

A Lacustrine Revolution: Adaptive Shifts in the Late Glacial of South Central Europe

Eine lakustrine Revolution: Adaptive Veränderungen während des Spätglazials im südlichen Mitteleuropa

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ABSTRACT

The environmental changes in Europe at the end of the last ice age had profound effects on human populations. One of these changes, the development of numerous lakes in the region north of the Alps, created new habitats and niches that were rapidly exploited, with significant effects on many aspects of behavior. The record of environmental and archaeological changes in southern Germany and Switzerland are examined with an emphasis on some of the implications of the resulting change in settlement patterns.

Keywords: Late Paleolithic, Mesolithic, south Germany, Switzerland, lake adaptations

ZUSAMMENFASSUNG

Die Umweltveränderungen in Europa am Ende der letzten Eiszeit hatten tiefgreifende Auswirkungen auf die menschliche Bevölkerung. Eine dieser Veränderungen, die Entstehung zahlreicher Seen in der Region nördlich der Alpen, schuf neue Lebensräume und Nischen, die rasch genutzt wurden, mit erheblichen Auswirkungen auf viele Aspekte des Verhaltens. Die ökologischen und archäologischen Veränderungen in Süddeutschland und der Schweiz werden untersucht, wobei der Schwerpunkt auf einigen der Auswirkungen der daraus resultierenden veränderten Siedlungsmuster liegt.

Faunenansammlungen und Artefakte deuten darauf hin, dass die Jagd die primäre Subsistenztätigkeit war. In der sich wandelnden Umwelt entwickelten sich die Seeufer zu einem reichen Lebensraum für viele Tierarten, insbesondere für Elche und Biber, aber auch für Weidetiere wie Rothirsche und Pferde. Die scheinbare Verlagerung der Besiedlung auf die Seeufer hatte zahlreiche Auswirkungen. Die Siedlungsmuster mögen zumindest saisonal an die Seen gebunden gewesen sein, während

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die Randgebiete mit kurzen, spezialisierten Lagern, die von den Seeufern ausgingen, ausgebeutet wurden. Die Nutzung von Inseln förderte die Entwicklung und Herstellung von Booten und damit eine Zunahme der Verwendung von Holz als Rohstoff, was Auswirkungen auf die Technologie und die Arbeitsorganisation hatte. Der Bedarf an Holz und die Schäden an den Lagerplätzen durch starke Nutzung haben möglicherweise sowohl die häufige Besetzung neuer Lagerplätze an den Seeufern als auch die Entwicklung von Rodungen an den Standorten der früheren Lager erforderlich gemacht. Dies wiederum hätte eine stärkere Anziehungskraft auf Weidetiere ausgeübt und damit die Möglichkeiten für die Jagd in Ufernähe erhöht. In der Tat hätte dies eine Rückkopplungsschleife geschaffen, die die Attraktivität der Seen als eine Art Nischenkonstruktion noch erhöht hätte.

Schlagwörter: Spätpaläolithikum, Mesolithikum, Süddeutschland, Schweiz, lakustrine Anpassungen

Introduction

As temperatures began to rise after the Last Glacial Maximum, the Alpine ice sheet and small glaciers at other high elevations began to retreat episodically and the meltwater filled basins, creating numerous lakes in the Alps and surrounding lowlands. In addition, progressive warming facilitated the reforestation of the region as various plant species expanded from glacial refuges. Together, these changes transformed the environment of low and middle elevations and demanded profound adjustments by human populations.

The lakes that were formed in the glacial aftermath were initially numerous, varying in size from very large, like Lake Constance at the modern border between Germany and Switzerland, to small ponds. Over the course of the late glacial period they experienced fluctuations in water level as well as episodic, but ultimately progressive, processes of in-filling due to natural in-growth. Many of the smaller lakes and ponds became reed marshes, bogs, and finally boggy grasslands.

Amid the changes in vegetation, lakes and other wetlands were probably the biotically richest parts of the landscape and occupied a special place. They were favored habitats of many immigrating plant species, including willow, alder, poplar, sedges and reeds and must have increasingly represented patches of greater plant diversity within the region. Such patches, in turn, would have attracted, at least seasonally, many animals, notably moose, aurochs, beaver and small fur-bearers. As fish and waterfowl came to inhabit the region in greater numbers, they would have been concentrated in the wetlands as well.

