The Magdalenian of Hohle Fels Cave and the Resettlement of the Swabian Jura after the LGM

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Abstract: Hohle Fels Cave is a Magdalenian basecamp in the Swabian Jura. The site yielded an exceptionally rich lithic assemblage including abundant backed pieces, as well as many organic tools and artefacts that express symbolic behaviour. Radiocarbon dates place the occupation before the Meiendorf amelioration which marks the onset of the late glacial interstadial cycle. These dates are in accordance with many other Central European Magdalenian sites and indicate a comprehensive colonization and resettlement of the region during the dry and cold late Pleniglacial. Origins of the Swabian Magdalenian to the west are indicated, and connections in that direction were maintained, as documented by marine shells from the Atlantic Ocean.

1 INTRODUCTION

The southwestern German site of Hohle Fels Cave lies 1,5 km east of Schelklingen in the Valley of the Ach, a small tributary stream which flows into the Danube in Ulm 15 km east. It is situated at the southern margin of the middle Swabian Jura at 534 m above sea level (**figure 1**). Hohle Fels Cave lies within a karstic massif that defines the valley on both sides and opens on the southern face of the valley. The cave is quite large at 500 m² of floor space and 6 000 m³ of volume, making it one of southern Germany´s largest cave halls (Blumentritt & Hahn 1990). The site contains remains from the Middle Palaeolithic, the Aurignacian, Gravettian and Magdalenian. It is famous for its exceptionally rich and very old Aurignacian finds, especially figurative art and musical instruments (see e.g. Conard 2003a, 2009; Conard & Malina 2009; Conard *et al.* 2009) which are among the oldest manifestations of their kind. Hohle Fels also yielded a singularly rich Magdalenian assemblage documenting a base camp occupation, which is currently under investigation. A techno-typological characterization of the lithic assemblage will bring the site into a regional and European perspective. Because of the unexpected scale of the Magdalenian occupation which became clear in recent years, Hohle Fels represents a crucial site for research on the resettlement of Central Europe after the near-hiatus around the last glacial maximum. It can also yield vital information concerning Magdalenian settlement patterns in late Pleistocene Swabia.

Hohle Fels Cave has in its vicinity many more Magdalenian sites including Sirgenstein, Geißenklösterle, Brillenhöhle, Schmiechenfels, Hohle Fels Hütten and others, indicating a comprehensive settlement in the Swabian Jurassic highlands after the last glacial maximum (LGM) and shortly before the onset of the late glacial interstadial cycle. This cycle begins with the Meiendorf-Interstadial at 14 450 calBP according to Litt *et al.* (2007), or, in the more southern parts of Central Europe, probably around 14 650 calBP, according to multi-proxy climatic information from Gerzensee in northern Switzerland (Lotter *et al.* 2012). The Magdalenian of Hohle Fels dates to a late Pleniglacial age of roughly 15 000 calBP.

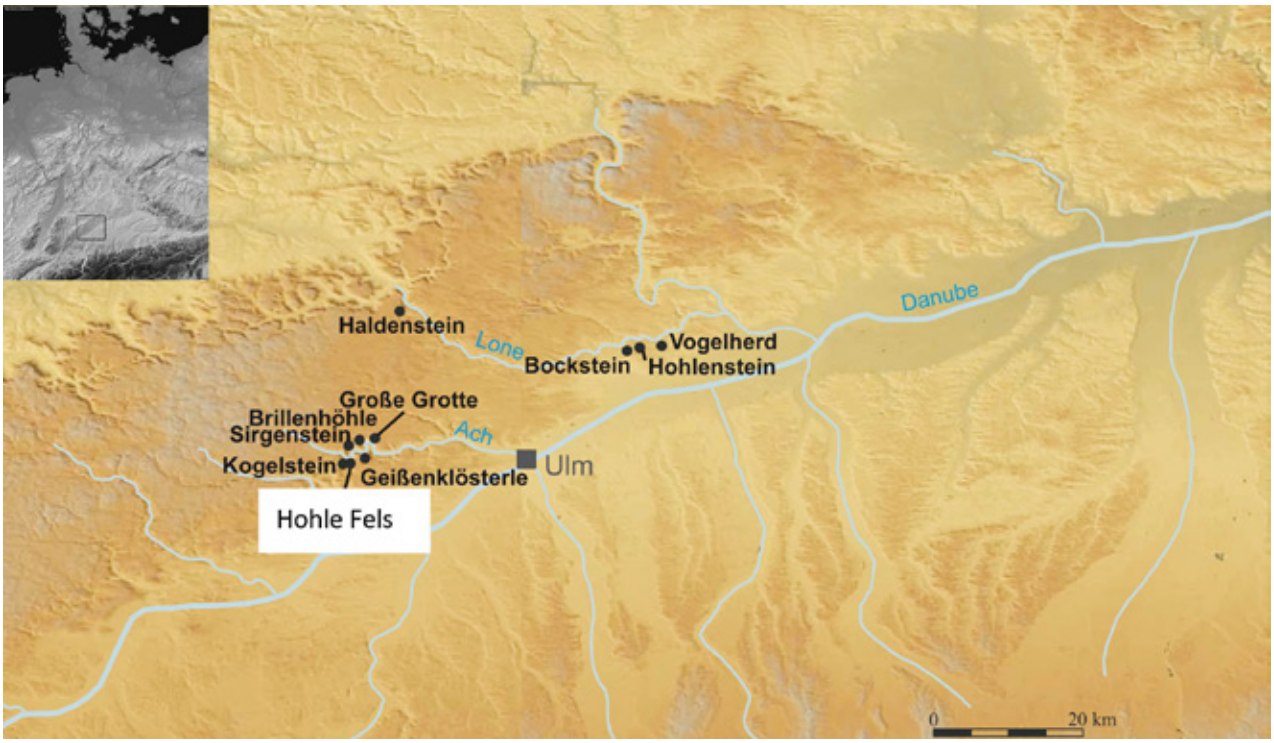


FIGURE 1 Location of Hohle Fels Cave (modified after M. Malina).

Some of the lithic raw materials, but also molluscs from the Mediterranean and the Atlantic Ocean, indicate connections to the west, where the origins of the Swabian Magdalenian seem to lie.

2 TIMEFRAME AND CHRONOSTRATIGRAPHY

The division of the late glacial chronology and the naming of the different climatic phases are inconsistent. Here we explain our view of the late glacial succession of climatic phases and their connection with the Magdalenian settlement. We refer to the results of Litt *et al.* (2007), where they present a climatic sequence based on varve counts from Meerfelder Maar. According to these, the late glacial sequence progresses as depicted in **figure 2**. We indicate the links to the respective GRIP-ice core-phases to clarify this framework (after Baales and Jöris 2001, fig. 1).

