

# Round antler rods: particular osseous artefacts of the Central European Magdalenian with unknown function

*Runde Geweihstäbe: besondere organische Artefakte des mitteleuropäischen Magdalénien mit unbekannter Funktion*

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**ABSTRACT** - The scope of this article is to discuss some particular osseous tools of the Central European Magdalenian. Several sites from Switzerland in the west to the Czech Republic in the east furnished long, overall modified antler rods with double-bevelled bases and rounded cross sections made on transversal segments (*en volume*). A comparison with other antler tools which occasionally were made on transversal segments as well, in particular fore-shafts and projectile points, suggests that these round rods could be a distinct artefact type. Chronologically, they seem to prevail in the Upper Magdalenian and thus coincide with the appearance of the multi-barbed point in the osseous toolkit. One possible interpretation could therefore be that they worked as socket pieces for multi-barbed points in a harpoon-like thrusting weapon. Other possible functions are counterweights attached to hand-held lances or snow/ice probes. However, since round rods are typical for big sites with evidence of ritual behaviour and symbolic communication, these often quite delicate artefacts could also have played a primarily non-utilitarian role.

**ZUSAMMENFASSUNG** - Ziel dieses Beitrags ist es, eine besondere organische Geräteklasse des mitteleuropäischen Magdalénien vorzustellen. An mehreren Stationen von der Schweiz bis zur Tschechischen Republik tauchen immer wieder sehr lange, stabförmige Geweihartefakte mit doppelt abgeschrägter Basis auf, deren Oberfläche vollständig modifiziert wurde, um einen gleichbleibenden, rund-ovalen Querschnitt zu erzeugen. Immer sind sie aus Transversalsegmenten (*en volume*) und nicht aus Spänen hergestellt und weisen die natürliche Stangenkrümmung auf. Schon früh in der Forschung wurden diese runden Stäbe als etwas Besonderes erkannt und unterschiedlich benannt. Auch andere Geräte mit doppelt abgeschrägten Basen wurden gelegentlich aus Transversalsegmenten hergestellt. Besonders Geschosspitzen und Vorschäfte vom Pekárna-Typ (Abb. 7 & 8), die oftmals an denselben Fundorten auftreten, sind hier zu nennen. Diese unterscheiden sich jedoch von den runden Stäben durch ihre Geradheit und eine sich verjüngende Silhouette bzw. zungenförmige Distalenden sowie deutlich geringere Dimensionen. Daher wird in Erwägung gezogen, dass diese Artefakte einen besonderen Gerätetyp repräsentieren könnten.

Die Datierung der runden Stäbe ist mit Problemen behaftet, da die meisten Fundstellen früh gegrabene Palimpseste ohne detaillierte Stratigrafien sind, für die nur wenige verlässliche <sup>14</sup>C-Daten vorliegen. Nach bisherigem Kenntnisstand sind runde Stäbe jedoch für das Spätmagdalénien charakteristisch und ihr Auftreten in Mitteleuropa geht somit mit dem Erscheinen der organischen Widerhakenspitze einher. Möglicherweise besteht zwischen beiden Gerätetypen ein funktionaler Zusammenhang: Die runden Stäbe könnten als Zwischenstücke gedient haben, um die Widerhakenspitzen lösbar mit einem Schaft zu verbinden und somit eine Art Harpune zu bilden. Mit Blick auf die Jagdausrüstung historischer Inuitgesellschaften ist aber auch eine Funktion als Gegengewicht an Stoßlanzen, oder als Schnee- bzw. Eissonde in Erwägung zu ziehen.

Eine andere Deutungshypothese eröffnet sich auf non-utilitaristischer Ebene. Es ist auffällig, dass diese Artefakte fast immer an großen Stationen (z.B. Petersfels, Pekárna) vorkommen, in denen neben Geräten auch vielfältige künstlerische Äußerungen belegt sind. Vielleicht hatten die relativ fragilen und oftmals reich dekorierten runden Stäbe auch eine Rolle vorwiegend im rituellen Bereich und in der symbolischen Kommunikation inne.

**KEYWORDS** - Late Upper Palaeolithic, Magdalenian, Central Europe, Petersfels, Pekárna, antler artefacts  
Spätes Jungpaläolithikum, Magdalénien, Mitteleuropa, Petersfels, Pekárna, Geweihartefakte

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## Introduction

The Late Upper Palaeolithic techno-complex of the Central European Magdalenian (in the following: CEM – Maier 2015), c. 19'000 to 14'600 calBP (Leesch et al. 2012; Nerudová & Neruda 2014; Pasda 2017; Street et al. 2012), is characterized by an un-preceded richness in osseous implements (Hahn 1993).

Hunting equipment always dominates (Langley 2015; Langley et al. 2016; Pétillon 2016). Many Central European sites have produced comprehensive assemblages of *unbarbed points* with different base morphologies (Feustel 1980; Höck 2000; Höneisen 1993; Pfeifer 2016; Tinnes 1994; Valoch 2001) which are commonly interpreted as spearheads (Pétillon 2006; Pétillon 2016; Stodiek 1993 – but also see: Owen 2005).

Another typical projectile component is the *multi-barbed point* which seems to be restricted to the Upper Magdalenian (Hahn 1993: 348; Julien 1982; Höneisen & Peyer 1994: 92; Langley et al. 2016: 149; Leesch 1993: 159; Pétillon 2016: 121). In contrast, the *half-round rod*, most probably part of a large bivalve point (Bosinski 1978; Feruglio 1992; Rigaud 2006), is characteristic of the Middle Magdalenian (Langley et al. 2016: 148; Leesch 1993: 157; Leesch et al. 2012: 197). Intermediate pieces in projectiles, or *fore-shafts*, are recorded as well, but usually in low numbers (Cattelain & Onorati 1993; Pétillon 2000: 46-47; 2016: 120; Pfeifer 2012). Spear thrower hooks are numerous at the site of Kesslerloch in northern Switzerland (Höneisen 1993), but very rare towards the east (Cattelain 1988 & 2005; Stodiek 1993).

*Needles* are another very frequent implement that is rather connected to the “domestic sphere” (Maier 2015: 125; Lázníčková-Galetová 2010; Stordeur-Yedid 1979), as are *wedges* (Hahn 1993: 372; Höneisen 1993: 180; Provenzano 1998a), *smoothers* and *awls* (Camps-Fabrer 1990; Höneisen 1993: 180). For the *bâtons percés* (Peltier 1992; Rigaud 2001) and *navettes* (Allain et al. 1985), the function is under debate. The same applies to the few richly decorated *spatulae* (Pétillon & Sacchi 2013; Valoch 2001) and slotted *daggers* (Kozłowski et al. 2012).

The strongly preferred raw material for any tool type was reindeer antler (Höneisen 1993; Pfeifer 2016), except for the needles which were commonly made of small mammal or bird bones (Lázníčková-Galetová 2010: 79-81). Big fore-shafts were occasionally executed in whalebone (Langley & Street 2013; Pétillon 2008 & 2013). Mammoth ivory played an important role for the production of points at some sites in central Germany and southern Poland (Höck 2000; Kozłowski et al. 2012; Mania 1999). Spatula, daggers and awls were made from large mammal bones (Kozłowski et al. 2012: Fig. 8; Pétillon & Sacchi 2013: 310).

The objective of this paper is to introduce and discuss the *round antler rods* of the CEM as a group of

osseous artefacts whose attribution to any of the well-established tool categories described above is not clear.

## History of research

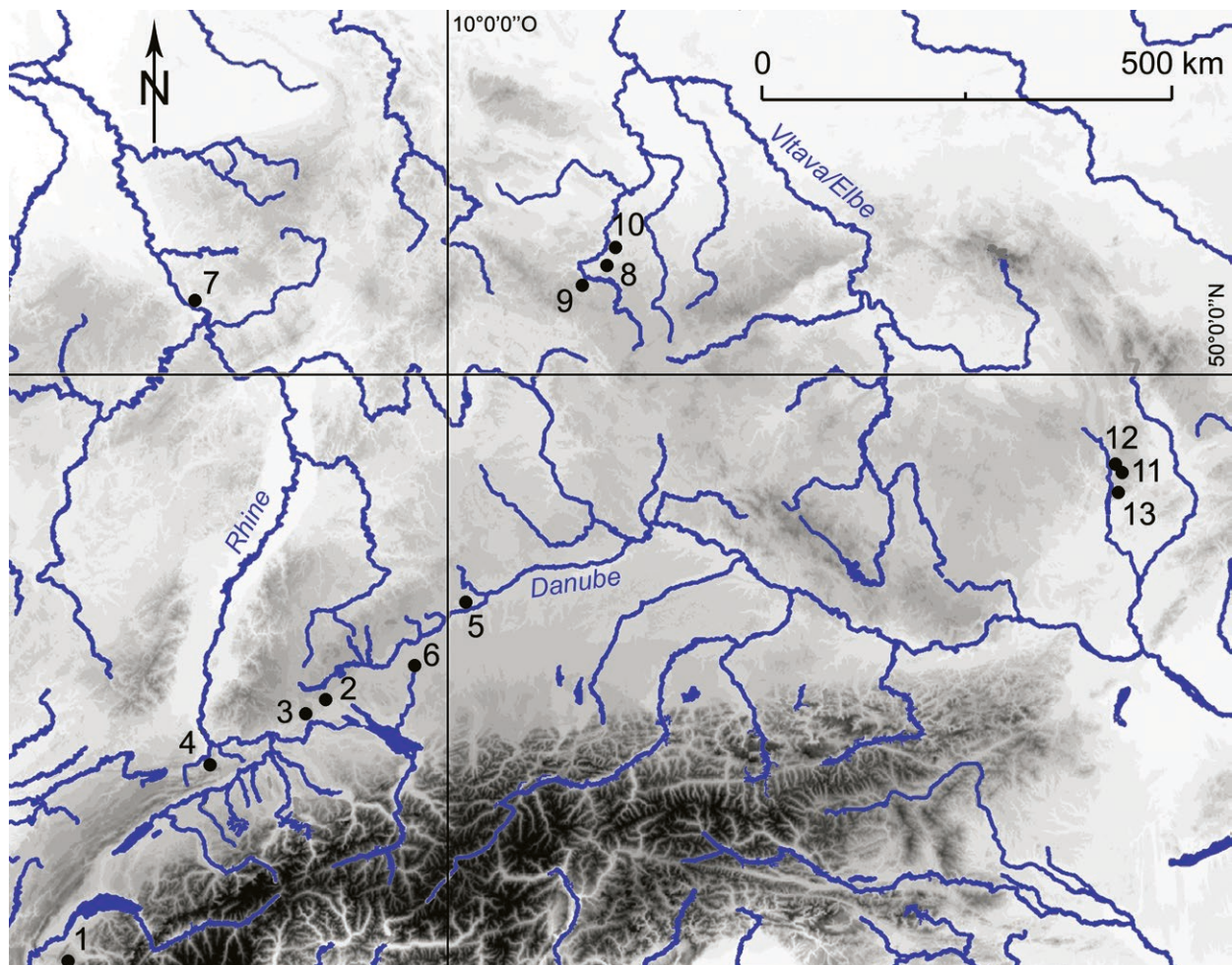
Round rods from reindeer antler were recognised very early as particular Magdalenian artefacts (Fig. 1): In 1866, O. Fraas excavated the open-air site Schussenquelle (Baden-Württemberg, Germany) which was particularly rich in antler manufacturing debris (Fraas 1867). Among the few tools recovered, he singled out a long, slender, slightly s-shaped rod with a round cross section and a double-bevelled base (Schuler 1994: Fig. 35).

