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Lake Constance transgressions as the cause of abandonment of the Arbon-Bleiche 2 Early Bronze Age lacustrine village

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Abstract

The lake-dwelling chronology in the Alps stretches from the Neolithic to the Early Iron age but, the entire phenomenon is not seen as continuous. There are in fact periods when the lake shores were abandoned and subsequently reoccupied. The pattern of occupation depends on cultural as well as environmental factors with climate playing a crucial part.
Unlike the southern part of the Alps, which seems to have had a more regular occupational pattern throughout the Neolithic and the Bronze Age, the northern Alpine region shows a marked discontinuity along most of the lake shores. Two relevant breaks in lake-shore occupation are known within the northern Alpine region Bronze Age. The first occurred between the 24th and the 20th centuries BC, and the second from the 15th to the middle of the 13th century BC.
The Early Bronze Age site of Arbon-Bleiche 2, situated on the southern shore of Lake Constance (CH), was abandoned immediately before the beginning of the second major occupational gap in 1508 BC. Two other Early Bronze Age sites namely ZH-Mozartstrasse on Lake Zurich, and Bodman-Schachen 1 on the German part of Lake Constance, follow a similar chronology in occupation; and they were both abandoned in the last decade of the 16th century BC.
A possible cause of abandonment is discussed in this paper using an environmental approach related to an abrupt change of climatic conditions which resulted in an increase of the lake levels which

forced prehistoric populations to leave the proximity of the lake shores. Following the implications of sedimentological analyses, the transformation of the Bronze Age landscape caused by the lake water invasion will be simulated with the help of GIS computer programs and the slow process of landscape transformation graphically displayed as it might have happened at the time.

Introduction

The lake-dwelling phenomenon on lake Constance was recognised soon after the fortunate discovery of the lacustrine settlement of Ober Meilen (Lake Zurich) in 1854. Arbon-Bleiche 2 was discovered in 1944 and promptly excavated the following year. Its chronology consists of a first occupation from the middle 17th to the beginning of the 16th century BC. The second started around the second half of the same century (1543 BC) and finished just before the Middle Bronze Age occupational hiatus (1508 BC)

Arbon-Bleiche 2 is situated on a vast alluvial and colluvial plain surrounded by gentle hills not higher than 500 m a.s.l. The EBA site is not directly located on Lake Constance shore, but it lies at about 600 metres inland. Recent multidisciplinary studies have shown that the possible main reason for the EBA abandonment of Arbon-Bleiche 2 at the beginning of the 15th century BC was the lake level rise caused by climatic change. The purpose of this paper is first of all to discuss whether this theory is plausible, and to show through computer simulations the possible consequences of the lake level transgression. A final objective is to deduce where those people decided to go once the shore was left behind.

Arbon-Bleiche 2: history of research

The first evidence of lacustrine villages around Arbon was discovered by Jacob Messikommer in 1882. The discovery, which consisted of wooden piles, an axe and pieces of pottery, was made near the Bär Hotel on the lake shore. The main lake-dwellings of Arbon, also known as Arbon-Bleiche, came to light because of water canalisation works carried out in 1885. The site (Arbon-Bleiche 1) was promptly excavated by Messikommer (1885) the same year and there were no further research until the second excavation campaign in 1925 (Keller-Tarnuzzer 1925).

Further water drainage works brought to the fortunate discovery of Arbon-Bleiche 2 Early Bronze Age village in 1944. The site excavated by Keller-Tarnuzzer (1945) resulted to be the most relevant one of the whole Arbon-Bleiche lake-settlement complex. Numerous objects were found and the high quantity of well preserved wood has made possible to obtain fairly accurate dendrochronological dates. A second excavation was carried out in 1990 and more accurate analyses confirmed the result obtained almost half century before (Hochuli 1994).
A new site namely Arbon-Bleiche 3 was discovered about 50 metres west of Arbon-Bleiche 1 in 1983. The settlement was partially excavated in the same year and some trenches around it also in 1990, but the main excavation campaign took place from 1993 to 1995 (Leuzinger 1997).

There are four other sites in the Arbon area known as Arbon -Bleiche 4, 5, 6 and 7. They were all discovered in 1944, but unfortunately none of them has ever been systematically excavated.