We are aware that many researchers consider the time before 14 450 calBP as "Dryas I" or "Oldest Dryas" (e.g. Schmider 1992; Leesch 1997; Richard *et al.* 2000; Rodriguez & Roblin-Jouve 2004; Leesch *et al.* 2012). But we are of the opinion that the chronological framework drawn up by Litt *et al.* (2007) is correct, as it directly refers to the type-sites where the stages have been defined. According to this system, Dryas I is a very short-lived phase (ca. 130 years) between the Meiendorf and Bølling Interstadials corresponding to GRIP-phase 1d (Litt *et al.* 2007; see also Baales and Jöris 2001, fig. 1). The term Bølling has repeatedly been used to describe the first warming of the late glacial interstadial cycle equaling GRIP-phase 1e (e.g. Eriksen 1996; Bosinski 2008; Langlais *et al.* 2012), but the correct denomination in this case is Meiendorf (Litt *et al.* 2007). The latter in turn is separated from the Bølling *sensu stricto* by the Oldest Dryas or Dryas I. For another application of the system followed here see Street *et al.* (2006, 2012).

GRIP-PHASE	CLIMATIC STAGE	DATING	DURATION IN YEARS
	Holocene	Beginning 11.590 calBP	To date
1	Dryas III	12.680–11.590 calBP	1090
1c1,1b,1a	Allerød	13.350–12.680 calBP	670
1c2	Dryas II	13.540–13.350 calBP	190
1c3	Bølling	13.670–13540 calBP	130
1d	Dryas I or Oldest Dryas	13.800–13.670 calBP	130
1e	Meiendorf	14.450–13.800 calBP Or 14.6500 calBP after Lotter *et al.* 2012	650
2	Pleniglacial	Until beginning of Meiendorf 14.450 calBP	

FIGURE 2 Climatic succession based on varve-counts of Meerfelder Maar (interstadial phases shaded; after Litt *et al.* 2007).

3 THE MAGDALENIAN OF HOHLE FELS CAVE - STRATIGRAPHY

The strata containing the Magdalenian remains directly overlie the Gravettian layers in Hohle Fels cave; some admixture between the two in the contact zones is indicated (e.g. Conard & Malina 2012). In part, the Magdalenian deposits represent the filling of channels which had cut into the Gravettian layers (Hahn 1991; Miller 2009). These channels seem to have originated due to erosional events taking place around or after the LGM, most probably in connection with freezing and thawing dynamics. Some of the sediments containing the Magdalenian remains were then deposited in the channels, and it is likely that they are not completely *in situ* but rather were transported there by solifluction or other sedimentational and geological dynamics. The direction of this probable redeposition is inherent in the continuous sloping of the cave floor towards the entrance.

Refittings between all Magdalenian layers at Hohle Fels further stress their homogeneity. We suggest that they represent a relatively short period of occupation.

4 DATING

All dates were calibrated with calpal (Weninger *et al.*: www.calpal-online.de). Twelve of the 21 dates from the Magdalenian of Hohle Fels are problematic, which results mainly from the nature of the stratigraphy and can therefore be explained. Six samples yielded a Gravettian age, but that is not surprising when considering admixture which occured where both layers were in contact. Three samples produced ages dating between the Gravettian and the LGM. Three further dates pointed towards an earlier Pleniglacial age; these, too, are not connected to the Magdalenian. Six of these age estimations were obtained using pre-AMS dating between 1978 and 1988 making the results less certain. Four of the too old dates were measured on bones of *Ursus spelæus*, a species that was already extinct in the Ach Valley in Magdalenian times (Münzel *et al.* 2007, 2011). Besides this, many of the older dates were measured on mixed bone samples of uncertain stratigraphical origin and are therefore of dubious value (Blumentritt & Hahn 1990, see also Housley *et al.* 1997).

The remaining nine dates all give acceptable Magdalenian ages spreading from a cluster at ca.12 600 uncal BP to peak values of ca. 13 300 uncal BP. These dates fit well into other chronological findings for the Central European Magdalenian (e.g. Leesch *et al.* 2012; Leesch & Müller 2012). In terms of calibrated age estimations, the youngest possible date from the Hohle Fels Magdalenian lies at ca. 14 700 calBP, the oldest possible at ca. 16 300 calBP. Bearing in mind the chrono-climatic framework presented earlier, this means that in any way the Magdalenian occupation began and apparently ended before the onset of the late glacial warming with GRIP-phase 1e (or, in other words, the Meiendorf interstadial). This is important to note, since traditionally it had been an accepted "fact" that the recolonization of Central Europe was connected with the onset of the late glacial interstadial cycle. Now it is likely that this was not the case. Recently Leesch *et al.* (2012) have published similar findings on the Magdalenian colonization of Switzerland following the LGM after evaluating new AMS dates. The same can be said for Hohle Fels, where new AMS dates either yield a clearly Gravettian age, when dating intrusive materials like cave bear bones, or give ages clustering around 12 600 uncalBP with only a few dates older than that. Coincidentally, Petersfels also produced dates centering around 12 600 uncalBP, albeit with a few slightly younger exceptions; see Kind 2003).

5 THE ASSEMBLAGE

The Magdalenian of Hohle Fels has yielded one of the richest assemblages in Germany. The history of research dates as far back as 1870/1871, when Oscar Fraas and Theodor Hartmann first excavated in the cave. However many of the Magdalenian artefacts are missing today, as they got lost. Then there was a short dig of G. Riek and G. Matschak 1958–1960. Further pieces are missing due to an illegal dig in the late 1980s. On the other hand, the Department of Early Prehistory and Quaternary Ecology of the University of Tübingen has been excavating in the cave almost uninterrupted since 1978; first under J. Hahn, and since 1997 under N. J. Conard who has conducted annually campaigns ever since. The finds from these excavations form the basis of the present work.