Settlement Changes – Reflection of a Revolution?

Site Locations

One of the most dramatic changes in the archaeological record over the course of the environmental transformations is a shift in site distribution north of the Alps. The overwhelming majority of Magdalenian sites in southern Germany and Switzerland are caves and rockshelters in the limestone plateaus of the Jura and Swabian Alb. During the Late Paleolithic there is an increasing proportion of open-air sites in previously glaciated regions and in periglacial areas that were always ice-free. Furthermore, many of these sites are situated on lakes, ponds, and other wetlands. This shift in distribution, emphasizing occupation of the new lakes, continued and often intensified during the Early Mesolithic.

In Switzerland, among the over 50 known Magdalenian sites there are only a handful of substantial sites with more than a few artifacts located on lakes, including Moosbühl, Monruz, and Champréveyres (Leesch et al. 2012). Similarly, over 50 Magdalenian sites are known from southwestern Germany, but only one substantial site, Schussenquelle, is situated by a spring-fed pond near a larger lake (Eriksen 1991). It is possible that this pattern has been affected by both excavator bias in selecting sites and erosional processes influencing site preservation and visibility, but during the succeeding Late Paleolithic the distribution is quite different. One example in Switzerland of this new pattern is the Wauwilermoos, a former small lake in the central plateau (Nielsen 1998). Fieldwalking over many years located 9 findspots with just a few Magdalenian artifacts, but 52 Late Paleolithic sites, many with considerable numbers of artifacts, and 31 sites of the Early Mesolithic.

The shores of Lake Constance were explored by fieldwalking during the early 1900s. No Magdalenian sites and only one Late Paleolithic site were located, but at least 76 sites of the Early Mesolithic were found (Reinerth 1953; Schlichtherle 1994). In southwest Germany, the Federsee lake has only a few scattered Magdalenian artifacts around its former shores, but 23 substantial sites of the Late Paleolithic and at least 65 sites of the Early Mesolithic (Jochim 1998). Similarly, the nearby Pfrunger Ried has some isolated Magdalenian finds, but 11 Late Paleolithic sites and 21 sites of the Early Mesolithic. The former lake and wetlands of the Donaumoos in Bavaria has no evidence of Magdalenian use, but at least 20 known Late Paleolithic sites and 40 sites of the Early Mesolithic (Seitz 1965).

Ethnographic Observations

The occupation of lakeshores is common among ethnographically known hunter-gatherers in many regions. A sample of groups in California and Canada provides insights into the economic importance of lakes and the nature of lakeside settlements. Among the Modoc of northern California, lakeshore settlements included permanent villages, summer villages, winter villages, and ritual centers (Ray 1963). The largest lake, Tule Lake, had settlements of three different subgroups. The dominant economic activity in these settlements varied seasonally and included fishing, gathering, and hunting for mammals and waterfowl. The Clear Lake Pomo of north-central California occupied both permanent villages and temporary

settlements on lakeshores and islands (Kniffen 1939). Clear Lake had settlements of 11 different named subgroups distributed along its shores. Fish, waterfowl, and shellfish were the most important resources obtained from their lakeside settlements, but acorns and game were brought in from other areas. The Washo gathered annually in summer fishing camps on the shores of Lake Tahoe, with two subgroups normally geographically separated, camping on different portions of the shore (Downs 1966). The Southern Valley Yokuts of south-central California maintained permanent villages on various lakes in their area, with three subgroups sharing use of Tulare Lake and arranged geographically from north to south along the lakeshore (Wallace 1978). The major foods obtained from these settlements were fish, shellfish, waterfowl, and various plant foods. Large mammals were mostly killed when they came to the lake to drink and small mammals were usually hunted away from the shore but brought into the villages.