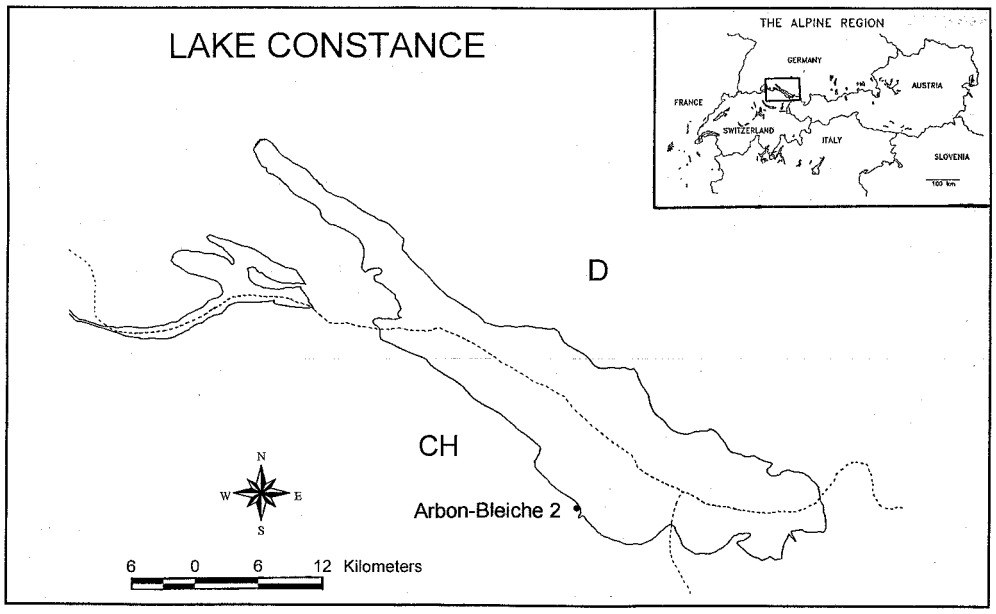

Fig. 1 Arbon-Bleiche 2 on Lake Constance

Arbon-Bleiche 2 chronology

The chronology of Bodman-Schachen 1 is based on sedimentological, dendrochronological as well as typological data, and two phases of occupation can be identified. The first phase took place in the Early Bronze Age during the second half of the 17th and the beginning of the 16th century BC and more precisely between 1650 and 1590 BC. The second and last occupation started around 1558 and ended at the brink of the 15th century BC (1508 BC) just before the MBA lake-dwelling hiatus (15th-13th centuries BC).

The time span of the initial occupational phase covers more than sixty years and, dendrochronologically speaking, has two sub-phases of tree felling and two of houses construction, all within 1640 and 1590 BC. The same happened during the second

phase of occupation (1558-1508 BC) although the distinction between the two felling phases (ca 1543 and 1527) is more difficult to be recognised (Hochuli 1994). There is also a possibility that the village was never abandoned between 1590 and 1550 BC. If it is the case we have almost 150 years of occupation with, of course, various phases of houses construction.

The topography of Arbon-Bleiche 2

The lacustrine settlement of Arbon-Bleiche 2 is located on the Swiss shore of Lake Constance (Fig.1). The site surrounding area consists of a vast flat land formed by alluvial and colluvial activity during the post glacial period. All this extremely flat area is surrounded northerly by gentle morainic slopes, westerly and southerly by medium height hills and the eastern side is the shore of Lake Constance. The plain is crossed by a number of small-sized rivers namely the Salbach, the Aach, the Steinach and a few others.

The lake-dwellings of Arbon-Bleiche were situated about 700 metres inland in a sort of land depression which was periodically flooded by the ancient River Salbach. Because the Early Bronze Age level of Lake Constance was at ca 392-393 metres a.s.l. and the prehistoric dwellings of Arbon-Bleiche 2 were found at an altitude which ranged between 396 and 396.90 metres a.s.l. (Hochuli 1994), the latter were never influenced by the seasonal lake transgressions which are usually less than three metres.

Although changes have been fairly limited, the alluvial plain has not maintained the same elevation contours throughout the past three and a half millennia. In fact, the average of today's altitude varies from 398 to 400 metres a.s.l. On the other hand, the coastal part has been largely modified by human activity in order to gain more land from the today's higher lake level (ca 396 metres a.s.l.).

Climatic change and lake fluctuations: GIS simulations

Palaeoclimatological studies based on dendrochronology (Bortenschlagen 1977, Furrer 1977 and Rennen 1982) pollen analysis (Burga 1987, 1988, 1991) and sedimentology (Joos 1982, 1991; Magny 1980, 1992) have shown that increases in humidity and precipitation within the catchment-area of a lake are directly reflected in lake levels. These lake-level transgressions are believed to be the main cause which forced the EBA lake-dwellers of Lake Constance region to abandon the lake shores and settle further inland at the end of the 16th century BC.