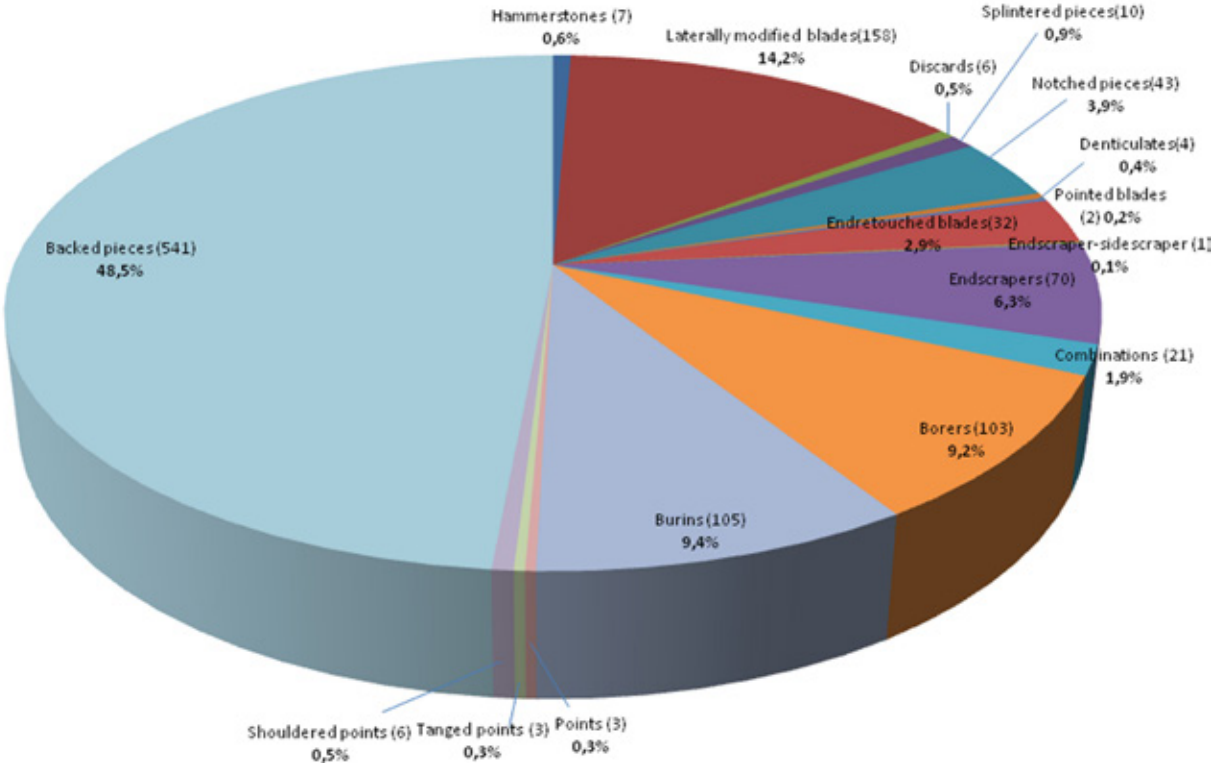
6 LITHIC ARTEFACTS

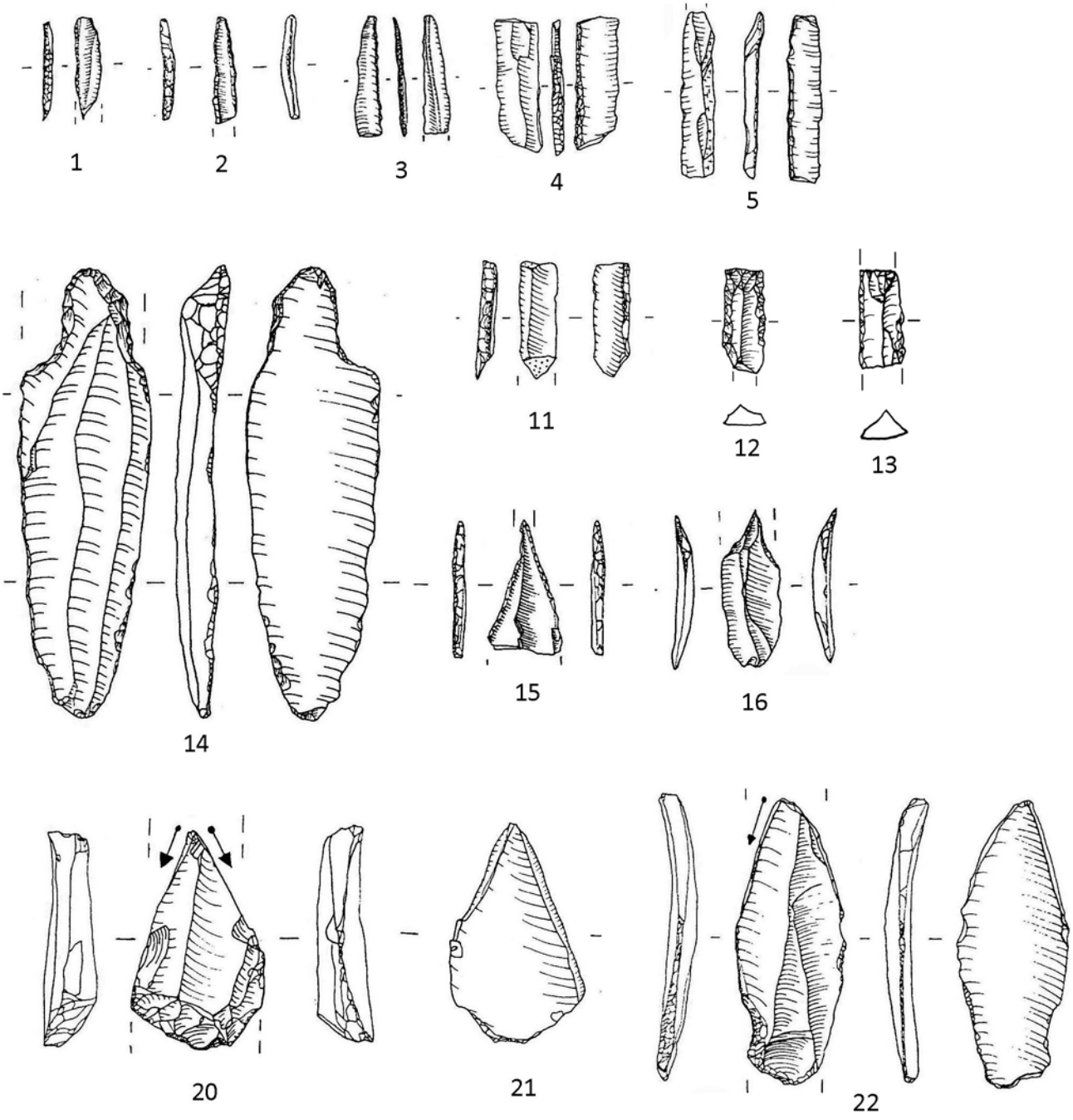
The lithics encompass 8 695 pieces larger than 1 cm and 1 115 tools as well as more than 15,000 pieces of small *débitage*.

The assemblage belongs to the late Magdalenian, as indicated by the general composition (see Schmidt 1912; Bosinski & Hahn 1973: high percentage of backed pieces (n = 541 equaling 48,5 %), many dihedral burins and burins on end retouch, many perforators, well prepared conical bladelet cores, many bone needles) as well as several tool-types that are considered characteristic of the Late Magdalenian: *Federmesser*-type points (convex backed points), Cheddar points with a double-angled back, shouldered points, tanged points, backed pieces with oblique end retouch, antler harpoons with bilateral barbs (**figures 3**, **4** and **7**).