In the boreal forests of Canada, the Weagamow Ojibwe had both winter villages and summer camps on various lakeshores (Rogers and Black 1976). These settlements were usually at or near outlets of lakes or mouths of rivers, with some camps on points of land extending out into the lake, creating narrows. The most important activity in most lakeside settlements in all seasons was fishing, along with securing waterfowl and some berries. Hunting and trapping usually occurred in other areas by streams and some small lakes. The Mistassini Cree gathered annually in summer at Lake Mistassini, but from fall until spring individual hunting groups dispersed to their hunting territories to hunt and trap (Rogers 1963). In one published example, the group's base camps and some hunting camps were situated on smaller lakes. Certain lakes were used for base camps in several years, but new campsites were usually chosen each year due to firewood depletion. Fishing was the major activity at lakeside camps throughout this period, but in certain seasons hunting and trapping were carried out from these camps as well. Among the Hatchet Lake Chipewyan, both summer and winter camps were usually on lakeshores, often on islands (Irimoto 1980). Summer camp locations were chosen for good fishing conditions as well as for moose hunting. Winter camps, on the other hand were placed close to caribou migration routes.

Plans of six summer camps and one winter camp of the Chipewyan have been published by Irimoto (1980). The summer camps range in area from roughly 1500 to 3500 square meters, with an average of 2700 square meters. They contain from 3 to 7 huts, resulting in an average of roughly 600 square meters per hut (range = 360–880 square meters). The distance from the shore to the nearest hut ranges from 8 to 20 meters. The one winter camp is considerably smaller, with an area of approximately 435 square meters. With 5 structures, this results in an average of only 108 square meters per structure. The distance from the shore to the nearest structure is 11 meters, within the range shown for the summer camps. Notably, trash disposal in winter included discard through holes in the ice into the lake.

These ethnographic examples provide some insight into the variety of patterns that lakeshore settlements can exhibit. Lakeside sites of different size, permanence, function, and season can all be established by individual groups. The variety of economic activities in such sites

can also vary; fishing and hunting of waterfowl are most common in these examples, but gathering shellfish and plants and hunting of large and small game can also be important. Locations on islands are not uncommon and watercraft are necessary and useful for both transportation and food-gathering. Other favored locations include river mouths and outlets as well as peninsulas and points of land. A lake might be used repeatedly through time, but in some cases specific campsites are not returned to each year due to firewood depletion. Different social units may utilize the same lake at the same time, but are spatially separated on the lakeshore. Among the Chipewyan at least, camps can vary in size, with summer sites larger in area than winter sites, perhaps related to the difficulty of clearing deep snow. Camps may be placed quite close to the lakeshore and some trash may be discarded into the lake.

Archaeology of Lakeside Sites

Archaeological evidence of variability among sites from the Federsee and Pfrunger Ried indicates that these lakes were utilized in many ways. Early Mesolithic sites on these lakes differ in size and density of finds and can be divided into large, dense sites, those of medium size and density, and locations with only a few artifacts (Jochim 2006). These differences seem to reflect functional differences among the sites as well. Primary lithic reduction is relatively more important at the large, diverse sites, as are tools such as scrapers and burins used in manufacturing activities. Smaller sites contain proportionally more projectile points and backed blades suggesting an emphasis on hunting and butchering. This pattern is also illustrated by the contrast between two Late Paleolithic sites on the Federsee (Jochim 1995). The small site of Henauhof West appears to have been a short-term hunting camp focused primarily on red deer, whereas the site of Henauhof NW level 6 seems to have been a residential base, with abundant reduction and manufacturing evidence as well as a more diverse fauna.

Because some Late Paleolithic and Early Mesolithic sites are located on islands in the Federsee and Pfrunger Ried, it is likely that some type of watercraft was present. In addition, in a pattern similar to that seen ethnographically, a number of sites on these two lakes are situated near stream inlets and outlets, perhaps locations of likely fishing activities. Furthermore, several of the sites are found on peninsulas jutting out into the lakes in positions that would maximize shoreline access. Some sites are very close to shore; two Late Paleolithic sites on the Federsee are on sandspits just a few meters from the former shore of the lake. On the other hand, on the same lake, the large, dense sites have an average distance of 30 meters from the former shore to the edge of the surface lithic scatter. There is some evidence of discard into the lake, as exemplified by the Early Mesolithic Level 5 of Henauhof NW, where the excavated materials occur in a thin peat layer reflecting the shallows of the former lake.