Research carried out by Gamper and Suter (1982) and Jacomet (1985) has shown that within the Lake Zurich region the lake level fluctuated considerably from 2500 BC to the present (Fig.2). These water-level variations were mainly related to changes in climate. Towards the end of the 16th century BC the humidity began to rise, precipitation increased and initiated lacustrine transgression. However, as Joos (1982) argues, climatic factors are not the only reasons for the lake-level changes. Land use and deforestation for example can easily alter the hydrologic balance of lakes and rivers, in fact the process of forest clearance associated with agricultural activity

reduces the permeability of the ground and consequently more water reaches the lakes causing them to rise (Gross and Ritzmann 1990).

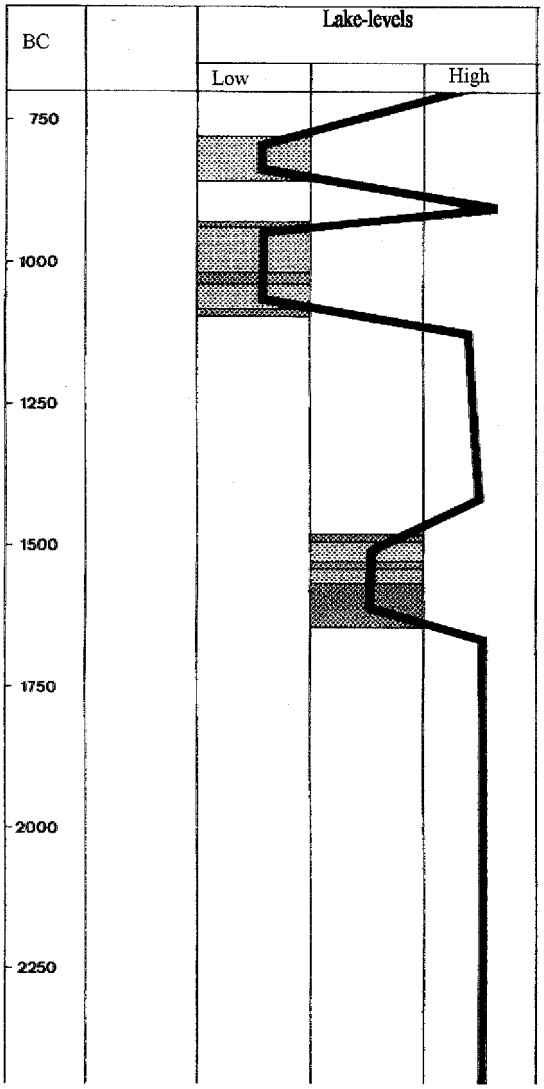

Fig. 2 Lake-level fluctuations on Lake Zurich (Modified from Gross and Ritzmann 1990: 168)

Since Lake Constance has a similar climate and comparable setting to Lake Zurich, it is very likely that an analogous situation happened in the Arbon-Bleiche area. A remarkable similarity is that according to dendrochronology the EBA lake-villages of Arbon-Bleiche 2 (Lake Constance) and ZH-Mozartstrasse (Lake Zurich) were both abandoned in the same decade namely 1510-1500 BC. If we compare this date with the graph of Fig.2 it can be seen that the two sites were occupied immediately before a significant rise in the lake level.

At this point an obvious question arises. How much did the level of Lake Constance near Arbon-Bleiche 2 fluctuate? Unfortunately there is no a straight answer to this question. What can be done instead are some computer simulations to show graphically the impact of the flooding water on the landscape.
The following four maps (Fig.3, Fig.4, Fig.5 and Fig.6) based on elevation contour lines have been digitised using AUTOCAD and exported in GIS ARCH.VIEW 3.1

whereby flood simulations have been represented by differentiating colours and thickness of the contour lines themselves. Light blue lines have been adopted to show the lake level altitude as it was during the Early Bronze Age (392 metres a.s.l.), dark blue thicker lines display the possible lake water level variations (fluctuations), green lines are the reasonably flat land (from 396 to 405 metres a.s.l.) and the brown ones the surrounding hilly area (410-450 metres a.s.l.).
Before explaining the computer simulations based on the rising of lake levels, it has to be pointed out that the maps' digitised contours have been reconstructed in relation to archaeological excavations and core sampling. The map can not therefore be 100% accurate.
The first map (Fig.3) shows the lake level (light blue lines) in the Early Bronze Age, at 392 metres a.s.l.