The backed pieces are of special interest, as they make up almost half of all tools. Their abundance suggests that they were crucial for everyday life during the Magdalenian. As they are often traditionally viewed as projectile points/parts *per se*, (Albrecht 1979; Löhr 1988; Höck 2000; Moreau 2009; Floss & Taller 2011) it was decided to do a functional analysis on a small sample. As a result, a good number of the backed pieces indeed served as projectile points or inserts. However, a substantial number was used as cutting knives for very different tasks, like butchering, cutting hide/leather and even vegetable fibres. Some backed knives with an oblique end-retouch had been used as perforators. It seems that backed pieces were not used for a single task, but rather represent a modular technological system which catered for many different needs. Therefore a diverse range of tools can be produced with this multifunctional toolkit (Taller *et al.* 2012).

FIGURE 3 Percentages of tool types (n = 1115).





7 LITHIC TECHNOLOGY AND RAW MATERIALS

The lithic technology is clearly focused on the production of laminar blanks. Of all 9810 pieces larger than 1 cm and tools, 5136 (52,3 %) are either blades or bladelets, thus showing the importance of the laminar concept for their makers. The assemblage also contains 129 cores. Of these, 105 still show traces of systematic blank production. They are all either blade or bladelet cores, or were used to produce both blank types simultaneously. Also 229 preparational removals documenting core maintenance belong to laminar technology. In sum, we can say that at least 5470 (55,7 %) lithic artefacts are connected with laminar blank production.

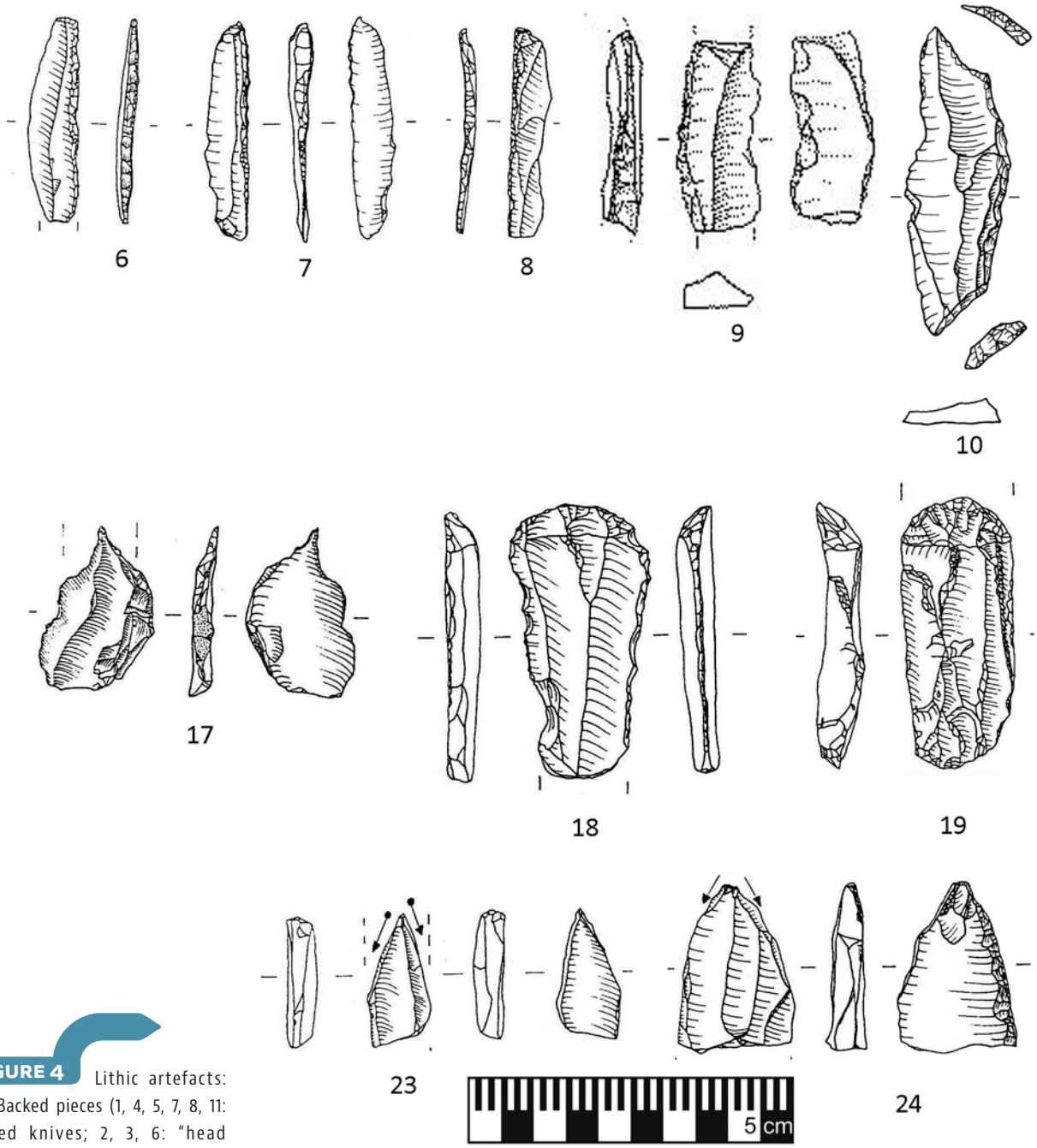


FIGURE 4 Lithic artefacts: 1-13. Backed pieces (1, 4, 5, 7, 8, 11: backed knives; 2, 3, 6: "head bladelet" in the sense of Pétillon *et al.* 2011; 9: convex backed point; 10: Cheddar-style point with double angled back; 12,13: backed knives with *Couze*-technique); 14–17. Perforators; 18–19. Endscrapers; 20-24. Burins (20, 23, 24: dihedral burins); 9-10. Drawings (E. Ghasidian); all others (S. Biedrowski).

This together with the fact that 953 (85,5 %) of the 1115 tools have been made on laminar blanks stresses the importance of this technological concept for the Swabian Magdalenians. The significance of laminar production for toolmaking is especially visible in the backed pieces, as all of them have been made on laminar blanks: 502 on bladelets and 39 on blades.

Blank production was conducted in an almost exclusively unidirectional fashion. Of the 105 cores analysed, 74 feature only one striking platform and one removal surface. In most cases where cores have a second platform opposing the first, this second one was applied for core maintenance and not for blank production.

