

COPING WITH CRISES II: THE IMPACT OF SOCIAL ASPECTS ON VULNERABILITY AND RESILIENCE

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There is a strong tendency in archaeological research circles to analyse crisis situations primarily from an economic point of view. However, the impact that crises have on individuals or groups and how it may affect their chances of coping successfully with these, essentially also depends on social factors. Based on studies in the area of sustainability research, we have compiled a list of social parameters that can influence the vulnerability and resilience of individuals or groups and that may also have played an important role in prehistoric societies. Using the Neolithic lakeside settlement Arbon Bleiche 3 (Switzerland) as a case study, these parameters are discussed here. We ask what concrete statements can be made about the vulnerability or resilience of the settlement's inhabitants based on the available data. This approach has proved extremely productive as it has provided new insight into the everyday lives and relationships of the people who lived in Arbon Bleiche 3.

INTRODUCTION

The present paper continues on from where our first contribution in this volume (Doppler et al.) left off. Starting from the hypothesis that the Neolithic settlement of Arbon Bleiche 3 was exposed to a gradual but marked deterioration of the climatic conditions (Haas and Magny 2004: 49), we argued that the detected shifts in the subsistence strategies during the final phase of the settlement could be explained as a reaction to this postulated climate crisis: the observed intensification of both the hunting of wild animals and the breeding of pigs would actually have been an adequate reaction to decreasing crop yields, even

though, as we pointed out, different or additional explanations for the phenomenon cannot be excluded. Therefore, we interpreted the archaeozoological findings primarily from an economic point of view and concluded that the inhabitants of the individual houses – henceforth called residential groups – reacted to the presumed worsening of the climatic conditions in different ways. We linked the variety of these reactions to the pre-existing mosaic of subsistence modes, more precisely to their different degrees of resilience to the deteriorating climate: we concluded that those residential groups that could no longer meet their subsistence needs by following their established routines had reacted first and foremost.

They had been forced to change their subsistence strategies by broadening their dietary basis and / or by intensifying their exploitation of specific food resources such as wild animals or plant species.

It seems plausible to seek an economic explanation for the observed changes in the archaeozoological spectra. We do, however, believe that a purely economic explanation of the statistical findings is incomplete in itself and that it is of crucial importance to include social aspects in our considerations. It goes without saying that social phenomena such as the distribution of food among socially related or hierarchically superior individuals in times of crisis are rather difficult to identify, even under such exceptional preservation conditions as prevailed in Arbon. However, we do feel that to include social factors influencing resilience – one might also say social security (see de Jong 2005) – in times of crisis will add further scope to the discussion.

With regard to the main issues of this volume we perceive both our papers – one concentrating on economic aspects (Doppler et al., this volume), the other focussing on the social perspective – as complementary contributions highlighting the interplay of performance and structure. By doing so, we wish to promote the systematic integration of social aspects in economic investigations by playing out different social scenarios and searching for any corresponding evidence in the archaeological findings.

This paper will cover the following topics. We will first discuss the different degrees of vulnerability experienced by individuals or social groups in times of crisis. Secondly, we will introduce a conceptual framework for “crises” which comprises both social and economic aspects and which will incorporate both viewpoints. We will then present social

aspects affecting the vulnerability and resilience of social groups and individuals, and finally, we will revisit Arbon Bleiche 3 and outline our conclusions with regard to the vulnerability or resilience of the settlement’s inhabitants.

DIFFERENCES IN THE VULNERABILITY OF INDIVIDUALS AND RESIDENTIAL GROUPS IN TIMES OF CRISIS

Crises affect individuals and social groups in different ways. At an individual level, factors of social inequality – such as age and gender hierarchies, social status and ethnicity – play a pivotal role. Especially in times of food shortages, the population’s health status is a central factor. Ill or malnourished individuals are therefore subject to a much larger risk and are much more vulnerable than well-nourished individuals of a higher social status, who are in a better position to cope with a crisis. Figure 1 most drastically illustrates the extent to which social aspects, in this case gender inequality, can affect the risk exposure, i.e. the resilience of individuals. The photograph depicts unequally treated twins and their mother: the well-fed boy on the left is much more likely to weather a crisis than his badly malnourished twin sister.