In the monograph on his excavations of Petersfels cave (Baden-Württemberg, Germany) from 1930, E. Peters provided a photograph of a round rod with a double-bevelled base and a complex decoration which he interpreted as an unusual projectile point (Peters 1930: 53; Pl. 26: 7a-c). P.-F. Mauser, who re-evaluated the site in the 1960ies, also referred to “*gravierte Geweihstangen mit zweiseitig abgeschrägtem Ende*” (engraved antler rods with a double-bevelled end) (Mauser 1970: 66-67; Pl. 86: 5-7). Contrary to Peters, he excluded a function as projectile points because of the crooked shape and great size of the artefacts. During further excavations of the Petersfels from 1974 to 1979, this time at the slope in front of the cave and on the valley floor, two similar but undecorated artefacts were recovered. G. Albrecht named them “*Gewehstäbe mit doppelt abgeschrägter Basis*” (antler rods with a double-bevelled base) (Albrecht 1979: 50; Pl. 7: 1; 11: 1).

In 1974, R. Feustel published the finds recovered from Kniegrotte, a cave site in Thuringia, Germany). Among the numerous osseous artefacts, he observed some particular specimens he briefly referred to as “*Gewehstäbe*” (antler rods) (Feustel 1974: 105-106).

In his comprehensive monograph on the site of Schussenquelle, A. Schuler introduced the artefact category of “*geglättete Stangen*” (smoothed beams) to which he ascribed five specimens: one tine with a roughly modified working end, one long and crooked beam of shed antler from which the brow and bez tines as well as the terminal part were removed, one beam with a roughly modified distal end, and one unshed beam without tines (Schuler 1994: 83-84; Pl. 12: 3; 15: 1; 19; 20). The fifth specimen is the above-mentioned artefact from Schussenquelle mentioned by Fraas.

Obviously, overall modified, long and crooked antler artefacts, sometimes with double-bevelled bases, have frequently been recognized in osseous inventories of the CEM for a long time. Apart from Peters (1930: 52-53), who interpreted them as projectile points, all scholars regarded them as a particular tool type.



**Fig. 1.** Map showing the location of particular Magdalenian antler artefacts made from transversal segments in Central Europe. 1: Veyrier; 2: Petersfels; 3: Kesslerloch; 4: Kohlerhöhle; 5: Bockstein-Törle; 6: Schussenquelle; 7: Gönnersdorf; 8: Kniegrotte; 9: Teufelsbrücke; 10: Oelknitz; 11: Balcarka; 12: Kůlna; 13: Pekárna. Illustration by the author.

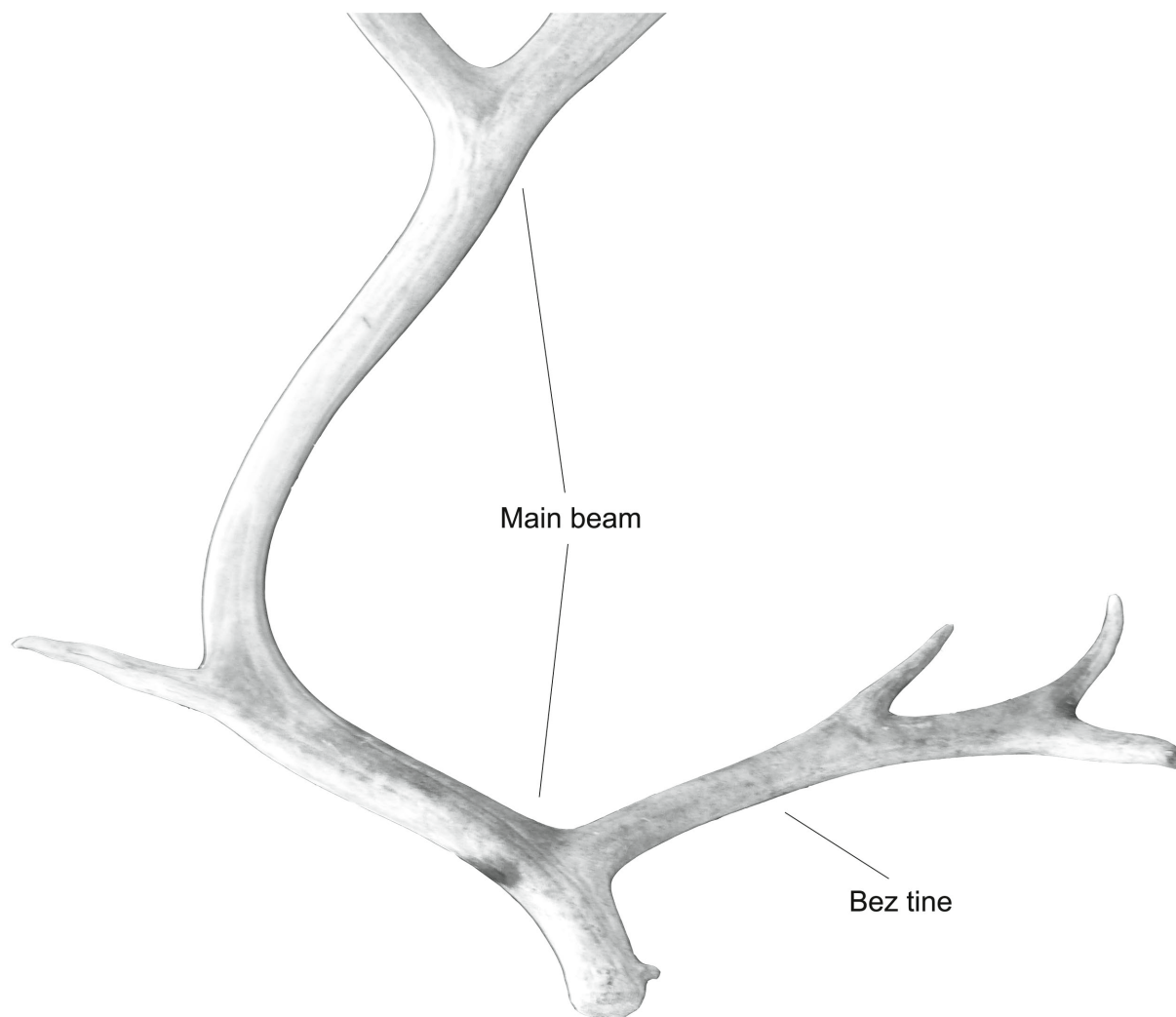
**Abb. 1.** Räumliche Verteilung spezieller Geweihartefakte aus Transversalsegmenten des Magdalénien in Mitteleuropa. 1: Veyrier; 2: Petersfels; 3: Kesslerloch; 4: Kohlerhöhle; 5: Bockstein-Törle; 6: Schussenquelle; 7: Gönnersdorf; 8: Kniegrotte; 9: Teufelsbrücke; 10: Oelknitz; 11: Balcarka; 12: Kůlna; 13: Pekárna. Abbildung: Verfasser.

## Description of the type

Round rods are always made on transversal segments of reindeer antlers (*en volume*), which according to their dimensions should have been extracted from either the main beam or large brow or bez tines and now mostly display their natural curvature (Fig. 2). The artefacts are long and slender with a double-bevelled base and a round or slightly oval cross section (Figs. 3-5; Appendix, Tab. 1). The shape of the distal part unfortunately remains unknown since it is never preserved. The diameter remains constant throughout the entire length. To obtain a very even, rounded cross section and constant diameter, the surface was thoroughly modified, usually resulting in an excessive thinning or even removal of the compacta at many spots. Frequently, round rods were polished and ornamented.

## Examples

The largest inventory of round antler rods stems from Petersfels. Eleven specimens, nine from the excavation by Peters in the cave (1927 - 1932) and two from the excavation by Albrecht on the valley floor below the cave (1974 - 1976), were recovered (Figs. 4: 1-3; 5). All of them are well preserved, retaining much of their original smooth surfaces. The preserved lengths range from 140 to 480 mm, the greatest diameters from 14 to 26 mm. The cross sections are circular with one exception. In four cases, the double-bevelled bases are preserved which are 36 - 65 mm long (Appendix, Tab. 1). One long piece (Fig. 5: 5) should be a pre-form since it still retains a circular groove from the transversal sectioning of the antler beam at the lower end. Four round rods from Petersfels are decorated: One piece bears incised bundles of short parallel lines at the lower end (Fig. 4: 2), another one a cross (Fig. 5: 4). The third piece is extraordinary since it displays a complex assemblage of signs consisting of



**Fig. 2.** Detail of a reindeer antler beam with sections relevant for the preparation of round rods. No scale. Illustration by the author.

**Abb. 2.** Detail eines Rentiergeweihs mit Abschnitten, die für die Produktion von runden Stäben relevant sind. Ohne Maßstab. Abbildung: Verfasser.

an animal figure, possibly a fish, four lenticular silhouettes filled with diagonal lines, and a zigzag ornament (Fig. 4: 1). The fourth rod bears a double line on each side and a row of alternating half-circles on the exposed spongiosa (Fig. 5: 1).

Schussenquelle yielded one round rod from the excavation by Fraas that unfortunately is missing today (Fig. 3: 3; Appendix, Tab. 1). According to the drawing provided by Fraas, it is c. 280 mm long, 18 mm wide and has a base that is c. 50 mm long. It is not decorated. Additionally, there are three very long (up to 680 mm), overall smoothed antler main beams with a round cross section and broken-off terminal parts that might be pre-forms (Schuler 1994: Pl. 15: 1; 19; 20).