These findings – maintaining one striking platform and one removal surface preferentially – have been observed by N. Pigeot for the Magdalenian of Étiolles in the Paris Basin (Pigeot 2004). Where a second removal surface and striking platform exist, they are present on cores that are relatively small through many removals, which had made it impossible to exploit the first platform and removal surface further. Also, considering the fact that the primary nodules of chert and other materials used in Hohle Fels are relatively small with maximum diameters of ca. 10 cm, formal knapping could only be done on sufficiently fine grained material. It comes as no surprise that raw material nodules of good quality have been reduced considerably further than those of less value. The eleven conical cores are the most characteristic core shape produced by the almost exclusive practice of unidirectional blank removal from one striking surface (**figure 5**). On these cores, the concept of coupling one striking platform with one removal surface has been pursued to the extreme. The result is a striking platform in some cases surrounding almost the complete core volume and, through the unidirectional removal of blanks on a longitudinally curved removal surface, the core has acquired conical form.

More than 60 % of the artefacts are made on local Jurassic chert (**figure 6**). Radiolarite and *Bohnerzhornstein* (a variant of chert) originate ca. 20 km south and southwest of the site respectively (Burkert 2001). Tertiary chert comes from a source 40 km northwest, and the *Keuper* chert from sources located 40–60 km to the north. The assemblage also includes a portion of tabular chert from Lower Bavaria, 200 km to the east along the Danube; and Jasper from the Upper Rhine (200 km, southwest). The very few pieces of Crystal Quartz might be of Alpine origin or come from the Black Forest or Vosges Mountains.

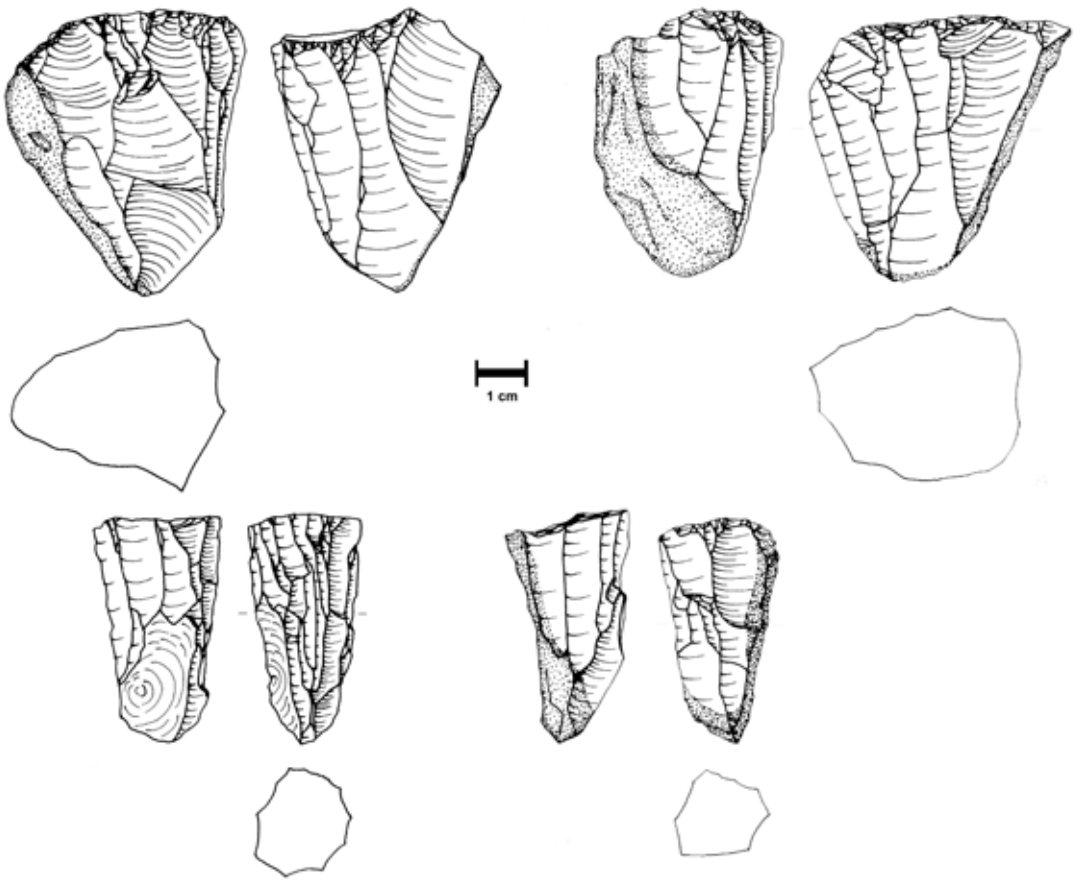


FIGURE 5 Four of the conical cores (drawing: E. Ghasidian).

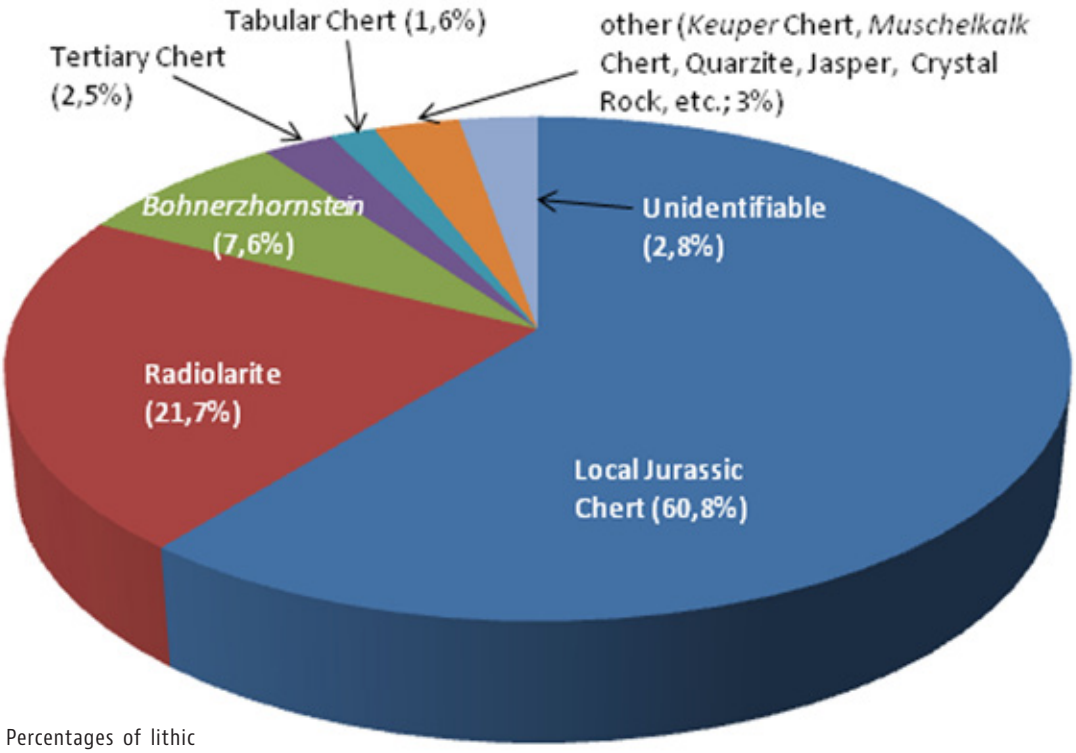


FIGURE 6 Percentages of lithic raw materials (n = 9810).