Although fish and waterfowl are the major focus of subsistence activities in many ethnographic examples of lakeside camps, this does not seem to be the case in the German and Swiss archaeological sites. Already during the Magdalenian of the wider region these resources were used, but appear to have played a very small role in subsistence, as exemplified by faunal collections from Schussenquelle near the Federsee and Monruz and Hauterive-Champréveyres

(Affolter et al. 1994; Schuler 1994; Morel and Müller 1997; Leesch et al. 2004). The succeeding Late Paleolithic shows a similar pattern in collections from the sites of Monruz, Haute-rive-Champréveyres, Henauhof NW level 6 and Henauhof West (Jochim 1998; Leesch et al. 2004). It should be noted, however, that recent isotopic studies of human bone from the Mesolithic site of Friesack in northern Germany suggest that some individuals had diets high in fish, even though the faunal collections contain relatively few fish remains (Meadows et al. 2018).

Because remains of fish, birds, and mammals may be differently preserved due to differential density or disposal, it is useful to examine artifactual evidence for fishing and fowling. Here, too, the evidence is slim. Magdalenian sites often contain bone harpoons that some interpret as fishing gear, but this is not certain. Late Paleolithic sites in this area contain few artifacts associated with either fishing or fowling – no nets, no fishhooks. One possible exception from the site of Kappel on the Federsee is a bilaterally barbed antler harpoon found in sediments dated to the Younger Dryas. This site contained primarily remains of large mammals including moose, red deer and a bovid, but also a few pike and other unidentified fish remains (Jochim and Kind 2008).

In the Early Mesolithic the evidence improves somewhat. The Federsee site of Henauhof Nordwest level 4 contains over 100 fragments of smooth bone points, perhaps parts of fish spears or composite hooks (Jochim 1998). One remarkable discovery, dated to the Early Mesolithic but located farther out in the lake sediments, consists of the bones of a pike together with the remains of a smaller fish and a smooth bone point sharpened at one end. These finds have been interpreted as the remains of line fishing using the point as a hook and the small fish as bait for the pike (Torke 1993). One other isolated find at the Federsee is a smoothed and sharpened hazelwood spear together with the remains of two large fish (Wall 1961). These were found in fine-grained sediments in a shallow bay behind a low gravel bank and interpreted as the remains of spear-fishing during spawning in the lake shallows.

Altogether, the evidence suggests that fish and waterfowl were utilized but this evidence is sparse and does not provide a convincing case that these resources were a major attraction for settlements. At present, it seems likely that fish and waterfowl were secondary, back-up resources to the main focus on large mammals. Nevertheless, their presence in predictable concentrations around lake edges may have been one important consideration in reducing subsistence risks.

As the increasing forest development proceeded, a number of mammal species appeared or increased in abundance that would have been attracted to wetlands. Among large mammals, moose are most closely associated with lakes, ponds and marshes and tend to confine most movements to their vicinity (Phillips et al. 1973; Saunders 1988). Reconstructions of aurochs morphology and behavior indicate that it, too, showed some preference for wetlands (Van Vuure 2005). The aurochs was predominantly a grazer, feeding on grasses available in open areas, although branches of bushes and trees were supplemental winter foods. In this period of increasing forest cover, such grasslands were becoming scarce, and relatively open sedge marshes along rivers and ponds probably became a favored habitat. Beaver is another mam-

mal closely associated with wetlands (Whitaker and Hamilton 1998). On the other hand, red deer are found in a variety of habitats and are not particularly associated with wetlands (Gebert and Verheyden-Tixier 2001). They have eclectic diets depending on habitat, but appear to have originally favored forest edges. In a study of mixed-coniferous forests, their major foods included coniferous and deciduous browse, heather, grasses and sedges. Some of these plants do occur by wetlands, and to the extent that forest openings occur near lakes and marshes, red deer may be expected to have utilized these areas. Horses are almost exclusively grazers, with a diet primarily of grasses and are found largely in open steppes and grasslands. Over the course of the environmental developments of the late glacial period, their preferred habitat would have declined, and the animals would have been increasingly restricted in distribution to higher elevations and lowland clearings. Weniger (1982:94) notes, however, that wetlands were apparently an essential feature of their preferred habitats. Many smaller mammals including otters, pine marten, weasel and ermine show some preference for the edges of streams and lakes, especially because of the diverse vegetation and cover.