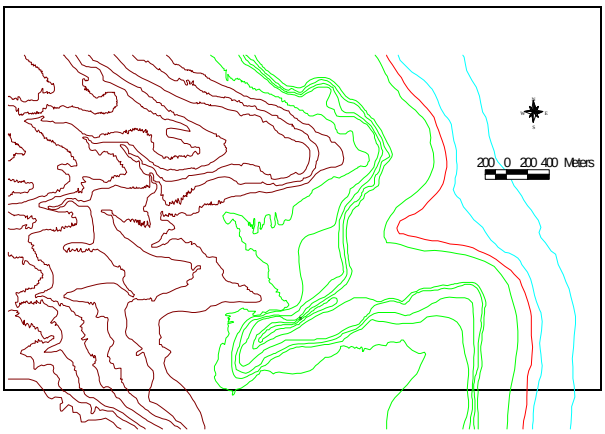

Fig. 3 Bronze Age Lake Constance level fluctuations at Arbon (CH) (392 metres a.s.l.)(the black dot is the site Arbon-Bleiche 2)

In the second map (Fig.4) it can be noticed that the land depression in which the prehistoric lake-dwellings were situated is not influenced at all if the lake level is raised to 394 metres a.s.l. because the stretch of land between the settlements and the lake is higher and the water can not flow through.

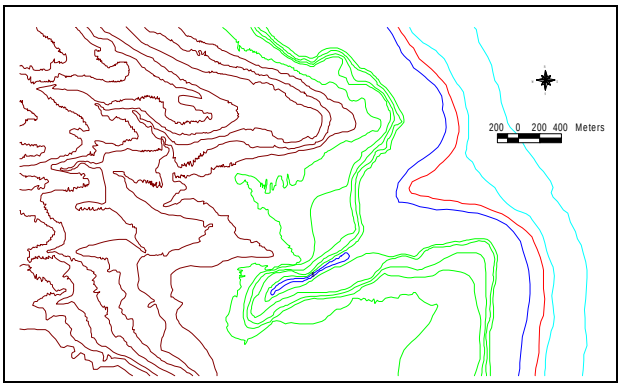

Fig. 4 Bronze Age Lake Constance level fluctuations at Arbon (CH) (394 metres a.s.l.)(the black dot is the site Arbon-Bleiche 2)

Two more metres of increase (396 metres a.s.l.) and the lake water reaches the depression partially flooding the EBA village situated at an altitude of 396 metres a.s.l. (Fig.5).

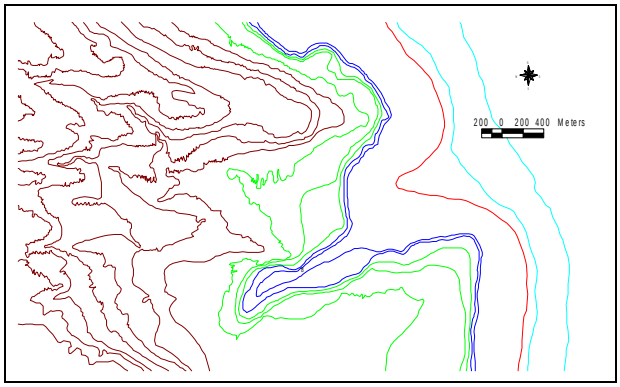

Fig. 5 Bronze Age Lake Constance level fluctuations at Arbon (CH) (396 metres a.s.l.)(the black dot is the site Arbon-Bleiche 2)

At the 398 metre-contour line, which is two metres below the maximum flood extension of Lake Constance thought to be around 400 metres a.s.l. (Schlichtherle 1995), the village is already inundated by a couple of metres of water (Fig.6).

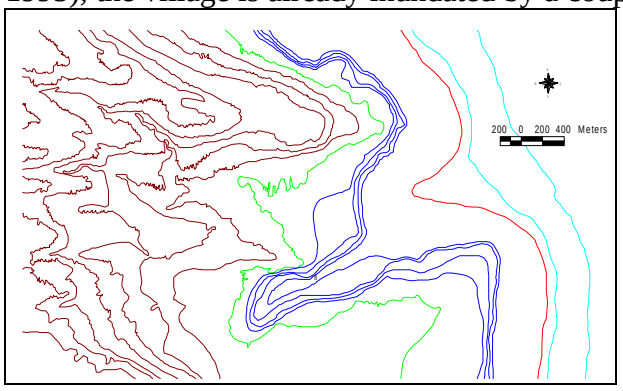

Fig. 6 Bronze Age Lake Constance level fluctuations at Arbon (CH) (398 metres a.s.l.)(the black dot is the site Arbon-Bleiche 2)

Assuming that during the Early Bronze Age, the 398 metre-contour line was in places somewhat more inland, it can be argued that 5-6 metres of lake level increment (from the EBA level of 392 m a.s.l.) should have been enough to flood a fairly extensive area influencing, to a certain extent, not only the village itself, but also its agricultural economy.