8 ORGANIC TOOLS & SYMBOLIC EXPRESSIONS

The most striking artefacts of organic raw materials are no doubt the three harpoons with bilateral rows of barbs (**figure 7**). The harpoons are also indicative of an Upper or Late Magdalenian. In addition to them, eleven antler points, both with single and double beveled bases and more than 30 sewing needles have been recovered (Walter 2000). Harpoons, antler points and needles have also been found in Petersfels (Mauser 1970) and Brillenhöhle (Riek 1973).

Among the symbolic expressions, there are many pieces of personal ornaments like cut reindeer incisors as well as perforated horse and red deer teeth. The many perforated marine shells including both fresh and fossil ones and are quite insightful. In the case of the fresh marine shells, they originate from the Atlantic Ocean and the Mediterranean (Rähle 1981; Alvarez Fernández 2001). The fossil molluscs seem to come mainly from the Steinheim Basin (50 km northeast) and the Mainz Basin 300 km northwest (Rähle 1981).

Jet was a material often used in the Magdalenian; in Hohle Fels we have different carved pieces, among them a *rondelle* as well as perforated beads. There are also many worked pieces of jet that are impossible to classify due to fragmentation as well as unworked pieces (Conard 2003b).

Further examples of organic artefacts include a band of ivory with many regularly spaced notches. The use of this piece is unclear. Riek found identical pieces in the Magdalenian of Brillenhöhle only a few kilometers downstream in the Ach Valley and argued that they might have been used as hairpins (Riek 1973).

It is interesting to note that the only evidence for mammoth in Hohle Fels are worked bits of ivory, among them a carved button. It is possible that the mammoth was already extinct at this time and that the ivory was collected as fossil material.

FIGURE 7 Three bilaterally barbed harpoons from Hohle Fels Cave (Photo: Taller).

The most impressive symbolic artefacts are 13 painted pieces of limestone. Especially the five pieces with red double-dot lines are characteristic for Hohle Fels Cave. The only other example of this motif has been found on a small limestone slab from Obere Klause Cave in Lower Bavaria (Floss & Conard 2001; **figure 8**). The site lies in the same region where the tabular chert originates.

One fascinating aspect of the Magdalenian record is documented in its figurative depictions. Here the Swabian Jura differs from the other regions in the paucity of carved three dimensional and engraved artworks. While the sites in the Hegau and northern Switzerland contain small, finely carved female figurines of jet that often served as personal ornaments (Mauser 1970; Höneisen 1993), the Swabian Jura sites lack this kind of depiction almost entirely. Similar motifs were found engraved on schist as well as carved in ivory and antler in Gönnersdorf and Andernach (Bosinski 2008); further female figurines in ivory are also known from Nebra in Thuringia (Toepfer 1965) and other sites. In Hohle Fels we only have the painted rocks, which are only comparable to the pieces from Obere Klause Cave in Lower Bavaria. These symbolic artefacts are hitherto without parallels.

9 MOBILITY/LONG DISTANCE CONTACTS

As depicted in **figure 9**, the origins of various lithic raw materials and also molluscs show, that the Magdalenian occupants of Hohle Fels were part of a quite differentiated web of relations. Some raw materials, like those from sources on the Upper Rhine and the tabular chert from Lower Bavaria (each ca. 200 km as the crow flies) are located far from the site. Concerning the artefacts from these outcrops it is clear that they are relatively few, and usually tools or at least blanks, with cores rare or absent (see Weniger 1990).

