstly, they are generally abundant on archaeological sites and secondly, the last twenty years of research have increasingly shown their potential in answering socio-historical questions (e.g. Crabtree 1990, Gifford-Gonzalez 1991, Scott 1996, Gumerman 1997, Rowley-Conwy 2000, Miracle and Milner 2002, Jones O'Day et al. 2004, Marciniak 2005, Vigne et al. 2005, deFrance 2009). We therefore strongly advocate a more diverse utilization of the socio-historical potential of archaeozoological data in order to establish social archaeozoology as a valuable and accepted tool in archaeological research. Using the proposed approach on the wealth of data available from Europe's numerous wetland sites will contribute significantly to our understanding of the past, and refine the picture drawn by Robert Munro more than 100 years ago.

Acknowledgements

We owe our thanks to Stefanie Jacomet and many collaborators at the Institute for Prehistory and Archaeological Science at Basel University for fruitful discussions and many useful hints. We also thank the Archaeological Service of Thurgau for help and further information on Arbon Bleiche 3. We are furthermore grateful to Géraldine D'Eyrames and Ben Jennings for their support during translation. This paper was realized as part of the research project "New foundations for research in prehistoric archaeology", funded by the Swiss National Science Foundation.

References

- Benecke, N. 1994, *Archäozoologische Studien zur Entwicklung der Haustierhaltung in Mitteleuropa und Südsandinavien von den Anfängen bis zum ausgehenden Mittelalter*. Schriften zur Ur- und Frühgeschichte 46. Berlin: Akademie Verlag.
- Bleicher, N. 2009, *Altes Holz in neuem Licht - Archäologische und dendrochronologische Untersuchungen an spätneolithischen Feuchtbodensiedlungen Oberschwabens*. Materialhefte zur Archäologie in Baden-Württemberg 83. Stuttgart: Konrad Theiss Verlag.
- Bonzon, J. 2004, Archaeometrical study (petrography, mineralogy and chemistry) of the ceramics. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 294-312.
- Brombacher, C. and Hadorn, P. 2004, Untersuchungen der Pollen und Makroreste aus den Profilsäulen. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 50-65.
- Crabtree, P.J. 1990, Zooarchaeology and Complex Societies: Some Uses of Faunal Analysis for the Study of Trade, Social Status, and Ethnicity. In: M.B. Schiffer (ed.) *Archaeological Method and Theory*. Tucson: The University of Arizona Press, 155-205.
- de Capitani, A. 2002, Gefässkeramik. In: A. de Capitani, S. Deschler-Erb, U. Leuzinger, E. Marti-Grädel and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Funde*. Archäologie im Thurgau 11. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 135-276.
- de Capitani, A., Deschler-Erb, S., Leuzinger, U., Marti-Grädel, E. and Schibler, J. (eds.) 2002, *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Funde*. Archäologie im Thurgau 11. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau.

- deFrance, S.D. 2009, Zooarchaeology in Complex Societies: Political Economy, Status, and Ideology. *Journal of Archaeological Research* 17: 105-168.
- Deschler-Erb, S. and Marti-Grädel, E. 2004a, Hinweise zur Schichterhaltung aufgrund der Tierknochen. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 90-100.
- Deschler-Erb, S. and Marti-Grädel, E. 2004b, Viehhaltung und Jagd. Ergebnisse der Untersuchung der handaufgelesenen Tierknochen. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 158-252.
- Doppler, T. in preparation, *Archäozoologie als Zugang zur Sozialgeschichte in der Feuchtbodenarchäologie. Forschungsperspektiven am Fallbeispiel der neolithischen Seeufersiedlung Arbon Bleiche 3 (Schweiz)*. PhD Thesis 2009, Basel University.
- Doppler, T., Pollmann, B., Pichler, S., Jacomet, S., Schibler, J. and Röder, B. 2011, Bauern, Fischerinnen und Jäger: Unterschiedliche Ressourcen- und Landschaftsnutzung in der neolithischen Siedlung Arbon Bleiche 3 (Thurgau, Schweiz)? In: J. Studer, M. David-Elbiali and M. Besse (eds.) *Paysage...Landschaft...Paesaggio... L'impact des activités humaines sur l'environnement du Paléolithique à la période romaine*. Cahiers d'archéologie romande 120. Lausanne: Musée d'archéologie et d'histoire, 143-158.
- Doppler, T., Pichler, S., Röder, B. and Schibler, J. in preparation, Coping with crises: Subsistence variety and resilience in the Neolithic lakeshore settlement Arbon Bleiche 3 (Switzerland).
- Ebersbach, R. 2010, Vom Entstehen und Vergehen – Überlegungen zur Dynamik von Feuchtbodenhäusern und –siedlungen. In: I. Matuschik, C. Strahm, B. Eberschweiler, G. Fingerlin, A. Hafner, M. Kinsky, M. Mainberger and G. Schöbel (eds.) *Vernetzungen. Aspekte siedlungsarchäologischer Forschung*. Festschrift für Helmut Schlichtherle zum 60. Geburtstag. Freiburg im Breisgau: Lavori Verlag, 41-50.
- Fokkens, H. 2008, The temporality of culture change. In: H. Fokkens, B.J. Coles, A.L. van Gijn, J.P. Kleijne, H.H. Ponjee, C.G. Slappendel (eds.) *Between Foraging and Farming – an extended broad spectrum of papers presented to Leendert Louwe Kooijmans*. *Analecta Praehistorica Leidensia* 40. Leiden: Faculty of Archaeology, Leiden University, 15-24.
- Gifford-Gonzalez, D. 1991, Bones are not enough: analogues, knowledge, and interpretive strategies in zooarchaeology. *Journal of Anthropological Archaeology* 10: 215-254.