Risk exposure and vulnerability or resilience are factors which also come to bear at a group level. The next paragraph aims to draw attention to one aspect of group resilience which is a matter of importance in our research on Arbon, i.e. the question as to how changes in the demographic composition affect the resilience of residential groups – an aspect which is often neglected in economic modelling in archaeology.



Fig. 1: Gender inequality can affect the risk exposure respectively resilience of individuals. The photograph depicts unequally treated twins and their mother: The well-fed boy on the left has a much better chance to weather a crisis than his badly malnourished twin sister (photo used by kind permission of Dr. Mushtaq A. Khan, Dr. Gul N. Rehman, Pakistan Institute of Medical Sciences PIMS, Islamabad)

In the archaeological literature, residential groups are commonly depicted as stable, or, in other words, static units, unchanged and unchanging through time and space (Pichler et al. 2009). Yet we all know that this is not the

case: partners split up, children are born, co-residents move in and out, people die. All of these everyday occurrences change the composition of the community around us, whether on the level of the family or

residential group respectively, or on a larger scale. Residential groups are social units which interact in a multitude of ways with their social, economic and political environments. Even though some changes are perceived as following a regular pattern (Neighbour 1985: 'the family life-cycle'), the process of transformation better resembles a moulding process, in which internal and external pressure and yield shape the finished product. All such changes do, however, greatly influence the resilience both of the individual residential groups and, in consequence, of the community as a whole (Jelín 1991).

The potential resilience of residential groups varies considerably, depending on their demographic composition and social organisation. In times of crises, these differences emerge markedly. Labour potential, time requirements, economic strength, strategic stock, but also family ties, neighbourhood relations and the faculty to call in favours play a major role in how scarcity, threats or actual blows are handled (Pankhurst 2009). They determine whether groups are potential donors or recipients of aid in times of need. Few of these factors are actually purely economic – in times of crises, the significance of social networks emerges. Studies have shown that the way threats and crises are met and weathered, or prove detrimental, is determined not only by the constitution of the individual or its close relations or residential group, but by the community or social group as an entity (Wellman and Wetherell 1996, Gaines and Gaines 2000, Pankhurst 2009, Woolley et al. 2010). The social setting of small-scale interpersonal relations as well as community makeup are therefore decisive factors in assessing consistency, stability and resilience of past and present human communities and are therefore not to be underestimated in their significance.

CONCEPTUAL FRAMEWORK OF CRISES LINKING SOCIAL AND ECONOMIC ASPECTS

In search of a suitable framework which would allow us to analyse and interpret archaeological sources against the background of crises, we defined a number of requirements the framework should meet. Firstly, it should support reflections on the genesis and management of crises and conceptualise the factors involved, so that, besides ecological and economic aspects, social factors are also included in the considerations. Secondly, it should be compatible with the conditions and theoretical concepts that apply in our research project. These refer to the following aspects: we perceive humans as an integral part of the environment they live in. Social and ecological systems are closely linked by co-evolutionary relationships; therefore, humans and environments affect and interact with each other (Adger 2000: 350–51). Furthermore, we regard societies from the perspective of the individual and therefore perceive them not as static and self-contained entities, but as open and highly dynamic social networks. Last but not least, we act on the assumption that prehistoric living conditions exhibited a high degree of complexity and were subject to perpetual non-linear processes of change. The framework must therefore be able to deal with complexity and non-linear change. In order to achieve this, a systems approach appears most suitable and will also allow for the integration of a range of perspectives – including, amongst others, economic, ecological and social aspects.

An appropriate framework has been developed by sustainability researchers. It is well-suited to our research due to certain shared premises and theoretical concepts.

In addition, the integration of social context is increasingly perceived as an important factor in sustainability research.