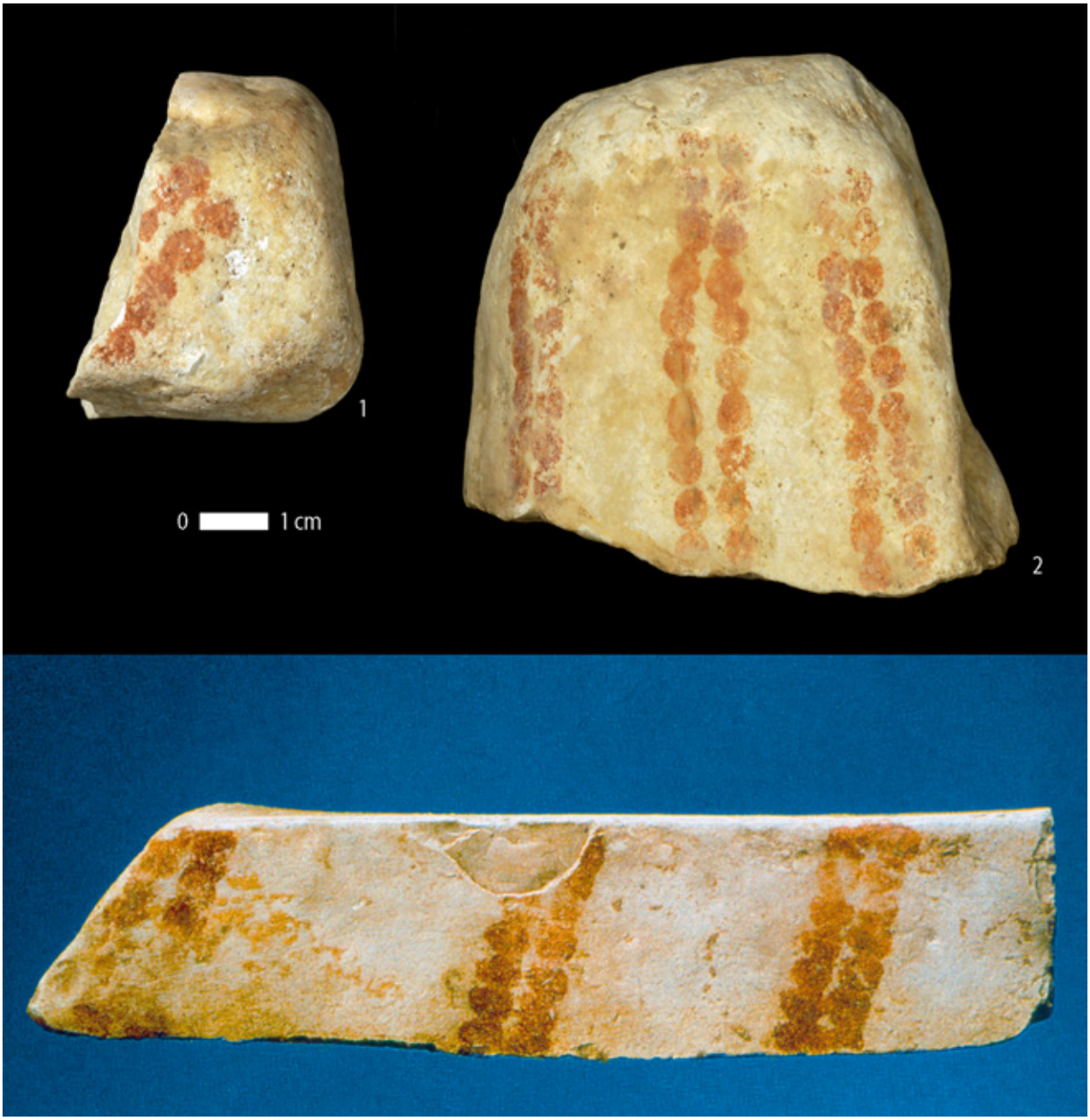


FIGURE 8 Painted limestone rocks. Upper half: Two pieces from Hohle Fels (Conard & Malina 2011). Lower half: piece from Obere Klause Cave (Photo: H. Jensen).

If we accept the fact that the limits of an area explored annually by hunter-gatherers is approximately 200 km (Weniger 1990, 1991; Floss 1994; Binford 1979), all sources of the lithic raw materials found in Hohle Fels Cave could well have been visited by the inhabitants of the site in connection with seasonal and general mobility of Palaeolithic hunter-gatherer groups. Regarding travels to and from the Upper Rhine area, we must assume a distance of 300 km, as the Black Forest massif – which blocks the direct route – seems to have rarely been visited during the Palaeolithic. Instead, a route following the Danube westwards to the source and then south through the Hegau-region, with the large and important Magdalenian open-air and cave site Petersfels, and the High Rhine, with sites like

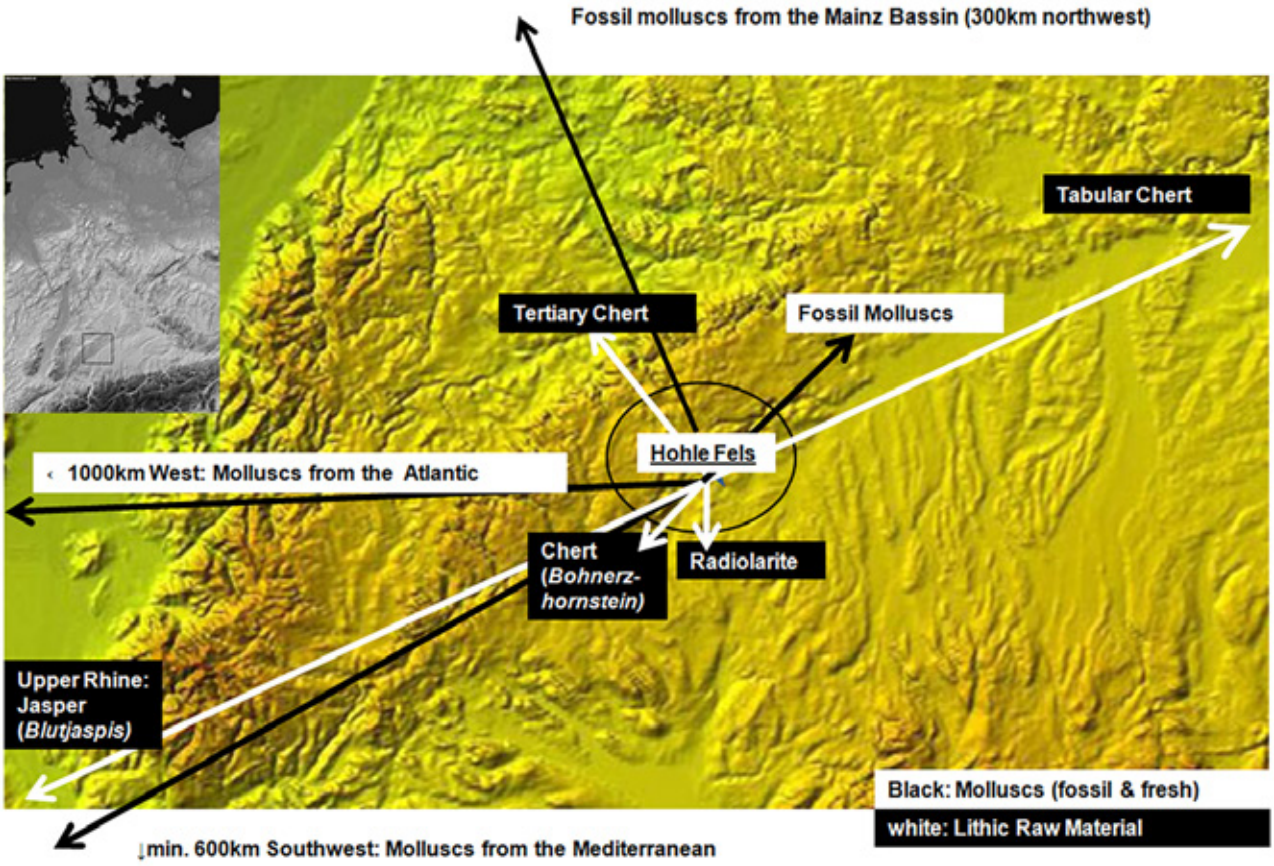


FIGURE 9 Origins of lithic raw materials and molluscs found in the Magdalenian of Hohle Fels (graph based on source map courtesy of www.scilands.de).

Kesslerloch and Schweizersbild on the Swiss side is more plausible. The contacts to Lower Bavaria are especially clear as demonstrated by Obere Klause Cave and the painted limestone slab with the same motif as the one characteristic of Hohle Fels (Floss & Conard 2001). The assemblage of Obere Klause is similar to Hohle Fels too and includes harpoons as well as sewing needles. Therefore we assume that both sites are part of the same area of exploitation, patrolled by groups with shared traditions and traits.

Concerning the molluscs and their provenience, it has been shown ethnoarchaeologically both for Australian and North American hunter-gatherers that the acquisition of exotic raw materials including marine molluscs was frequently accomplished through systems of exchange (Weniger 1991). The high importance of these molluscs for the "inland" Magdalenians is also demonstrated by some finds that imitate the molluscs such as those carved from jet in the Central European sites of Petersfels, Kleine Scheuer and Kesslerloch (Albrecht 1987). Since the Mediterranean is at least 600 km and the Atlantic 1 000 km away from Hohle Fels, a system of exchange must have existed in late Pleistocene Europe. Regarding the possible travel routes to both the Atlantic and Mediterranean, the hypothesis of the Rhine-Rhône corridor as an axis of communication, exchange and travel must be considered (Floss 2000; Alvarez Fernández 2001). This use of natural corridors along river valleys is highly probable and may also have played an important role in the spread of the Magdalenians to Central Europe.