- Greenacre, M. 2007, *Correspondence Analysis in Practice*. Boca Raton: Chapman & Hall/CRC.
- Gumerman, G. 1997, Food and Complex Societies. *Journal of Archaeological Method and Theory* 4(2): 105-139.
- Haas, J.N. and Magny, M. 2004, Schichtgenese und Vegetationsgeschichte. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 43-49.
- Hosch, S. and Jacomet, S. 2004, Ackerbau und Sammelwirtschaft. Ergebnisse der Untersuchung von Samen und Früchten. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 112-157.
- Hüster Plogmann, H. 2004, Fischfang und Kleintierbeute. Ergebnisse der Untersuchung von Tierresten aus den Schlämmproben. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 253-276.
- Hüster-Plogmann, H., Jordan, P., Rehak, A., Schibler, J. and Veszeli, M. 1999, Mittelalterliche Ernährungswirtschaft, Haustierhaltung und Jagd. Eine archäozoologische Untersuchung ausgewählter Fundensembles aus der Schweiz und dem angrenzenden Ausland. *Beiträge zur Mittelalterarchäologie in Österreich* 15: 223-240.
- Ismail-Meyer, K. and Rentzel, P. 2004, Mikromorphologische Untersuchung der Schichtabfolge. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 66-80.
- Jacomet, S. and Schibler, J. 2006, Traction animale et données paléoenvironnementales au Néolithique dans le nord des Alpes. In: P. Pétrequin, R.-M. Arbogast, A.-M. Pétrequin, S. van Willigen, and M. Bailly (eds.) *Premiers chariots, premiers araires - La diffusion de la traction animale en Europe pendant les IVe et IIIe millénaires avant notre ère*. Paris: CNRS éditions, 141-155.
- Jacomet, S., Leuzinger, U. and Schibler, J. (eds.) 2004a: *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau.

- Jacomet, S., Leuzinger, U. and Schibler, J. 2004b, Synthesis. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 379-416.
- Jones O'Day, S., van Neer, W. and Ervynck, A. (eds.) 2004, *Behaviour Behind Bones. The zooarchaeology of ritual, religion, status and identity*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books.
- Königer, J., Kolb, M. and Schlichtherle, H. 2001, Elemente von Boleráz und Baden in den Feuchtbodensiedlungen des südwestdeutschen Alpenvorlandes und ihre mögliche Rolle im Transformationsprozess des lokalen Endneolithikums. In: P. Roman and S. Diamandi (eds.) *Cernavodă III – Boleráz. Ein vorgeschichtliches Phänomen zwischen dem Oberrhein und der unteren Donau*. Studia Danubiana, Series Symposia 2. Bucureşti: Institutul Român de Tracologie, 641-673.
- Leuzinger, U. 2000, *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Befunde*. Archäologie im Thurgau 9. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau.
- Leuzinger, U. and Jacomet, S. 2004, Einleitung. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 25-39.
- Marciniak, A. 2005, *Placing Animals in the Neolithic: Social Zooarchaeology of Prehistoric Farming Communities*. London: University College London Press.
- Marti-Grädel, E., Deschler-Erb, S., Hüster-Plogmann, H. and Schibler, J. 2004, Early evidence of economic specialization or social differentiation: a case study from the Neolithic lake shore settlement 'Arbon-Bleiche 3' (Switzerland). In: S. Jones O'Day, W. van Neer and A. Ervynck (eds.) *Behaviour Behind Bones. The zooarchaeology of ritual, religion, status and identity*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books, 164-176.
- Messer, E. 1984, Anthropological Perspectives on Diet. *Annual Review of Anthropology* 13: 205-249.
- Milisauskas, S. and Kruk, J. 1989, Neolithic Economy in Central Europe. *Journal of World Prehistory* 3(4): 403-446.
- Miracle, P. and Milner, N. (eds.) 2002, *Consuming passions and patterns of consumption*. McDonald Institute Monographs. Cambridge: McDonald Institute for Archaeological Research, University of Cambridge.