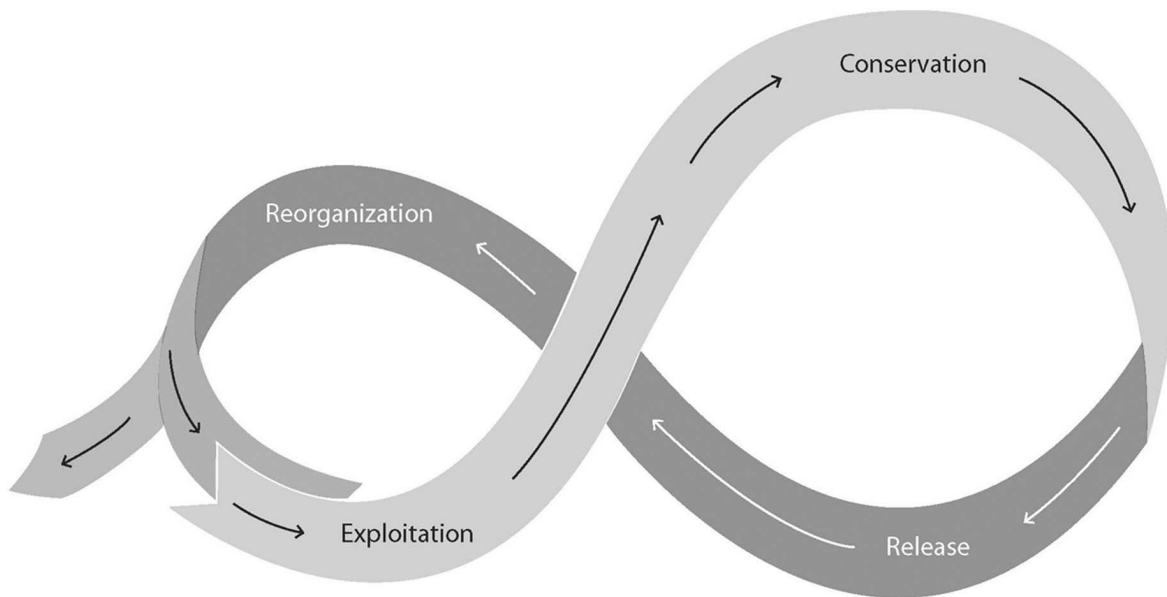


Fig. 2: The adaptive renewal cycle: a heuristic model deriving from ecology based on the concept that (social–) ecological systems go through regular cycles of organisation, collapse, and renewal. Frontloop = succession of ecosystems with phases of exploitation and conservation, backloop = rapid processes of release and renewal triggered by disturbance or crisis (Cordula Portmann after Gunderson and Holling 2002)

Fundamental work in the linking of social and ecological systems has been carried out by a group of US and Canadian researchers who have published a number of major works that are most inspiring for archaeologists as well (Berkes and Folke 2000, Gunderson and Holling 2002, Berkes et al. 2003a). These volumes all combine both theoretical considerations and practical implementations from around the world and illustrate the great potential of this approach in recent projects attempting to enhance sustainability and resilience. It is significant that the term “social–ecological system” (Berkes et al. 2003a) has become a set phrase.

One of the basic concepts in this field of research is the so–called adaptive renewal cycle (Fig. 2), ie. a heuristic model – some scholars prefer the term “metaphor” – that was developed in 1986 by Holling in order to describe the dynamics of ecosystems (Holling 1986). Holling’s underlying concept was the idea that ecological systems go

through regular cycles of organisation, collapse and renewal. The adaptive cycle concept has since also been adopted in the study of social–ecological systems (Redman and Kinzig 2003, Redman 2005. Tengö and Hammer (2003: 154) describe the adaptive renewal cycle as follows: “The frontloop describes the succession of ecosystems, with phases of exploitation and conservation, whereas the backloop represents the rapid processes of release and renewal triggered by a disturbance” or a crisis. Disturbances or crises are thus integral components of this model.