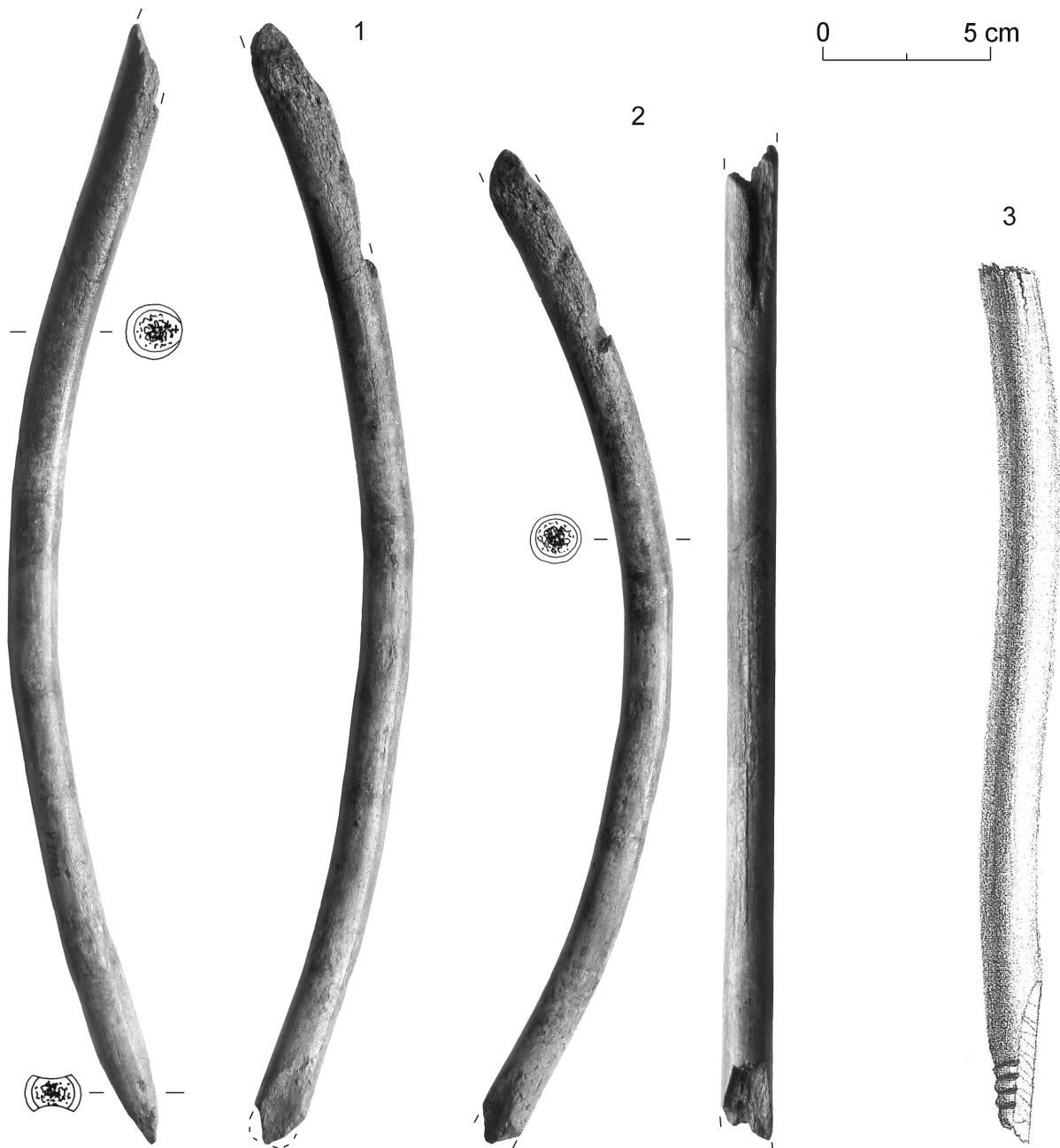
At Kesslerloch cave site (Schaffhausen, Switzerland), one round rod was recovered during the excavations conducted by J. Nüesch and J. Heierli in the beginning of the 20<sup>th</sup> century (Heierli 1907). It is 110 mm long, curved and has an oval cross section. The double-bevelled base is 53 mm long (Fig. 4: 4; Appendix, Tab. 1).

From Pekárna cave in the Moravian Karst (Czech Republic), excavated from 1925 to 1930 by K. Absolon

and R. Czižek (Valoch 2001), two examples are known (Appendix, Tab. 1). The first piece is 363 mm long, 17 mm wide and has a double-bevelled, fractured base that measures 31 mm (Fig. 3: 1). The second piece is 311 mm long, 20 mm wide and has no preserved base. It is overall decorated with very fine zigzag lines (Fig. 3: 2).

From Balcarka cave, located in the Moravian Karst as well, one round rod measuring 150 mm in length and 17 mm in thickness was recovered during the excavations by J. Knies from 1898 to 1900 (Nerudová 2010). The base is 60 mm long, laterally broken and markedly bent to one side. The piece has been sectioned by a circular groove. It has a broad, central ridge carved from the compacta. (Fig. 4: 5; Appendix, Tab. 1).

Additionally, several unclassified short fragments with a round-oval cross section and a double-bevelled base made on transversal antler segments are reported from all above-mentioned sites and also from Kohlerhöhle (Basel-Landschaft, Switzerland), Bockstein-Törle (Baden-Württemberg, Germany) and Kniegrotte (Thuringia, Germany) (Fig. 6; Appendix, Tab. 2). One



**Fig. 3.** Round antler rods. 1-2: Pekárna; 3: Schussenquelle. Illustrations by the author, except for Fig. 3: 3 – O. Fraas, in: Schuler 1994.

**Abb. 3.** Runde Geweihstäbe. 1-2: Pekárna; 3: Schussenquelle. Abbildungen: Verfasser, bis auf Abb. 3: 3 – O. Fraas, in: Schuler 1994.

piece from the latter site served secondarily as a pre-form of a projectile point (Fig. 6: 14).

### Is the round rod a particular tool type?

Round rods are elongated antler artefacts with a rounded cross section and one double-bevelled end made on a transversal antler segment. These features also apply to other Magdalenian osseous types, in particular wedges, unbarbed points and certain fore-shafts. Thus it can be problematic to distinguish between them, especially in case of high fragmentation and re-working (Fig. 6; Appendix, Tab. 2; Appendix, Plate 3).

From wedges, the round rods clearly differ by their greater length, the much more slender silhouette and the absence of any crushing marks (Pfeifer 2016: 63; Pl. 10; Provenzano 1998b: 19). The bases of round rods are never polished, abraded or splintered from use. Moreover, the round rods are quite delicate since they mainly consist of spongiosa (Appendix, Tab. 1; Appendix, Plate 3 E) whereas especially compact raw material was frequently chosen for wedges (Pfeifer 2016: Tab. 34).

Can the round rods be projectile points? The vast majority of Magdalenian unbarbed points are made on antler blanks (Langley et al. 2016: 150; Pétilion & Ducasse 2012; Pfeifer 2016), but there are examples

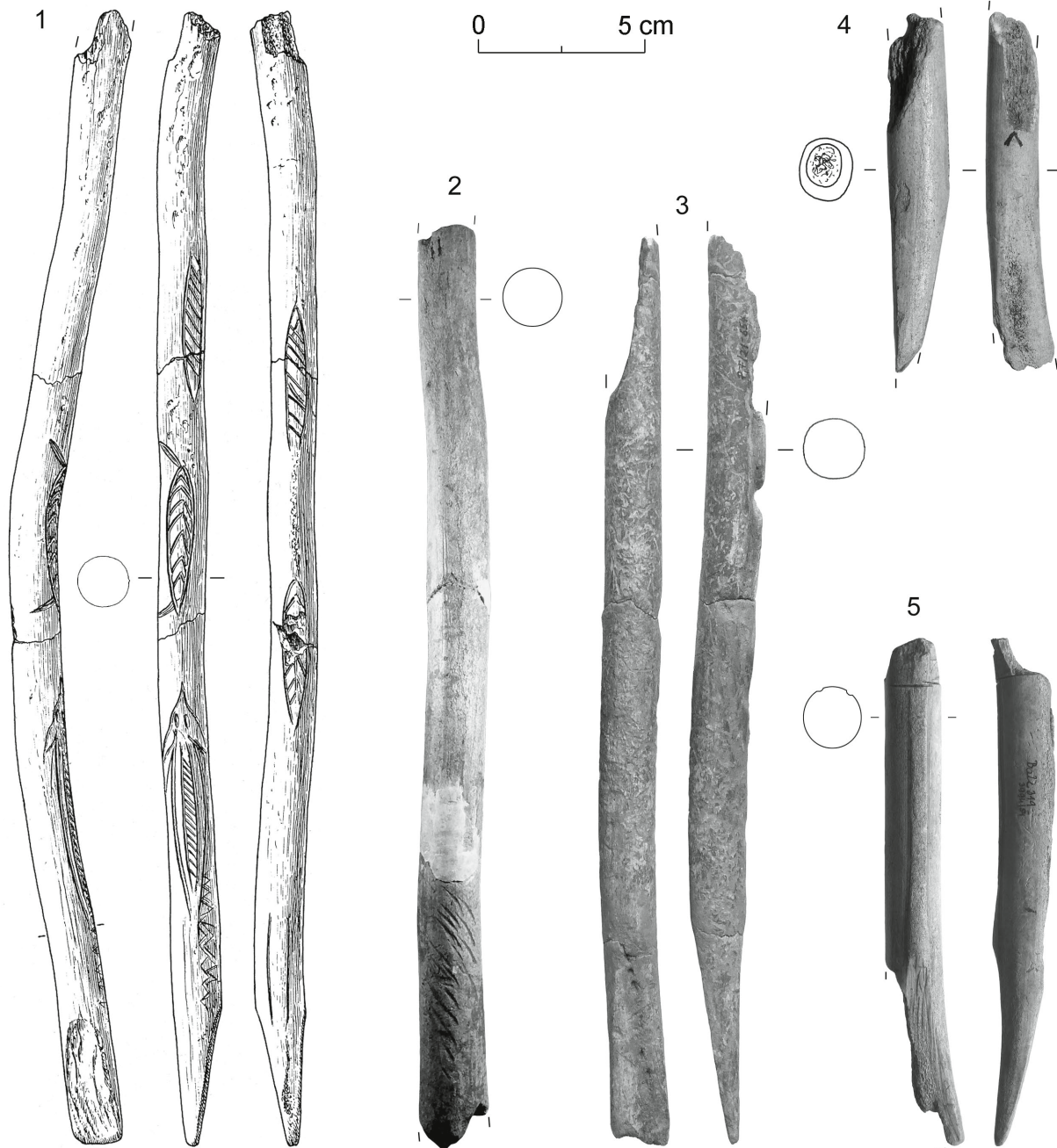


Fig. 4. Round antler rods. 1-3: Petersfels; 4: Kesslerloch; 5: Balcarka. Illustrations by the author, except for Fig. 4: 1 – Mauser 1970.