- Moreno-García, M., Orton, C. and Rackham, J. 1996, A New Statistical Tool for Comparing Animal Bone Assemblages. *Journal of Archaeological Science* 23: 437-453.
- Murray, J. 1973, Einige Gesichtspunkte über die Beziehung zwischen Viehzucht und archäologischen Kulturen im Spätneolithikum in Europa. In: J. Matolcsi (ed.) *Domestikationsforschung und Geschichte der Haustiere*. Budapest: Akadémiai Kiadó, 177-186.
- Pucher, E. and Schmitzberger, M. 1999, Einige Bemerkungen zu den bisher in Österreich geborgenen Tierknochenfunden der Boleráz-Gruppe. *Fundberichte aus Österreich* 38: 623-625.
- Röder, B., Doppler, T., Pichler, S., Pollmann, B., Jacomet, S. and Schibler, J. in preparation a, Beyond the settlement grid: investigating social differences through archaeobiology in waterlogged sites.
- Röder, B., Pichler, S. and Doppler, T. in preparation b, Coping with crises: The impact of social aspects on vulnerability and resilience.
- Rowley-Conwy, P. (ed.) 2000, *Animal Bones, Human Societies*. Oxford: Oxbow Books.
- Schibler, J. 2004, Bones as a key for reconstructing the environment, nutrition and economy of the lake-dwelling societies. In: F. Menotti (ed.) *Living on the lake in prehistoric Europe. 150 years of lake-dwelling research*. London: Routledge, 144-161.
- Schibler, J. 2006, The economy and environment of the 4th and 3rd millennia BC in the northern Alpine foreland based on studies of animal bones. *Environmental Archaeology* 11(1): 49-64.
- Scott, E.M. 1996, Who ate what? Archaeological Food Remains and Cultural Diversity. In: E.J. Reitz, L.A. Newsom and S.J. Scudder (eds.) *Case Studies in Environmental Archaeology*. New York: Plenum, 339-356.
- Sherratt, A. 2004, The importance of lake-dwellings in European prehistory. In: F. Menotti (ed.) *Living on the lake in prehistoric Europe. 150 years of lake-dwelling research*. London: Routledge, 267-275.
- ter Braak, C.J.F. 1986, Canonical Correspondence Analysis: A new eigenvector technique for multivariate direct gradient analysis. *Ecology* 67(5): 1167-1179.
- Thew, N. 2004, The Aquatic and Terrestrial Molluscs from the Profile Columns. In: S. Jacomet, U. Leuzinger and J. Schibler (eds.) *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3: Umwelt und Wirtschaft*. Archäologie im Thurgau 12. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau, 81-89.
- Valamoti, S.M. 2005, Grain versus chaff: identifying a contrast between grain-rich and chaff-rich sites in the Neolithic of Northern Greece. *Vegetation History and Archaeobotany* 14: 259-267.

- van der Veen, M. 2007, Formation processes of desiccated and carbonized plant remains. The identification of routine practice. *Journal of Archaeological Science* 34: 968-990.
- Vigne, J.-D., Arbogast, R.-M., Horard-Herbin, M.-P., Méniel, P. and Lepetz, S. 2005, Animaux, sociétés et cultures. In: M.-P. Horard-Herbin and J.-D. Vigne (eds.) *Animaux, environnements et sociétés*. Collection "Archéologiques". Paris: Editions Errance, 151-181.
- Wilk, R.R. and Rathje, W.L. 1982, Household Archaeology. *American Behavioral Scientist* 25(6): 617-639.