Whether social–ecological systems collapse when confronted with surprises, disturbances or crises or whether they remain intact, depends on their resilience. Resilience is “a characteristic of ecosystems to maintain themselves in the face of disturbance” (Adger 2000: 347). It is a buffer capacity (Adger 2000: 349) and may be considered as the “capability to absorb disturbance and to reorganise while undergoing change”

(Berkes and Turner 2006: 479). The greater the resilience, the greater the ability to adapt to change, in other words to cope with stress and crisis.

SOCIAL ASPECTS SHAPING VULNERABILITY OR RESILIENCE

Resilience is an antonym of vulnerability, the latter being defined as “the exposure of groups of people or individuals to stress as a result of the impacts of environmental change. Stress, in the social sense, encompasses disruption to groups’ or individuals’ livelihoods and forced adaptation to the changing physical environment. Social vulnerability in general encompasses disruption to livelihoods and loss of security” (Adger 2000: 348). This in turn means that resilience impedes disruption to livelihoods and ensures social security. In general, resilience increases with growing diversity and flexibility (Adger 2000: 354; Turner et al. 2003: 442, 456–57). The latter are pivotal factors that affect the adaptive repertoire of a social–ecological system. At this point it is important to remember that much like resources and landscapes, diversity and flexibility are not “natural givens”, but rather for the main part social constructs. Diversity and flexibility can be nurtured by cultural practices and values. In this way, conditions that favour reorganisation and renewal can be created, either consciously or unconsciously. That is why the analysis of social factors which strengthen resilience and thus also social security are of central importance in sustainability research (Folke et al. 2000, Folke et al. 2003). In addition, social and medical anthropology as well as family and kinship research in sociology, history and historical demography are also increasingly concerned with social aspects shaping resilience and social security. It is evident that there is enormous cultural variability in this area. With regard to the

question as to which social factors increase the diversity and flexibility of social–ecological systems while at the same time boosting resilience, a number of universal parameters appear to exist which have a positive effect in most contexts. The following paragraphs highlight some examples predominantly referring to farming communities.

Generalist strategies resulting in the development of a resource mosaic represent a positive factor in resilient subsistence strategies (Davidson–Hunt and Berkes 2003: 61–63). The same goes for the cooperation of different social groups sharing the same habitat but using different ecological niches; this way they all broaden their resource base (Barth 1956). Seasonal mobility like transhumance is also an adequate means of increasing resilience (Adger 2000: 355–57; Colding et al. 2003: 174–75). Flexible social organisations also have a positive effect in general, whereas rigid hierarchies and centralised resource management are rather unfavourable (Davidson–Hunt and Berkes 2003: 66–68). A very important point is social and cultural capital (Adger 2000: 351; Scheffer et al. 2002: 231; Berkes et al. 2003b: 11–12; Ramirez–Sanchez and Pinkerton 2009: 1) that can be mobilised in times of crisis (Ramirez–Sanchez and Pinkerton 2009: 1, 17). This includes wide–ranging ecological and social knowledge, broadly defined rights of resource access, use and ownership (Davidson–Hunt and Berkes 2003: 67) as well as a positive attitude towards change and innovation (Folke et al. 2000: 427; Davidson–Hunt and Berkes 2003: 66), the capacity to learn from crises (Berkes and Turner 2006) and the regard for cultural values – such as trust, sharing, generosity and reciprocity (Folke et al. 2000: 427–28; Ramirez–Sanchez and Pinkerton 2009). Finally, social networks are of central importance because they can increase resilience by way of exchanging resources

and goods, knowledge and technologies (Turner et al. 2003: 453).

Especially in societies without governmental institutions – as we presume existed in prehistory – social networks based on kinship, friendship, neighbourhood and acquaintance are of utmost importance for social security; in some cases they can even compensate inefficient subsistence strategies (Redman and Kinzig 2003: 6). How well they protect individuals in times of crisis depends, amongst other aspects, on the dimension, geographical coverage and complexity of the networks. However, family types also play a role. They may differ in terms of the degree of connectedness within their social networks – in other words, the closer the ties are within families, the smaller the networks outside of family structures tend to be (Bras and van Tilburg 2007: 300, 313, 317). Furthermore, marriage rules also exert a strong influence on resilience and social security; exogamy can foster larger relational networks while polygyny can enlarge the social networks by simultaneously increasing the economic productivity and reducing the workload of the family members (Merten and Haller 2005). And last but not least, as mentioned above, the demographic composition of households and settlements also plays an important role for the capacity of individuals and residential groups to cope with crises.