Abb. 4. Runde Geweihstäbe. 1-3: Petersfels; 4: Kesslerloch; 5: Balcarka. Abbildungen: Verfasser, bis auf Abb. 4: 1 – Mauser 1970.

with massive or double-bevelled bases and sometimes even longitudinal grooves at several CEM sites which were made from transversal segments. In some instances, such points can be quite long and thick while having a comparatively low compacta thickness (Appendix, Plate 3; Fig. 7; Appendix, Tab. 4). However, often they have a pronounced distal taper and they are straight.

The sites Pekárna, Kůlna and possibly also Petersfels (Pfeifer 2016: Pl. 8: 9) and Veyrier (Dép. Haute-Savoie, France – Stahl Gretsch 2006: 121-123; Fig. 8) contain artefacts made from transversal antler segments with a rounded cross section, a

double-bevelled base and two distal languets that can be interpreted as fore-shafts for points with double-bevelled bases (Cattelain & Onoradini 1993; Pfeifer 2012). In Western Europe, corresponding single examples of that type are known from La Madeleine (France), Abri du Colombier (France) and probably Tru de Chaleux (Belgium) (Cattelain & Onoradini 1993: Figs. 3: 6 & 10; 4: 4; Pétilion 2000: 46-47).

These artefacts form a relatively consistent metric cluster and their diameters overlap with the more slender examples of round rods (Appendix, Plate 3: B & C; Fig. 8; Appendix, Tab. 5). Could the round rods (whose distal ends are always missing) have been such

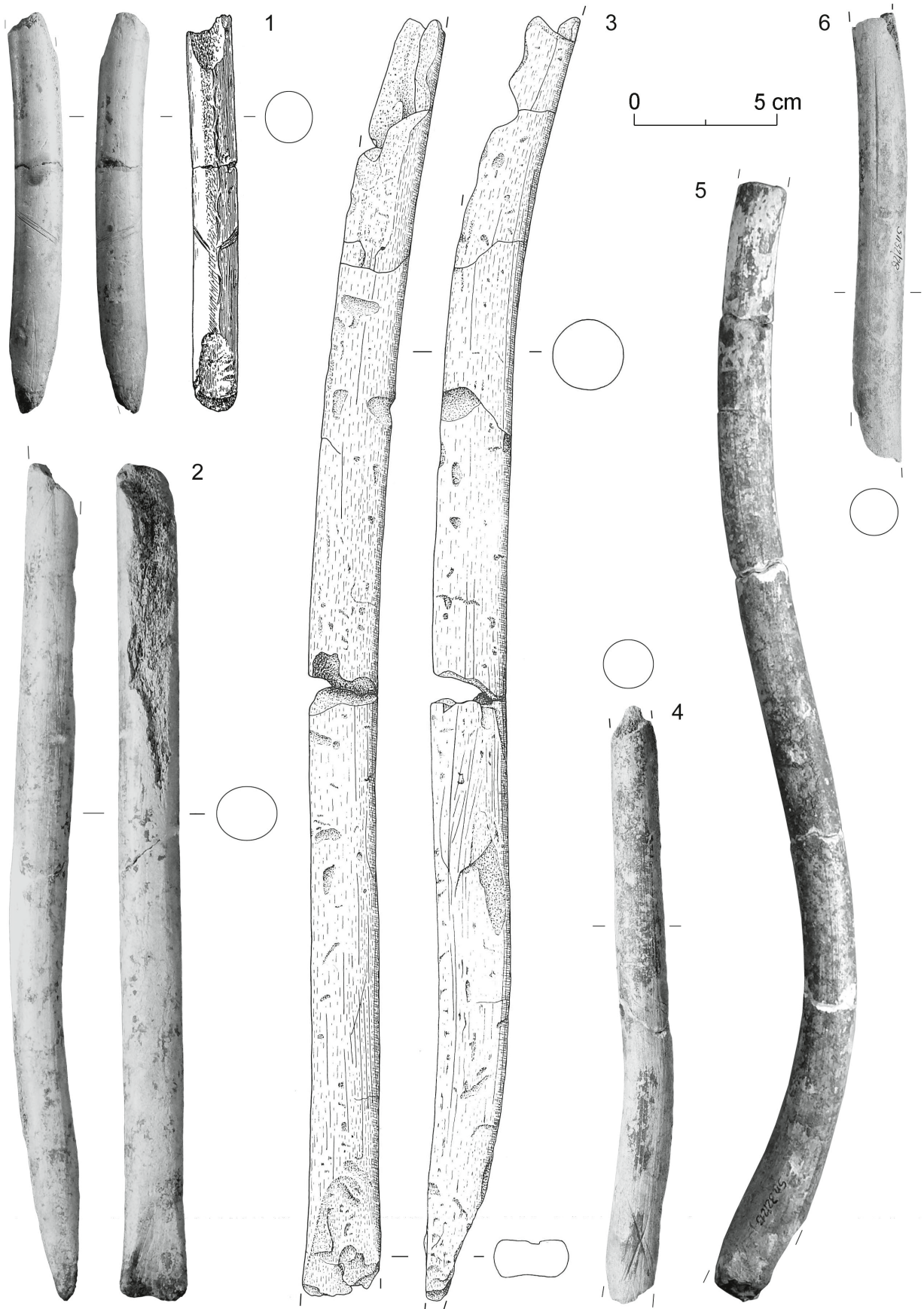
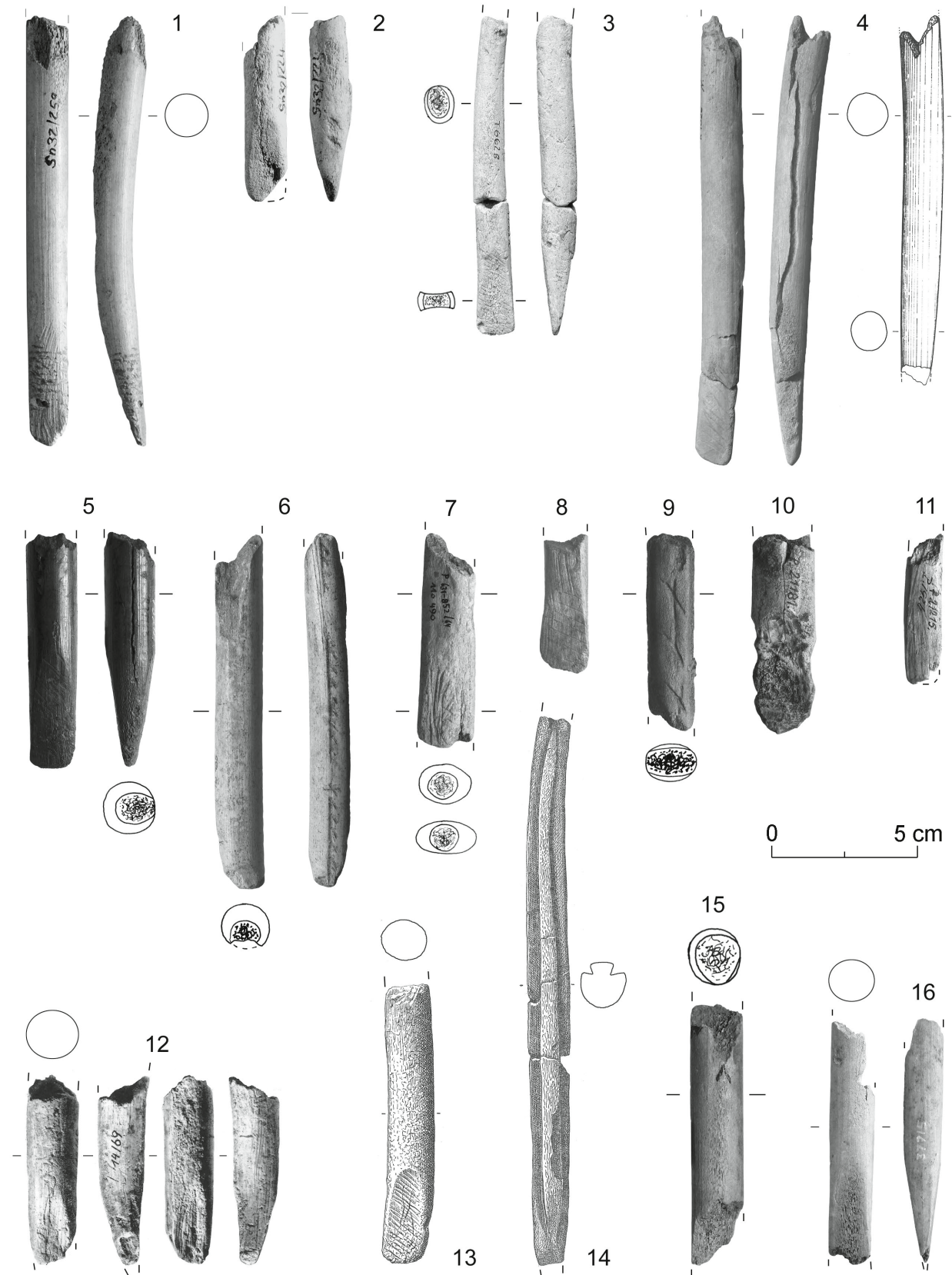