10 RESETTLEMENT OF THE SWABIAN JURA AFTER THE LGM IN A EUROPEAN PERSPECTIVE

In conclusion, the radiometric dates and chrono-cultural attributions place the Magdalenian occupation of Hohle Fels before the onset of the late glacial interstadial cycle. This means that the resettlement of the Swabian Jura in fact took place in the cold and dry conditions of the late Pleniglacial so that ameliorating climatic conditions can no longer be cited as the main cause of resettlement. Instead we argue that the Magdalenian hunters grew in numbers and spread all over Europe so quickly because of their adaptation to very specific environmental conditions. Indeed this argument has been put forward also in regard to the noticeable population increase in Magdalenian times in the core region of Southwestern France (Delpech 1999; Langlais 2011). An increase in grassland, favoured by the cold and dry climate of the late Pleniglacial, enabled a growth in biomass of ungulate herds (Delpech 1999). This in turn posed ideal conditions for the well adapted Palaeolithic hunter-gatherers and allowed for population numbers to grow (Langlais 2011; Bocquet-Appel and Demars 2000 even speak of a "demographic explosion").

After the comparably quick retreat of the glaciers in Central Europe (e.g. Leesch *et al.* 2012), the newly exposed land was then colonized by the Magdalenian hunters. They seem to have followed the spread of an environment that they knew and to which they were adapted. As Leesch *et al.* (2012) have correctly stated, it is appropriate to correlate human colonization of a new landscape with the colonization of the same area by flora and fauna rather than primarily relating it to climatic events *per se*. That the resettlement of Swabia was quick and comprehensive is supported by the Southern German dates which mostly cluster between 12 500 and 13 500 uncalBP (Kind 2003). The Upper Rhine site of Munzingen presents a puzzle in this context, as the dates indicate very early Magdalenian occupations at 17 000 uncalBP and around 15.000 uncalBP (Kind 2003). These early dates have not been undisputed, Housley *et al.* (1997) view Munzingen as a site of unknown age because unmodified bones were dated and the dates did not coincide. The only other Central European site of similar age is Maszycka Cave in southern Poland. This site poses another exception with substantially older dates (ca. 15 000 uncalBP; Kozlowski *et al.* 2012; Street *et al.* 2012). Apart from Munzingen, the southern German Magdalenian sites form a coherent regional entity with relatively little time-depth.

The resettlement of Central Europe followed a southwest-northeast direction, as can be seen in the distribution of sites as well as the dates (e.g. Housley *et al.* 1997; Miller 2012). Another argument for this general direction of recolonization is the fact that southwestern France had comprehensively and consistently been occupied during the LGM (Terberger 2003). The network of contacts and exchange which was maintained by the Magdalenians of Hohle Fels points westwards too. This is evident in the marine molluscs from the Atlantic and the Mediterranean, but also in the lithic raw material from the Upper Rhine region. Considering these relations and the apparent social-economic network, the westward orientation of the Central European Magdalenians seems to be of great importance, which in turn may be attributed to their roots in the southwest. In the lithic raw material from the Upper Rhine we see evidence of how far west the Magdalenian inhabitants of Hohle Fels ranged in pursuit of their economic activities. However, this observation does not necessarily imply that the Upper Rhine area represents the actual limits of the area used and patrolled by the Magdalenian population of Swabia.

We have no answer as to why the Magdalenian occupation of Hohle Fels ended even before the onset of the Meiendorf Interstadial (GRIP-phase 1e). We can assume, however, that this is linked to environmental changes. As hunters of the arid grassland steppe, the Magdalenians might have been affected by the climatic amelioration in southern Central Europe during GRIP 1e and the ensuing significant increase in tree cover coming (Baales and Jöris 2001, fig.1). This might have resulted in a significant change in composition of the fauna and game as well. There are indications that the Azilian in Switzerland was in fact established no later than 12 300 uncalBP; this may also hold true for Southern Germany.

As a comparatively large Magdalenian site surrounded by many small to very small ones, Hohle Fels offers much potential for further research on Magdalenian settlement dynamics in Southwestern Germany.

On a European scale, we include Hohle Fels Cave as a base camp of the Late Magdalenian. The findings from the Magdalenian of Hohle Fels, on the whole, are in good accordance with the neighbouring sites of Southern Germany and Switzerland, where most sites also pre-dated the GRIP–1e climatic phase (e.g. Felsställe, Schussenquelle, Geißenklösterle, most dates from Petersfels, Kesslerloch, Champréveyres, Monruz; see e.g. Kind 2003; Leesch *et al.* 2012). Gönnersdorf and Andernach in the Central Rhineland of Germany date to this time span as well, even though they are possibly slightly older. Some eastern German sites in Thuringia (Nebra, Kniegrotte) also yielded older dates (Housley 1997; Street *et al.* 2012). Nonetheless, this means that all of these sites dated roughly to the same time-span, with only Munzingen on the Upper Rhine and Maszycka in southern Poland posing exceptions to that trend. It is therefore probable that the sites were colonized in the same movement of Magdalenian dispersal, sharing common roots to the southwest.

11 CONCLUSION

Hohle Fels is a base camp site of the late Magdalenian. Based on other sites in surrounding regions, a comprehensive resettlement of southern Central Europe in general and the Swabian Jura specifically occured after the LGM before the onset of the late glacial interstadial cycle. An extensive settlement system existed during the Late Pleniglacial in southern Germany, the German central Rhineland and Switzerland. We have to assume that these sites shared common origins in Southwestern France, which is documented in the long-distance westward contacts maintained throughout this period of colonization. These network-based relations are visible in marine shells as shown by Magdalenian sites in all the above mentioned regions (Alvarez Fernández 2001). Relations between the different Central European Magdalenian find regions are somewhat unclear. In Hohle Fels we can see connections to the east (Lower Bavaria) and southwest (Upper Rhine) through the lithic raw materials. The only indications of contacts to the Middle Rhine are the fossil shells from the Mainz basin. Instead, the Magdalenian inhabitants of Gönnersdorf and Andernach maintained economic contacts to the North and Northwest (Street *et al.* 2012).

It is an idiosyncrasy of the Swabian Jura that the female figurines and engravings, known from various Central European Magdalenian sites, seem to be missing here. In Hohle Fels there are only the painted rocks, to which no real parallels are known besides the piece from Obere Klause Cave in Lower Bavaria. This raises a range of important questions about the details in the pattern of resettlement of Central Europe described here, and the specific nature of the social identity of the various groups of Magdalenian people in Central Europe.

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