WHAT CAN WE SAY ABOUT VULNERABILITY AND RESILIENCE IN ARBON BLEICHE 3?

Coping with crises obviously involves a variety of social aspects which are especially relevant in phases of release and organisation of social–ecological systems. On a positive note, we can say that at least some of these so-called “soft factors” become tangible or may at least be guessed at in the archaeological record. Now let us return to

Arbon Bleiche 3 and ask: what can be said about vulnerability and resilience in a Neolithic community? As a preliminary hypothesis we can propose that the social factors discussed in this chapter must have been relevant for the inhabitants’ resilience.

Subsistence strategies in Arbon Bleiche 3 exhibited a high degree of diversity, thus forming an extraordinarily multifaceted mosaic of subsistence modes: the inhabitants drew on a wide range of both wild and domestic plant and animal resources (Jacomet et al. 2004, Doppler et al., this volume). They also exploited diverse ecological zones in the vicinity and further afield. This is demonstrated by the wide spectra of plant and animal remains found in the settlement, including (sub)alpine species from locations as far away as 30 km or more (Hosch and Jacomet 2004: 152–56). These (sub)alpine regions were probably used for hunting and as pasture–land in the summer (Hosch and Jacomet 2004: 152). As we have pointed out, there is evidence that certain cooperating groups of inhabitants – either of particular houses, of two or three neighbouring houses or of settlement halves – seem to have had a preference for specific resources, thus exploiting different ecological zones and niches both on land and on water (Doppler et al. 2010: 130–33; Doppler et al. this volume). We refer here for instance to the results obtained from charcoal analyses suggesting that the inhabitants of neighbouring houses collected their fire wood in specific areas (Dufraisse and Leuzinger 2009: 795–99). Another example is the interesting phenomenon that the inhabitants of the two settlement halves caught fish in different areas of the lake using different fishing techniques (Hüster Plogmann 2004: 272–75) – not only exploiting different resources, but also applying different cultural knowledge.

Such strategies not only minimise the competition regarding land use and the exploitation of resources, but also broaden

and secure the subsistence base – provided the different social groups that use different ecological niches cooperate. In the case of Arbon cooperation is quite likely to have existed: in view of the extraordinarily high spatial density in the lake dwellings (Doppler et al. this volume: Fig. 2) we may also expect a high social density. This means that the inhabitants must have established practices and rules which facilitated such close living conditions. In Arbon this challenge might have been compounded by the fact that there is evidence for an influx of individuals, possibly from as far away as Bavaria and the Vienna Basin. According to ceramic finds several cultural groups may have been living together in these 27 close-packed houses (de Capitani 2002: 209–23; Bonzon 2004: 296–97, 312). It is worth noting that the sherds from the different ceramic traditions did not cluster in particular houses but were scattered across the entire settlement (de Capitani 2002: 216–17, 219–20). This might indicate that members of different cultural groups lived under the same roof. The mixing of local and foreign ceramic technologies points in the same direction (de Capitani 2002: 215–16; Bonzon 2004: 311–12). On the other hand, the tendency towards different dietary habits in the two halves of the settlement raises the question as to whether the immigrants predominantly lived in the northern part of the settlement showing a preference for cattle and goats. Such dietary habits were rather unusual in other local Neolithic communities, which were characterised by a marked preference for pork.