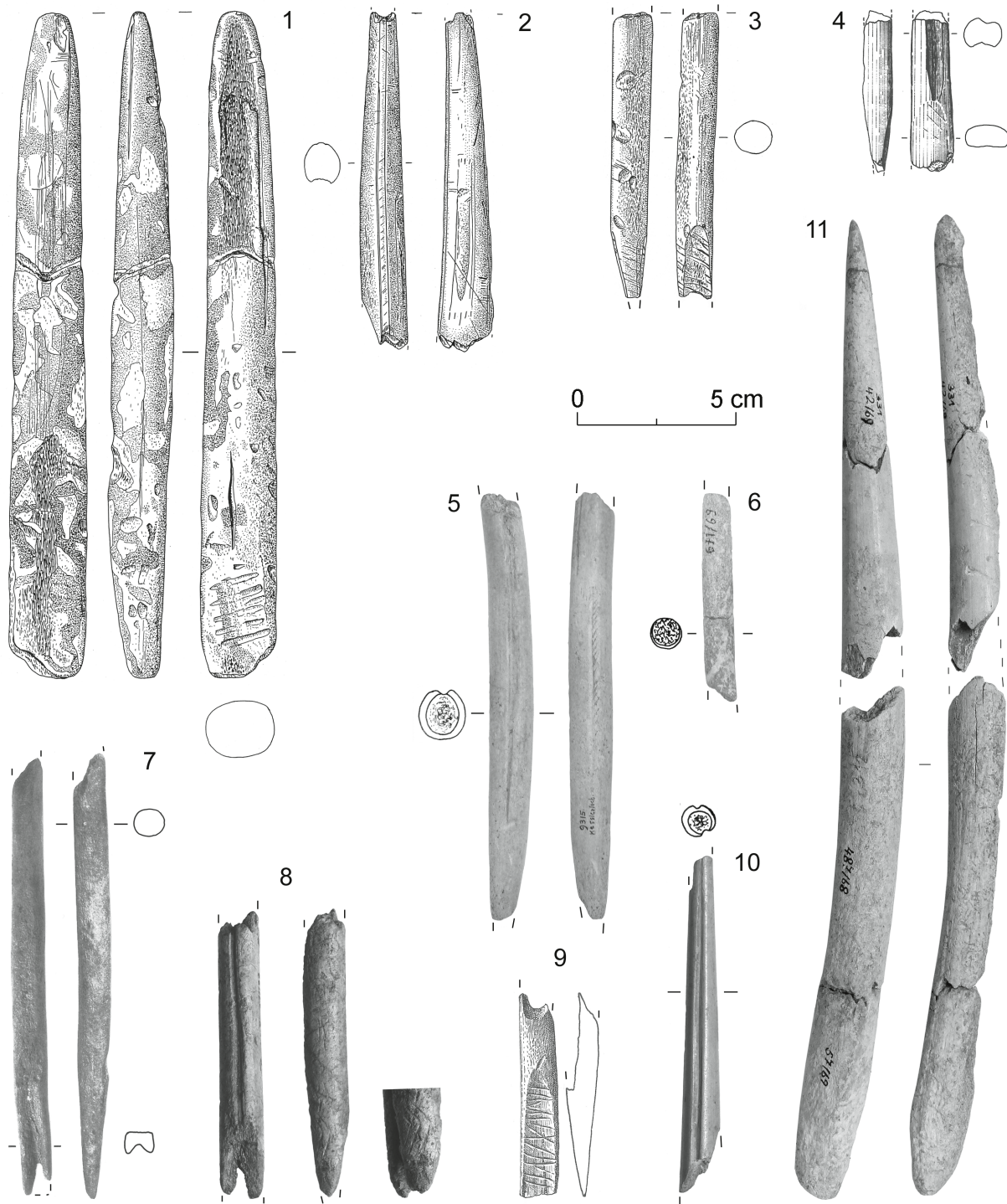
Fig. 5. Round antler rods. 1-6: Petersfels. Illustrations by the author, except for Fig. 5: 1 – Mauser 1970; Fig. 5: 3 – Albrecht 1979.  
 Abb. 5. Runde Geweihstäbe. 1-6: Petersfels. Abbildungen: Verfasser, bis auf Abb. 5: 1 – Mauser 1970; Abb. 5: 3 – Albrecht 1979.



**Fig. 6.** Unclassified fragments of antler artefacts made from transversal segments. 1-2: Petersfels; 3: Bockstein-Törle; 4: Kohlerhöhle; 5-11: Pekárna; 12-14: Kniegrotte; 15-16: Kesslerloch. Illustrations by the author, except for Fig. 6: 4 (drawing) – J. Sedlmeier; Fig. 6: 12, 13 & 14 – Feustel 1974.

**Abb. 6.** Unklassifizierte Fragmente von Geweihartefakten aus Transversalsegmenten. 1-2: Petersfels; 3: Bockstein-Törle; 4: Kohlerhöhle; 5-11: Pekárna; 12-14: Kniegrotte; 15-16: Kesslerloch. Abbildungen: Verfasser, bis auf Abb. 6: 4 (drawing) – J. Sedlmeier; Abb. 6: 12, 13 & 14 – Feustel 1974.



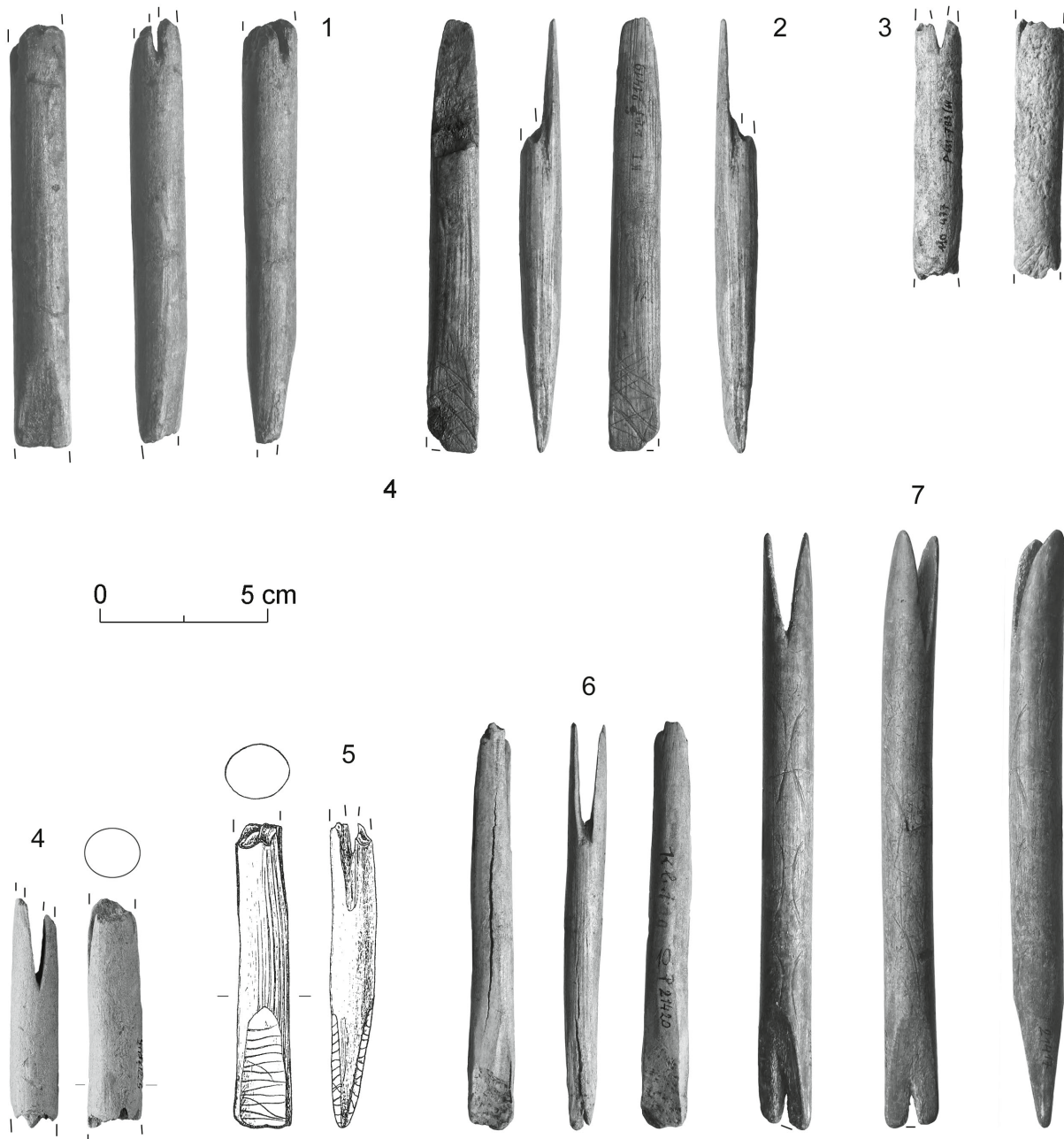


**Fig. 7.** Projectile points made from transversal segments: 1-3, 5 & 10: Kesslerloch; 4: Kohlerhöhle; 6: Teufelsbrücke; 7: Schussenquelle; 8: Pekárna; 9 & 11: Kniegrotte. Illustrations by the author, except for Fig. 7: 1-3 – M. Höneisen; Fig. 7: 4 – J. Sedlmeier; Fig. 7: 7 – Schuler 1994; Fig. 7: 9 – Feustel 1974.

**Abb. 7.** Geschosspitzen aus Transversalsegmenten. 1-3, 5 & 10: Kesslerloch; 4: Kohlerhöhle; 6: Teufelsbrücke; 7: Schussenquelle; 8: Pekárna; 9 & 11: Kniegrotte. Abbildungen: Verfasser, bis auf Abb. 7: 1-3 – M. Höneisen; Abb. 7: 4 – J. Sedlmeier; Abb. 7: 7 – Schuler 1994; Abb. 7: 9 – Feustel 1974.

fore-shafts? Compared to round rods, fore-shafts of the Pekárna type are much shorter (Appendix, Plate 3: A), they are straight and their surface is not thoroughly worked with the result of a largely preserved compacta and un-exposed spongiosa. The nowadays crooked appearance of the round rods

which is in conflict with a function as part of a thrown projectile can of course be due to post-sedimentary processes causing the once straightened pieces to return to the original shape of the antler beam/tine. The slimmer specimens could certainly have been straightened after wetting analogous to antler blanks.



**Fig. 8.** Fore-shafts of the Pekárna type. 1-3, 6 & 7: Pekárna; 4: Petersfels; 5: Külna. Illustrations by the author, except for Fig. 8: 5 – Valoch 2001.  
**Abb. 8.** Vorschäfte vom Pekárna-Typ. 1-3, 6 & 7: Pekárna; 4: Petersfels; 5: Külna. Abbildungen: Verfasser, bis auf Abb. 8: 5 – Valoch 2001.

Yet, it appears not very convenient to alter the shape of a cylinder with a relatively large diameter (up to 26 mm) and, at the same time, thin compacta. Presumably for that reason, clear fore-shafts of the Pekárna type were kept short, and the long fore-shafts with forked distal ends known from the Upper Magdalenian of South-western France as well as the fore-shafts of the Hamburgian culture on the northern European plain either were made on especially compact antler blanks or from whalebone (Pétillon 2006: Pl. VI; 2013: Figs. 6 & 7; 2016: Fig. 11; Pétillon & Cattelain 2004; Wild et al. 2018).

Summing up, the round antler rods of the CEM very probably were no wedges, but perhaps unbarbed

points, or fore-shafts. Yet, it appears equally possible that they represent a special artefact type – a question to be discussed below.

### Dating

The chronological position of the round rods within the CEM is problematic: First, no round rod has been subjected to direct dating so far. Second, most of the sites at which these artefacts are present were excavated in the rather early days of Prehistoric archaeology and therefore lack a fine stratigraphic resolution that could help to subdivide their large osseous inventories.

For Petersfels, there are a number of conventional

radiocarbon dates on undetermined bones recovered during the excavations on the valley floor. According to them, all archaeological horizons are dated between 16'000 and 14'000 calBP and hence to the Upper Magdalenian (Albrecht 1979; Jaguttis-Emden 1983; Kind 2003; Maier 2015). The total absence of bones of characteristic species of the mammoth steppe like mammoth, saiga, musk ox and woolly rhino in the very rich faunal assemblages from both cave, front area and valley floor (Müller 2013; Pfeifer 2016: 19-22; Weniger 1982) as well as the typological composition of the lithic and osseous inventories provide further support for a mainly Upper Magdalenian occupation of Petersfels (Pfeifer 2016: 69).