A predictable availability of various mammals around wetlands thus may have been the major factor attracting settlement to the shores of the new lakes. A secondary factor may have been the reliability of auxiliary or back-up foods like fish and waterfowl. It may be suggested that the attraction of the lakes, therefore, lay especially in their role in facilitating hunting in the face of environmental changes that increased both the costs and risks of this activity.

Revolutionary Implications

Although the change in settlement patterns to emphasize lakes and other wetlands may appear to be simply a shift to take advantage of newly formed rich resource patches, this change would have had revolutionary implications for many other aspects of behavior. One of the definitions of “revolutionary” according to Merriam-Webster is “a major or fundamental change,” and this seems appropriate to this situation.

Changes in Land Use and Settlement

As the patterns of settlement changed to include lakes as an important focus, the geographic scope of land use seems to have decreased. Sources of utilized stone raw material appear to suggest a shrinking of home ranges after the Magdalenian. Some Magdalenian sites contain significant proportions of material from sources at some distance. At the Swiss site of Haute-rive-Champréveyres, for example, most of the material used comes from sources 80 to 140 kilometers away (Leesch et al. 2004). The Late Paleolithic level of the same site, on the other hand, contains 83 % local material. At a smaller scale, the Magdalenian assemblage of the site of Schussenquelle south of the Federsee consists of 85 % gray chert from the Swabian Alb, about 25–30 km away. By contrast, the nearby Late Paleolithic sites of Sattenbeuren and Kappel, on the former Federsee, contain 89 % and 80 % respectively of a brown chert from just 8 kilometers away (Kind 1995; Jochim and Kind 2007). The lakes may have had a tethering effect, limiting the scale of regional movement.

The environmental changes would also have affected the organization of settlement systems. With the decline in herd species and the loss of predictable intercept points, group aggregation for cooperative hunting as seen in the Magdalenian would have become less profitable. The more dispersed distribution of prey would have encouraged a dispersal of human populations. Local areas could rapidly have been depleted of the larger herbivores, prompting frequent movements. The lakes and other wetlands would have been an important component of these movements, particularly as the increasingly dense and homogeneous pine-birch forests of the Late Paleolithic developed. The lakeshores offered a diverse vegetation and at least seasonally a diversity of potential prey as well. Thus, lakeshores would have become, not just a component of the settlement systems, but perhaps a very significant component. It is notable, in this regard, that in large regional surveys in the area south of the Danube in Germany, all the Late Paleolithic sites discovered were situated on larger lakes (Jochim et al. 1998).

Changes in Technology and Labor

A number of technological changes occurred during this period, but those most closely connected to the shift to lakeside occupations may have involved a greater emphasis on wood-working. Not only were trees increasing in abundance as a ready source of material, but also the use of watercraft to reach islands implies a greater reliance on wood. No axes or other tools usually associated with wood-working are known from Late Paleolithic sites in this region, but the importance of scrapers and especially of burins in many assemblages may in part reflect such activities. Nielsen (1998), for example, notes that in Late Paleolithic sites around the Wauwilermoos in Switzerland burins often constitute over 50 % of the retouched tools. At the Federsee sites of Sattenbeuren, Henauhof NW level 6, and Kappel, burins account for 45 %, 40 % and 27 % respectively. In contrast, the Late Paleolithic level of the non-lakeside cave site of Dietfurt on the Danube contains only 9 % burins among the retouched tools (Gietz 2001). Without detailed microwear analyses, it cannot be assumed that they were used extensively in wood-working, but previous microwear studies have demonstrated that a wide variety of tools, including burins, scrapers, borers, backed blades, truncated blades, and utilized blades, have been used for wood-working in other Late Paleolithic and Mesolithic sites (Dumont 1987). Studies of scrapers from the Federmesser site of Niederbieber in the Rhineland have shown that these tools as well had many uses, including wood-working (Bolus 1992).

Niche Construction

Another implication of the increasing use of lakeside camps is unintentional alteration of the local environment that positively influenced subsistence, leading to niche construction. Studies of modern forest campsites document significant impacts brought about by human occupation (Cole 2004; Smith et al. 2012). Considerable alterations in campsite areas can be caused by trampling, creation of trails, and collection of branches and saplings for bedding and wood

for fuel. Foot traffic in campsites and trails tends to favor the growth of grasses, sedges and rushes. Collection of woody material has been documented to reduce wood by 25 %–63 % in surrounding areas, which may extend up to 45 m from the campsite center.