Further research will be required to gain a better understanding of the processes generated by these intercultural contacts in terms of the material culture and cultural practices. However, there is already a large amount of evidence suggesting that intercultural cohabitation was based on cooperation rather than strong competition. Another aspect indicating a close cooperation

amongst the inhabitants was the evidence for the exchange – and perhaps for the sharing – of meat. Based on the distribution of articulating fragments of bones, Deschler–Erb and Marti–Grädel (2004a: 92) suggested that meat was distributed throughout the entire settlement, while pork was predominantly shared out in the southern half. They also pointed out that red deer were apparently butchered in houses 8 and 20 and then probably shared with the inhabitants of the other houses (Deschler–Erb and Marti–Grädel 2004b: 231). Another clue pointing to sharing and cooperation was an observation made by de Capitani (2002: 176–86): ceramic vessels with certain characteristic features, which she considered to have been made by particular individuals often occurred in several neighbouring houses. As suggested by de Capitani (2002: 179), this could mean that each potter produced the vessels for several “households” (ie. houses according to de Capitani).

Another possible scenario – and we would favour this option – is that larger household units or residential groups were formed either by neighbouring houses with very similar inventories or by houses with complementary inventories (Doppler et al. 2010: 133–34). In this case each potter would have provided the members of their residential group with ceramics – another piece of evidence pointing towards cooperation and exchange.

As a preliminary conclusion we can state that in terms of the diversity of resources and technologies and with regard to cultural values such as cooperation, exchange and perhaps sharing, the conditions in Arbon seem to have favoured resilience. The same applies to the cultural capital, which was expanded by several cultural groups living together and applying their distinct ecological and cultural knowledge. The positive attitude of the local population towards change and innovation can also be added in this context. This last statement is based on the fact that

several major innovations developed by the eastern cultural groups were implemented in the Neolithic groups living in the northern Alpine upland at the time (Köninger et al. 2001), most of which can also be found in the settlement at Arbon: for example the use of draught cattle and of spindle whorls, the cultivation of emmer, the intensified cultivation of flax, dairy farming and the adoption of ceramic technologies and probably also of vessels from other ceramic traditions (Jacomet et al. 2004: 410–11).

This leads us to another aspect mentioned in the previous chapter as one of the factors that increases resilience: a flexible social organisation. This aspect is more difficult to evaluate than those already mentioned. Nevertheless, a number of clues suggest that the social organisation was indeed rather flexible. First of all, it must be emphasised that there is no evidence for rigid hierarchies – an aspect which on its own would not convince, because hierarchies are not necessarily visible in the archaeological record. However, other factors that can be cited are the willingness or capability to integrate ‘foreign’ people and maybe even to share the same roof with them. Another argument is the settlement history itself which reflects marked dynamics, starting with only one house in the first year and growing to 27 houses in year nine. Since such a rapid development could not have been based on demographic growth, the only reasonable explanation is an influx of people from other settlements. In this context it is interesting to note that there is evidence of people keeping adjacent ‘building plots’ free of construction for people they were expecting to arrive at a later date and with whom they were hoping to form a close residential unit (Doppler et al. 2010: 131–33).

Wetland sites from the Recent and Late Neolithic period appear to have been characterised by highly dynamic but at the same time very short settlement histories (15

years in the case of Arbon; for a short overview see Ebersbach 2010a: 41). Bleicher (2009) outlined such dynamics based on dendrochronological studies on seven settlements in Upper Swabia covering the time span between 3283 BC and 2840 BC. He identified rhythms in the series of tree ring dates obtained from these sites, which he interpreted as representing small-scale cyclical settlement relocations. He proposed several models but favoured one which consisted of settlements that were inhabited only for very short periods, ie. four or five years, and then relocated within two or three overlapping economic areas (Bleicher 2009: 167). While Bleicher’s work focusses on the reconstruction of settlement systems and their interactions within particular economic areas, the analyses carried out by Ebersbach (2010a–c) are predominantly centred on the dynamics within individual settlements. With reference to Hillier and Hanson (1984), she suggests classifying Neolithic societies as “noncorrespondence systems”, characterised amongst other aspects by a limited local stability, a high mobility rate among individuals and small groups, a strong integration in networks on a regional and supra-regional scale, little control and a limited tendency to construct hierarchies due to the instability of residential groups, the openness to outsiders and a tendency to balance social inequalities and asymmetries (Ebersbach 2010b: 151; 2010c: 206). Ebersbach’s view of the social conditions in Neolithic wetland sites not only fits in very well with the results obtained at Arbon, but the characteristics of ‘noncorrespondence systems’ also comply almost ideally with the resilience-enhancing factors highlighted in the previous chapter.