Concerning Schussenquelle, four radiocarbon dates obtained on bone, antler and charcoal from the main layer in which several find horizons were present (Eriksen 1991: 60) fall between 16'000 and 14'800 calBP (Schuler 1994: 166). If only the two AMS measurements are accepted, the age of the main layer is 15'100 - 14'800 calBP (Maier 2015: Tab. A.6). Hence, Schussenquelle is dated to the late Upper Magdalenian (Schuler 1994: 169; 2009: 139). This is again supported by the absence of mammoth, saiga, musk ox and woolly rhino in the very rich and diverse faunal record (Schuler 1994: 47-50).

For Pekárna, there are three conventional radiocarbon dates for horizon g/h obtained on undetermined bones with an age of 15'800 - 14'800 calBP, which point towards the Upper Magdalenian – like most other absolute dates obtained for Magdalenian sites in Moravia (Nerudová & Neruda 2014: Fig. 5). Again, mammoth, saiga, musk ox and woolly rhino are absent in the very rich faunal record (Musil 2002: 79).

In contrast, Kesslerloch covers a considerable time span. Multiple AMS measurements on humanly modified bones resulted in dates from 17'400 - 14'800 calBP (Housley et al. 1997; Leesch et al. 2012: Fig. 15; Maier 2015: Tab. A.6; Napierala 2008: 16-17) which correspond to the Middle and Upper Magdalenian. In the faunal record, musk ox, mammoth and rhino bones are frequent in the lower layers and these species are also represented by art (Napierala 2008). The lithic and osseous artefact inventory must be an admixture of older and younger occupations as the co-occurrence of several multi-barbed antler points with many half-round rods clearly illustrates (Höneisen 1993). There are also strong parallels to the late Middle Magdalenian of South-western France and Cantabrian Spain (Leesch et al. 2012: 203).

Balcarka cave yielded one conventional radiocarbon date (GrN-28448) that with an age around 17'100 calBP is remarkably ancient for Moravia (Neruda 2010: 92; Fig. 3). However, since the conventional measurement was carried out on undetermined, unmodified bone and since the excavated assemblage is un-stratified (Pfeifer 2017), its connection to the round rod fragment remains doubtful.

It seems that all more or less reliably dated sites

with round rods either have their main occupation during the Upper Magdalenian (Petersfels, Pekárna g/h, Schussenquelle) or at least bear a strong Upper Magdalenian imprint (Kesslerloch). In return, it is conspicuous that round rods seem not to be present at rich Central European sites where the Upper Magdalenian is not attested. This is the case at the open-air site of Munzingen (Baden-Württemberg, Germany) which may be attributed to the Lower Magdalenian (Pasda 2017) as well as Maszycka cave in southern Poland, dating to the early Middle Magdalenian (Kozłowski et al. 2012). The main occupation of Kniegrotte cave which dates to c. 16'100 calBP according to a weighted average of seven relatively consistent AMS measurements (Kübner 2009: 185; Maier 2015: 241; Tab. A.6; Street 2000) still belongs to the late Middle Magdalenian. Three highly fragmented antler artefacts with double-bevelled bases made from transversal segments cannot be further characterized (Fig. 6: 12-14; Appendix, Tab. 2).

These considerations suggest that, at the current state of knowledge, round antler rods are characteristic of the Upper Magdalenian. Yet, due to the above-mentioned problems, this conclusion cannot be regarded as definitive.

## Function

Round antler rods are long, bent objects which according to their double-bevelled bases probably were hafted longitudinally. The meticulous overall modification aiming at a very regular rounded cross section and constant diameter required the removal of a big part of the tough compacta. Thus, they appear not to be optimized for mechanical applications in the first place. However, some rods feature clear bevelled breaks that speak for a certain mechanical strain during use (Figs. 3: 2; 4: 1; 5: 1). Assuming that some round rods neither were points nor fore-shafts in thrown projectiles, alternative functions have to be discussed.

If an Upper Magdalenian dating is accepted, the appearance of round rods in the osseous toolkit coincides with the emergence of the multi-barbed point around 16'000 calBP (Höneisen 1993; Langley et al. 2016; Maier 2015: 52-53; Pétilion 2016; Pfeifer 2016: 63). Except from Balcarka cave, all round rod-bearing assemblages presented here also contain multi-barbed antler points of various sizes and shapes. The functional spectrum of osseous barbed points is a matter of lively debate (Julien 1982; Langley 2015; Langley et al. 2016; Pétilion 2009). If for some pieces owing to their pointed bases featuring lateral protrusions or even perforations, a harpoon-like application is favoured (Owen 2005; Pfeifer 2016; Weniger 1987), there must have been an appropriate hafting mechanism that allowed the point to come loose. The distal end of the round rod could have acted as a ferrule for the base of the barbed point to make a

hand-held thrusting weapon used e.g. for fishing. Interestingly, one round rod from Petersfels bears an incised fish-like decoration (Fig. 4: 1). In that scenario, the relative fragility and partially crooked silhouette of the round rod would possibly not be that much of an issue. Functional reproductions of hand-held ice hunting harpoons from the Central Arctic can have bent osseous fore-shafts (Rast 2011). One big drawback of that interpretation of course is the lack of preserved distal ends on the round rods, and thus it has to remain unclear whether they were designed to receive another component. Moreover, artefacts like round rods are not mentioned for the rich Upper Magdalenian assemblages of South-western France and Cantabrian Spain which contain numerous barbed points (Julien 1982; Langley 2015; Pétilion 2016; Weniger 1987).

Ethnographical sources might produce further hints. Until the mid-20<sup>th</sup> century, Inuit societies in the North American Arctic have made extensive use of osseous raw materials, especially caribou antler, to manufacture an un-paralleled diversity of tools (Balıkcı 1989; Damas 1984; Gulløv 1997). These include digging sticks – long, slender objects with one or two pointed or spatulate ends which were used to dig out edible roots (Kuhnlein & Turner 1991: 10-11). The exploitation of nutritious tubers during the Magdalenian is likely (Owen 2005) and thus artefacts used as digging sticks should have existed. However, since digging in stony and sub-frozen soil places heavy mechanical stress on the tool, an application round rods clearly are not optimized for, possible digging sticks should rather be sought among osseous projectile points and wedges (Owen 2000: 195).

Another possible function of the round rods is that of a counterweight. Several historic Inuit societies in the Bering Sea region used hand-held thrusting lances for dispatching harpooned seals and swimming reindeer which had long (up to 700 mm) rods of walrus tusk and sometimes wood attached to the proximal end to balance the weapon. These pieces were usually highly polished, decorated and, due to the raw material, slightly bent (Rousselot 1983: 16-23; Figs. 1; 161; 167-174). That thrusting lances existed in the Magdalenian can be presumed due to some very large antler points which usually were made *en volume* (Appendix, Plate 3: A-C; Fig. 7: 1 & 11; Appendix, Tab. 4).

In the Central Arctic, long and bent antler rods with a very regular circular cross section were used as probes to test the thickness and consistence of snow for igloo building as well as for examining the breathing holes of seals in the winter ice. Often, these probes were assembled from several pieces (Balıkcı 1989: 69-74; Figs. 20; 28; 34). Although neither the construction of snow houses nor seal hunting are plausible scenarios for the CEM (but see Cziesla 2007 for the Late Palaeolithic), the use of round antler rods as probes to test suspicious snow and ice surfaces or to search for cadavers under snowdrifts could be a possible application (comp. Gamble 1987).

Concerning the find context, it can be observed that round rods are typical of large assemblages very rich in various antler artefacts and in particular art and adornment. For Petersfels, Kesslerloch, Schussenquelle and Pekárna, there is a controversial discussion concerning the interpretation as base camps or aggregation sites, where apart from hunting-related and domestic activities also symbolic and ritual actions played an important role (Albrecht 2009; Eriksen 1991: 182-183; Pasda 1998: 107; Pfeifer 2016: 104-105; Valoch 2001: 122; Weniger 1982: 184-191). In these circumstances, it could well be that the round antler rods served a primarily non-utilitarian function. In ethnographic societies of the Arctic, for example, osseous rods were frequently used as drumsticks (Gilberg 1984: Fig. 14). However, it is very difficult to test such functional interpretations.

## Conclusions and perspectives

According to the current state of knowledge, the functional interpretation of CEM round antler rods is unsatisfactory. Nevertheless, there are prospects for future work. While there do not seem to be any direct ethnographic analogies to round rods in the North American Arctic, it might be fruitful to search for further evidence in the global archaeological and ethnographic record. The fore-shaft hypothesis for barbed points presented above and the use as snow probes could be addressed by experiments to test their general practicability. The most promising starting point, however, seems to be a dedicated quest for round antler rods in other Magdalenian contexts, especially the big osseous assemblages of Western Europe. Here, better preserved specimens might be found whose typological characterization and functional interpretation, e.g. as projectile points or fore-shafts, are clearer. Moreover, the spatial distribution, chronological significance and find context of these particular artefacts could be discussed from a more holistic perspective.

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Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Kesslerloch	Cantonal Archaeological Service Schaffhausen (Switzerland)	8600	4	10	108	16	19	oval	double bevel	53	Fig. 4: 4	recorded by the author
Petersfels	University of Tübingen (Germany)	PF/21-654	4	10	274	18	18	round	double bevel	65	Fig. 4: 3	recorded by the author
Petersfels	University of Tübingen (Germany)	no inf.	no inf.	no inf.	480	26	26	round	double bevel	42 (broken)	Fig. 5: 3	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/221	6	10	140	17	17	round	double bevel	29 (broken)	Fig. 5: 1	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/213	4	10	214	19	19	round	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/257	6	8	247	23	17	oval	no inf.	no inf.	Fig. 4: 2	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	23/244	5	10	198	18	18	round	no inf.	no inf.	Fig. 5: 4	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/257	5	13	276	20	20	round	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/213	6	11	156	17	17	round	no inf.	no inf.	Fig. 5: 6	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/213	6	7	398	19	19	round	no inf.	no inf.	Fig. 5: 5	recorded by the author
Petersfels	Archäologisches Hegamuseum Singen (Germany)	32/245	4	15	293	21	21	round	double bevel	36	Fig. 5: 2	recorded by the author
Petersfels	Badisches Landesmuseum Karlsruhe (Germany)	32/245	7	12	334	14	14	round	double bevel	41	Fig. 4: 1	recorded by the author
Schussenquelle	missing	no inf.	no inf.	no inf.	ca. 280	ca. 18	ca. 18	round	double bevel	ca. 50 (broken)	Fig. 3: 3	Schuler 1994
Pekárna	Moravian Museum Brno (Czech Republic)	P 21923	3	11	363	17	17	round	double bevel	31 (broken)	Fig. 3: 1	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	21922	3	14	311	20	19	round	no inf.	no inf.	Fig. 3: 2	recorded by the author
Balcarka	Moravian Museum Brno (Czech Republic)	Balc 319	5	12	153	17	17	round	double bevel	59	Fig. 4: 5	recorded by the author

Appendix, Tab. 1. Round rods: metric data. Inv.no.: inventory number; no inf.: no information.