Ethnographic studies in the boreal forest of Canada note the importance of firewood in the selection of campsites on lakeshores by the Chipewyan and Cree (Tanner 1979; Irimoto 1980). The need for firewood can be intense, particularly in winter: Tanner (1979:60), for example, estimates that each Cree household burned about 30 cubic feet of firewood each day. Deadwood, which is easiest to gather, is abundant in unmanaged forests (Dudley et al. 2004), but exhaustion of easily collected firewood is often a reason to avoid old campsites, even those abandoned for up to ten years, and to establish new ones (Tanner 1979:38). Savishinsky (1978:8) similarly cites the depletion of firewood and other resources as a disadvantage of reusing old campsites. Nevertheless, due to their concentration of resources, the lakes may have exerted considerable attraction year after year, at least in certain seasons. Adding to this attraction may have been the need to store heavy watercraft (dugouts?) at the lakes when seasonal moves to other areas were required, encouraging a return to the lakes for later use. Consequently, lakeshores may have been used repeatedly, but with frequent occupation of new locations. These factors seem to be a major reason, for example, that over a 40-year period one local group of Weagamow Ojibwe established 14 different home basecamps on a 10 kilometer stretch of the shore of one lake (Rogers and Black 1976:27).

Studies of charcoal and wood have been carried out on material from Paleolithic and Mesolithic sites in southwestern Germany (Schweingruber 1976). Although these are caves and rockshelters not on lakeshores, they help to inform about the likely impact that occupations in these periods had on their habitats. During the Late Magdalenian, willow provided most of the firewood, but pine became increasingly important during the late glacial period. In the Late Paleolithic levels of the sites of Jägerhaushöhle and Zigeunerfels, all of the charcoal came from pine, illustrating the dominance of this tree in the surrounding area. Moreover, the vast majority of utilized wood appears to have been deadwood.

Over the course of repeated occupation of lakeshores, it is likely that human activity would have significantly altered portions of these areas. Studies of modern lake edges in Sweden, Finland and Canada suggest that natural clearings may have been scarce (Harper and Macdonald 2001; Timbal et al. 2005; Komonen 2009). Near-shore areas tend to have high densities of trees, very few wind-downed trees, and only single-tree gaps. Deadwood, however, tends to be relatively abundant. Initial clearance of vegetation for camping, together with collection of branches and saplings would have led to a decline in trees in the immediate camp area, while trampling would have favored the growth of grasses, sedges and rushes. Thus, small clearings would have been created that, after abandonment, attracted largely grazing animals such as horse, aurochs and red deer, precisely those species that may have initially been least attracted by lakeshores. The development of such clearings would have helped create a mosaic of microhabitats within the increasingly dense pine-birch forests. As the easily collected deadwood around campsites was diminished and new camps

established, the number of small clearings would have increased. This would have added to the original attractions of lakeshores by increasing the likely availability of the grazing animals, enhancing the lakes' subsistence potential.

Conclusion

The environmental changes at the end of the ice age clearly had significant effects on human behavior. Most discussions of these changes have focused on the warming and reforestation and their impact on subsistence resources, hunting technology and mobility. In the context of these changes, however, it may be argued that the formation of lakes and other wetlands constituted a major additional, and perhaps revolutionary, factor influencing subsequent cultural developments. Over the course of the late glacial period, wetlands became increasingly important concentrations of resources, replacing migration routes of reindeer and horse as foci of human exploitation. The initial attractions were largely related to hunting and the changing distribution of prey, but may also have included the concentrated availability of secondary resources such as fish and waterfowl. The increasing use of lakes and other wetlands had important effects on technology, including a greater emphasis on wood-working and water travel and doubtless on the organization and division of labor. Moreover, the growing importance of lakeshore occupation may have started a feedback loop involving the inadvertent creation of small clearings just as increasingly closed forests were developing, thereby augmenting the diversity of attractions exerted by the lakes and other wetlands.

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