There is very clear evidence of wide-ranging social and economic networks in the archaeological record of the settlement in Arbon: pottery and perhaps also certain dietary habits attest to the presence of and contact with people from Bavaria and the Vienna Basin. Further links with eastern

regions are reflected in the already mentioned innovations that had emanated from those areas. Copper, possibly imported from the Oberhalbstein region in the Grisons (CH) (Leuzinger 2001: 24), flint imported from regions including northern France and the Lessini Mountains in northern Italy, *dentalium* beads from the Mediterranean or Atlantic coasts (Leuzinger 2002: 22–26, 74–75) and plants from areas south of the Alps (Hosch and Jacomet 2004: 152–56) attest to the existence of large-scale networks exchanging not only raw materials and goods but also knowledge and technologies.

Besides these known parameters which increased the resilience of the population of Arbon Bleiche 3, there are several aspects which cannot be assessed. Firstly, it must be noted that in the absence of burials, conclusions concerning a population's vulnerability and resilience can only be drawn in terms of the settlement "as a whole" and not with regard to individuals. The only direct evidence of people living in the settlement are faeces containing various parasites, some capable of causing lethal disease (Le Bailly and Bouchet 2004, Marti 2004). The health status of infected individuals might have been negatively affected, which would have considerably increased their vulnerability. However, we do not know whether parasitoses affected all the inhabitants of the settlement or only a proportion. Another aspect which is difficult to determine is the demographic composition of the inhabitants of the individual houses. So far, we have no knowledge of their age–sex structure. Consequently, we cannot assess the role played by the demographic composition with regard to the different reactions to the presumed climatic deterioration pointed out in our other contribution in this volume. This decisive factor with regard to the population's vulnerability or resilience completely evades our analysis. The same applies to forms and rules of marriage such as exogamy and

polygyny, and family types, all of which would be highly relevant to the subject matter discussed here. As already mentioned, there is no evidence for social hierarchies. However, it cannot be excluded that social inequality based on age, gender and ethnicity had an impact on the circulation of food to socially related or hierarchically superior community members in times of crisis, thus causing differences in the vulnerability of individuals, be they from the same or from different residential groups.

To clarify: although the data give no indication of the existence of rigid social hierarchies strictly speaking we are not able to decide whether the distribution of meat was based on principles of sharing and reciprocity or on aspects of social inequality. A similar statement can be made with regard to the basis of the intercultural cohabitation: the 'foreigners' might have been included in the local group by 'kinning', ie. integration in the local kinship system. On the other hand, it cannot be entirely excluded that the foreigners coming from the east were held as slaves in this 'terraced housing estate' which otherwise corresponds so well with commonly held views concerning the intact social life (Röder 2010).

CONCLUDING REMARKS

In spite of some uncertainties concerning the evaluation of vulnerability and resilience, all in all, the inhabitants of Arbon would have had a good chance of coping with the intensifying climatic deterioration – had it not been for a devastating fire that put an end to the adaptive cycle and destroyed the settlement in its 15th year. On the other hand, perhaps the fire was not the end of the story, but just another challenge to cope with. It is, therefore, quite easy to imagine that the former inhabitants of Arbon Bleiche 3 split up, found accommodation with family and friends in neighbouring settlements and later

made a new start and rebuilt the settlement in a different location, thus initiating a new adaptive renewal cycle.

In the discussion following our talk we were asked whether wetland sites were not a very specific kind of settlement that cannot easily be compared with those on mineral soils. We are of the opinion that this is not the case: the only extraordinary aspects are the preservation conditions, which allow us to gain a much better insight into the social settings of past communities. In this respect the site of Arbon Bleiche 3 can help to

generate questions and hypotheses for the analysis of other settlements which do not provide the same amount of information due to a lack of waterlogged soils and organic materials.

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