Moving inland: MBA settlements around Lake Constance

A striking feature of the chronological chart of lake-dwellings is the complete lack of archaeological evidence of human occupation along all the northern Alpine region lake-shores during the Middle Bronze Age (15th to 13th centuries BC). Although it is too hazardous to state for sure that the exodus from the lake shores was homogeneous

and sudden all over the region, there is evidence for a landwards movement of EBA lake-dwellers. Middle Bronze Age land-settlements north of the Alps have always been known, but recent discoveries of some MBA sites in the very proximity of the lakes have reopened the issue of whether or not these settlements should be regarded as lake-dwellings, or at least of lacustrine origin.

Around Bodman-Schachen area on the north-western extreme of Lake Constance (D), for example, in a locality called *Breite*, a Middle Bronze Age settlement has been found at an altitude of 404 metres a.s.l. and at about 400 metres away from the present shoreline of the lake. Unfortunately, the dates obtained from the site are not very precise: some pieces of organic material have been ^{14}C dated, but the total absence of wooden structures has not allowed a more precise estimate using dendrochronology. As a result the chronological position of the prehistoric site is mainly based on pottery typological analyses (Schlichtherle 1995).

On the Swiss side of the City of Constance area, an archaeological survey preceding the construction of the motorway N7 Schwaderloh - Kreuzlingen has revealed a few MBA sites, Kreuzlingen-Wildenwis, Saubach-West and Kreuzlingen-Schlossbühl. Due to a combination of factors such as a slightly different pottery typology, lack of dendrochronological analysis, distance from the shoreline (about 2-3 km) and the fairly elevated location of the settlements (above 500m a.s.l), it is still difficult to be able to classify them as "former" lake-dwellings. Anyway, a fairly clear "inland" movement from EBA to LBA is shown by the two sites of Tägerwilen Hochstrasse and Tägerwilen im Ribi (near Konstanz). The former is an EBA site and it is situated in the lower valley whereas the latter belongs to the LBA and lies in the upper part of the morainic slope (Rigert 1998).

Good archaeological evidence of EBA lake-dwellers moving away from the lake shores and settling further inland comes from Lake Zug some 15 kilometres south of Lake Zurich. In fact, a fairly high number of MBA sites have been found in the immediate surrounding of the lake. Some of the most important ones are those of Hünenberg-Chämleten Luzernstrasse, Cham-Eich Zugerstrasse, Steinhausen Schlossberg, Steinhausen-Eschenmatt, Baar Altersheim Martinspark and Cham-Oberwil Hinterbüel.

The occupational patterns of some of them are particularly relevant because, as it is the case of Cham-Eich Zugerstrasse, Cham-Oberwil Hinterbüel and Steinhausen Schlossberg, the settlements were occupied throughout the MBA lake-dwelling occupational "gap" (15th-13th centuries BC) and also part of the Late Bronze Age (12th century BC) before the lake shores of the northern Alpine region started to be resettled (Hochuli 1995; Gnepf 1995).

Conclusions

The Early Bronze Age lake-village of Arbon-Bleiche 2 occupies a crucial position within the Bronze Age lake-dwelling archaeology in the northern Alpine region. It is, chronologically speaking, situated at the brink of the 15th century BC just before the MBA lake-dwelling occupational hiatus and it is particularly relevant for the understanding of the possible factors which might have triggered this prehistoric exodus from the lake shores. Multidisciplinary research has confirmed that one of the

main causes of abandonment could well have been related to environmental and climatic change. Weather conditions causing a rise in lake levels forced EBA lake-dwellers to abandon the immediate proximity of the lakes.

Although the exact limit of the transgression during the Middle Bronze Age is unknown, the impact of the flooding water as simulated through computer analyses has shown that only a few metres of lake level increment would have been enough to flood a quite vast area in the Arbon-Bleiche 2 surroundings.

Although it is not always noticeable, the fact that the EBA lake-dwellers were forced away from the lake shores is confirmed by the increasing number of MBA "land" settlements found near Lake Constance. Unfortunately, because these MBA villages have been poorly preserved, it is difficult to determine whether or not they can be classified in some sense as lake-dwellings. However, there is still a strong possibility that some at least are of lacustrine origin.

In conclusion it can be stated that the lake-shore "exodus" at the end of the 16th century BC did certainly take place. Equally, some lacustrine groups did not abandon the lake shore completely, they just shifted along with the lake level fluctuations, settling the most suitable land within the surroundings of the lakes.

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