Appendix, Tab. 1. Runde Stäbe: metrische Daten. Inv.no.: Inventarnummer; no inf.: keine Information.

Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Kesslerloch	Cantonal archaeological service Schaffhausen (Switzerland)	8602.	4	7	69	15	15	round	no inf.	no inf.	Fig. 6: 15	recorded by the author
Kesslerloch	Cantonal archaeological service Schaffhausen (Switzerland)	8573	no inf.	no inf.	54	10	11	round	double bevel	22 (broken)		recorded by the author
Kesslerloch	Bernisches Historisches Museum (Switzerland)	37715	4	5	65	12	12	round	double bevel	26 (broken)	Fig. 6: 16	recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/224	4	8	54	14	14	round	double bevel	23 (broken)		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/224	4	9	62	14	14	round	double bevel	27 (broken)	Fig. 6: 2	recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/224	5	10	77	15	15	round	double bevel	31		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/224	3	8	72	12	12	round	double bevel	24 (broken)		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/259	5	10	131	17	17	round	double bevel	45	Fig. 6: 1	recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/227	4	5	39	13	11	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/227	3	3	36	12	9	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/220	3	6	43	13	15	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/213	2	12	50	22	18	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Hegaumuseum Singen (Germany)	32/227	5	4	52	14	14	round	no inf.	no inf.		recorded by the author

Appendix, Tab. 2. continued next page.

Appendix, Tab. 2. Fortsetzung nächste Seite.

Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/227	3	5	54	12	9	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/213	4	5	54	12	10	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/213	3	5	57	16	10	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/229	2	7	61	10	10	round	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/213	3	8	61	16	13	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/213	3	5	87	14	11	oval	no inf.	no inf.		recorded by the author
Petersfels	Archäologisches Heegaumuseum Singen (Germany)	32/213	2	5	108	13	10	oval	no inf.	no inf.		recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21163	4	10	81	18	18	round	double bevel	41	Fig. 6:5	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	110490	3	13	73	20	15	oval	double bevel	37 (broken)	Fig. 6:7	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21181	4	13	69	21	15	oval	double bevel	41	Fig. 6:10	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21215	3	7	52	13	11	oval	double bevel	42 (broken)	Fig. 6:11	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	110485	4	7	122	17	14	oval	no inf.	6 (broken)	Fig. 6:6	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21204	4	9	48	17	12	oval	double bevel	27	Fig. 6:8	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21116	2	13	68	17	13	oval	no inf.	no inf.	Fig. 6:9	recorded by the author

Appendix, Tab. 2. continued next page.

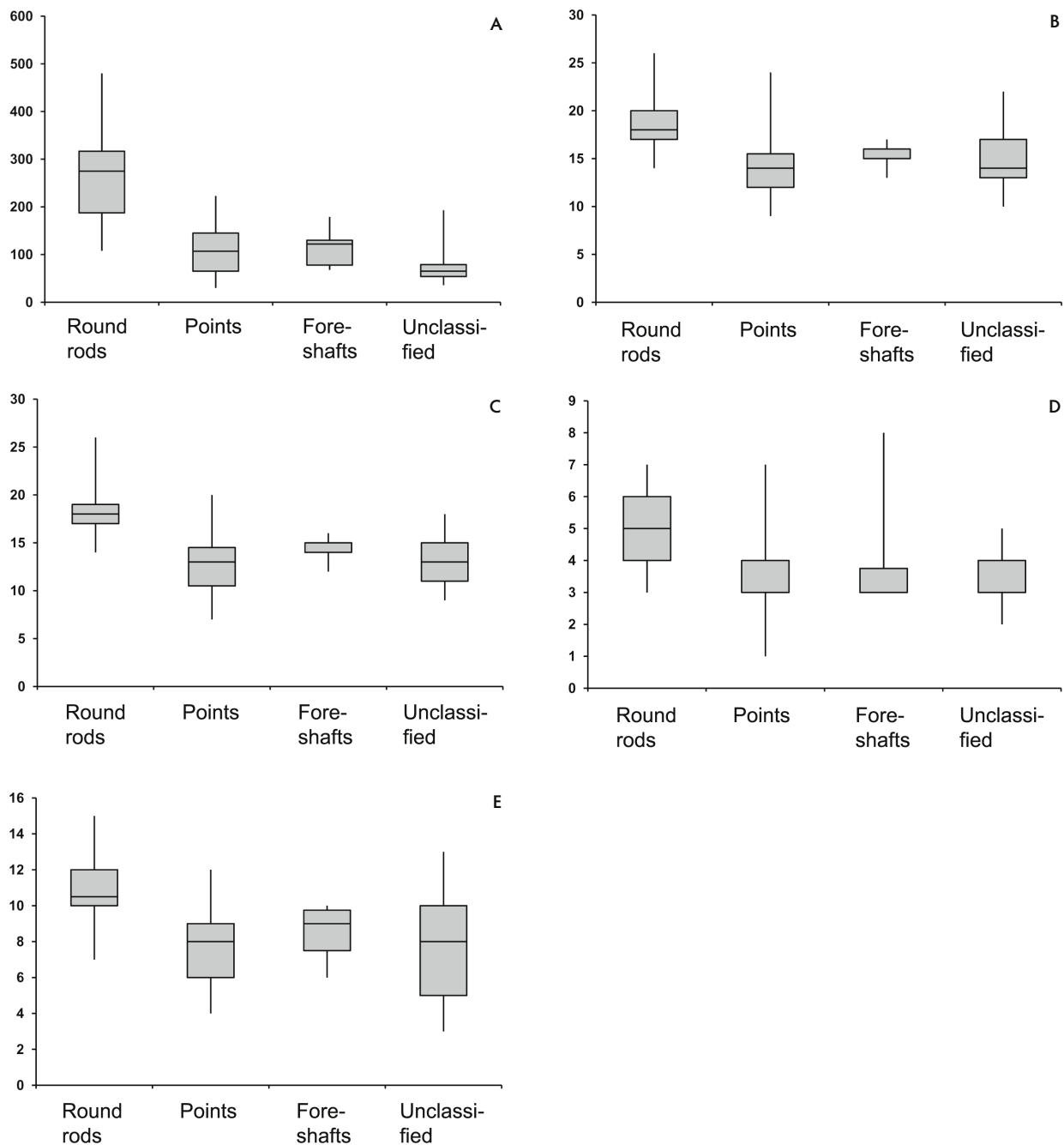
Appendix, Tab. 2. Fortsetzung nächste Seite.

Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Kohlerhöhle	Cantonal Archaeological Service Baselland (Switzerland)	K 1026	3	8	155	15	15	round	double bevel	39	Fig. 6: 4	recorded by the author
Bockstein-Törle	Museum Ulm (Germany)	T 6628a; b	2	9	110	13	13	round	double bevel	30	Fig. 6: 3	recorded by the author
Kniegrotte	Thuringian Archaeological Service Weimar (Germany)	14/69	3	12	65	17	17	round	double bevel	27 (broken)	Fig. 6: 12	recorded by the author
Kniegrotte	Thuringian Archaeological Service Weimar (Germany)	52/69	2	10	193	14	14	round	double bevel	29 (broken)	Fig. 6: 14	recorded by the author
Kniegrotte	Thuringian Archaeological Service Weimar (Germany)	17/69	no inf.	no inf.		13	11	oval	double bevel	27	Fig. 6: 13	Feustel 1974

Appendix, Tab. 2. Unclassified artefacts: metric data. Inv.no.: inventory number; no inf.: no information.

Appendix, Tab. 2. Unklassifizierte Artefakte: metrische Daten. Inv.no.: Inventarnummer; no inf.: keine Information.





**Appendix, Plate 3.** A Boxplot showing the distribution of maximal length of fragments of round rods, projectile points, fore-shafts and unclassified artefacts made from transversal segments. Whiskers extend to minimum and maximum of the data. Illustration by the author; B Boxplot showing the distribution of maximal width of round rods, projectile points, fore-shafts and unclassified artefacts made from transversal segments. Whiskers extend to minimum and maximum of the data. Illustration by the author; C Boxplot showing the distribution of maximal thickness of round rods, projectile points, fore-shafts and unclassified artefacts made from transversal segments. Whiskers extend to minimum and maximum of the data. Illustration by the author; D Boxplot showing the distribution of maximal compacta thickness of round rods, projectile points, fore-shafts and unclassified artefacts made from transversal segments. Whiskers extend to minimum and maximum of the data. Illustration by the author; E Boxplot showing the distribution of maximal spongiosa thickness of round rods, projectile points, fore-shafts and unclassified artefacts made from transversal segments. Whiskers extend to minimum and maximum of the data. Illustration by the author.

**Appendix, Tafel 3.** A Box-Plot der Verteilung der maximalen Länge von Fragmenten von runden Stäben, Vorschäften vom Pekárna-Typ, Geschosspitzen und unklassifizierten Artefakten aus Transversalsegmenten. Die Whiskers reichen bis zum Minimum und Maximum der Daten. Abbildung: Verfasser; B Box-Plot der Verteilung der maximalen Breite von runden Stäben, Vorschäften vom Pekárna-Typ, Geschosspitzen und unklassifizierten Artefakten aus Transversalsegmenten. Die Whiskers reichen bis zum Minimum und Maximum der Daten. Abbildung: Verfasser; C Box-Plot der Verteilung der maximalen Dicke von runden Stäben, Vorschäften vom Pekárna-Typ, Geschosspitzen und unklassifizierten Artefakten aus Transversalsegmenten. Die Whiskers reichen bis zum Minimum und Maximum der Daten. Abbildung: Verfasser; D Box-Plot der Verteilung der maximalen Kompaktadicke von runden Stäben, Vorschäften vom Pekárna-Typ, Geschosspitzen und unklassifizierten Artefakten aus Transversalsegmenten. Die Whiskers reichen bis zum Minimum und Maximum der Daten. Abbildung: Verfasser; E Box-Plot der Verteilung der maximalen Spongiosadicke von runden Stäben, Vorschäften vom Pekárna-Typ, Geschosspitzen und unklassifizierten Artefakten aus Transversalsegmenten. Die Whiskers reichen bis zum Minimum und Maximum der Daten. Abbildung: Verfasser.

Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Kesslerloch	Cantonal archaeological service Schaffhausen (Switzerland)	37706	3	4	45	12	10	oval	no inf.	no inf.		recorded by the author
Kesslerloch	Cantonal archaeological service Schaffhausen (Switzerland)	9317	4	8	108	13	13	round	no inf.	no inf.	Fig. 7: 3	recorded by the author
Kesslerloch	Cantonal archaeological service Schaffhausen (Switzerland)	9315	3	9	135	15	14	round	massive	33 (broken)	Fig. 7: 5	recorded by the author
Kesslerloch	Rosgartenmuseum Constance (Germany)	U 127	7	12	208	24	20	oval	double bevel	41	Fig. 7: 1	recorded by the author
Kesslerloch	Rosgartenmuseum Constance (Germany)	U 79	3	9	90	12	12	round	double bevel	24 (broken)	Fig. 7: 10	recorded by the author
Kesslerloch	Rosgartenmuseum Constance (Germany)	U 56	4	9	176	16	13	oval	massive	37 (broken)		recorded by the author
Kesslerloch	Rosgartenmuseum Constance (Germany)	U 44	5	9	107	15	15	round	no inf.	no inf.	Fig. 7: 2	recorded by the author
Schussenquelle	Naturkundemuseum Stuttgart (Germany)	SMNS 32830.110	no inf.	no inf.	140	11	11	round	double bevel	40	Fig. 7: 7	Schuler 1994
Pekárna	Moravian Museum Brno (Czech Republic)	21422	3	6	91	14	13	round	double bevel	24 (broken)	Fig. 7: 8	recorded by the author
Kohlerhöhle	Cantonal Archaeological Service Baselland (Switzerland)	K 1020	3	4	52	14	10	oval	double bevel	23 (broken)	Fig. 7: 4	recorded by the author
Kniegrotte	Thuringian Archaeological Service Weimar (Germany)	18/69	3	6	64	12	11	round	double bevel	41	Fig. 7: 9	recorded by the author
Kniegrotte	Thuringian Archaeological Service Weimar (Germany)	42/69	6	8	320	22	20	round	massive	48	Fig. 7: 11	recorded by the author
Gönnersdorf	RGZM Monrepos (Germany)	JT 149	2	4	30	9	7	oval	double bevel	20		recorded by the author
Teufelsbrücke	Thuringian Archaeological Service Weimar (Germany)	671/69	1	9	66	10	10	round	no inf.	no inf.	Fig. 7: 6	recorded by the author
Oelknitz	RGZM Monrepos (Germany)	VII; 103/60	no inf.	no inf.	223	17	16	round	no inf.	no inf.		recorded by the author

Appendix, Tab. 4. Projectile points from transversal segments: metric data. Inv.no.: inventory number; no inf.: no information.

Appendix, Tab. 4. Geschosspitzen aus Transversalsegmenten: metrische Daten. Inv.no.: Inventarnummer; no inf.: keine Information.

Site	Collection	Inv.no.	Max. compacta thickness (mm)	Max. spongiosa thickness (mm)	Length (mm)	Max. width (mm)	Max. thickness (mm)	Cross section	Shape of base	Length of base (mm)	Figure	Source of data
Petersfels	Archäologisches Hegau-museum Singen (Germany)	Sn 32/225	5	7	68	15	15	round	no inf.	no inf.	Fig. 8: 4	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 21420	3	6	122	13	12	round	double bevel	27	Fig. 8: 6	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	21418	4	9	127	17	16	round	double bevel	28 (broken)	Fig. 8: 1	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	21419	3	10	130	15	13	oval	double bevel	32	Fig. 8: 2	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	21417	3	10	179	16	15	round	double bevel	41	Fig. 8: 7	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic)	P 631-783/64	3	9	78	15	14	round	double bevel	11 (broken)	Fig. 8: 3	recorded by the author
Pekárna	Moravian Museum Brno (Czech Republic) - permanent exhibition	P 21416	no inf.	no inf.	130	16	14	oval	double bevel	43		recorded by the author
Kůlna	Moravian Museum Brno (Czech Republic)	no inf.	no inf.	no inf.	92	16	14	oval	double bevel	39	Fig. 8: 5	Valoch 2001
Veyrier	Musée d'art et d'histoire de Genève (Switzerland)	no inf.	no inf.	no inf.	70	15	14	round	no inf.	no inf.		Stahl Gretsch 2006

Appendix, Tab. 5. Fore-shafts of Pekárna type: metric data. Inv.no.: inventory number; no inf.: no information.

Appendix, Tab. 5. Vorschäfte vom Pekárna-Typ: metrische Daten. Inv.no.: Inventarnummer; no inf.: keine Information.

## Literature cited

- Albrecht, G. (1979).** *Magdalénien-Inventare vom Petersfels. Siedlungsarchäologische Ergebnisse der Ausgrabungen 1974-1976.* Archaeologica Venatoria, Tübingen.
- Albrecht, G. (2009).** Durch diese hohle Gasse... – Ein Durchgangstal im Hegau. In: Archäologisches Landesmuseum Baden-Württemberg & Abteilung Ältere Urgeschichte und Quartärökologie der Eberhard Karls Universität Tübingen (Eds.) *Eiszeit. Kunst und Kultur.* Thorbecke, Ostfildern, 142-145.
- Allain, J., Desbrosse, R., Kozłowski, J. K. & Rigaud, A. (1985).** Le Magdalénien à navettes. *Gallia Préhistoire* 28: 37-124.
- Balicki, A. (1989).** *The Nesilik Eskimo.* Waveland Press, Long Grove.
- Bosinski, G. (1978).** Eine zusammengesetzte Magdalénien-Geschosspitze aus der Höhle im Freudenthal, Kanton Schaffhausen. *Archäologisches Korrespondenzblatt* 8: 87-89.
- Camps-Fabrer, H. (1990).** Poinçons, pointes, poignards, aiguilles – Fiche générale. In: H. Camps-Fabrer (Ed.) *Poinçons, pointes, poignards, aiguilles.* Fiches typologiques de l'industrie osseuse préhistorique 3. Publications de l'Université de Provence, Aix-en-provence, 1-16.
- Cattelain, P. (1988).** *Propulseurs.* Fiches typologiques de l'industrie osseuse préhistorique 2. Publications de l'Université de Provence, Aix-en-Provence.
- Cattelain, P. (2005).** Propulseurs magdaléniens: marqueurs culturels régionaux. In: V. Dujardin (Ed.) *Industrie osseuse et parures du Solutréen au Magdalénien en Europe.* Actes de la table ronde sur le Paléolithique supérieur récent, Angoulême (Charente), 28 - 30 mars 2003 (pp.). Mémoire 39. Société Préhistorique Française, Paris, 301-317.
- Cattelain, P. & Onorati, G. (1993).** Fiche éléments intermédiaires de hampe de projectiles. In: H. Camps-Fabrer (Ed.) *Éléments recepteurs.* Fiches typologiques de l'industrie osseuse préhistorique 6. Éditions du CEDARC, Treignes, 15-22.
- Cziesla, E. (2007).** Robbenjagd in Brandenburg? Gedanken zur Verwendung großer Widerhakenspitzen. *Ethnographisch-archäologische Zeitschrift* 48: 1-48.
- Damas, D. (Ed.) (1984).** *Handbook of North American Indians 5.* Smithsonian Institution, Washington.
- Eriksen, B. V. (1991).** *Change and continuity in a prehistoric hunter-gatherer society: a study of cultural adaptation in late glacial - early postglacial southwestern Germany.* Archaeologica Venatoria, Tübingen.
- Feruglio, V. (1992).** Fiche baguettes demi-rondes. In: H. Camps-Fabrer (Ed.) *Batons percés, baguettes.* Fiches typologiques de l'industrie osseuse préhistorique 5. Éditions du CEDARC, Treignes, 71-83.
- Feustel, R. (1974).** *Die Kniegrotte. Eine Magdalénien-Station in Thüringen.* Veröffentlichungen des Museums für Ur- und Frühgeschichte Thüringens 5. Hermann Böhlau Nachfolger, Weimar.
- Feustel, R. (1980).** *Magdalénienstation Teufelsbrücke.* Veröffentlichungen des Museums für Ur- und Frühgeschichte Thüringens 3. Museum für Ur- und Frühgeschichte Thüringens, Weimar.
- Fraas, O. (1867).** Die neuesten Erfunde an der Schussenquelle bei Schussenried. *Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg* 23: 48-74.
- Gamble, C. (1987).** Man the shoveler. Alternative models for Middle Pleistocene colonization and occupation in northern latitudes. In: O. Soffer (Ed.) *The Pleistocene old world. Regional perspectives.* Interdisciplinary Contributions to Archaeology 1. Plenum Press, New York, 81-98.
- Gilberg, R. (1984).** Polar Eskimo. In: D. Damas (Ed.) *Handbook of North American Indians 5.* Smithsonian Institution, Washington, 577-594.
- Gulløv, H. C. (1997).** *From Middle Ages to colonial times. Archaeological and ethnohistorical studies of the Thule culture in South West Greenland 1300-1800 AD.* Meddelelser om Grønland, Man & Society 23. The Commission of Scientific Research in Greenland, Copenhagen.
- Hahn, J. (1993).** *Erkennen und Bestimmen von Stein- und Knochenartefakten. Einführung in die Artefaktmorphologie.* Archaeologica Venatoria, Tübingen.
- Heierli, J. (1907).** *Das Kesslerloch bei Thaugen.* Neue Denkschriften der Schweizerischen Naturforschenden Gesellschaft 43. Zürcher & Furrer, Zürich.
- Höck, C. (2000).** *Das Magdalénien der Kniegrotte - Ein Höhlenfundplatz bei Döbritz, Saale-Orla-Kreis.* Weimarer Monographien zur Ur- u. Frühgeschichte 35. Thüringisches Landesamt für archäologische Denkmalpflege, Weimar.
- Höneisen, M. (1993).** Technologie und Verarbeitung von Geweih, Knochen und Elfenbein. In: J. M. Le Tensorer (Ed.) *Die Schweiz vom Paläolithikum bis zum frühen Mittelalter 1.* Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, Basel, 173-181.
- Höneisen, M. & Peyer, S. (1994).** *Schweizersbild - ein Jägerlager der Späteiszeit. Beiträge und Dokumente zur Ausgrabung vor 100 Jahren.* Schaffhäuser Archäologie 2. Kantonsarchäologie Schaffhausen, Schaffhausen.
- Housley, R. A., Gamble, C. S., Street, M. & Pettitt, P. B. (1997).** Radiocarbon evidence for the Lateglacial human recolonisation of northern Europe. *Proceedings of the Prehistoric Society* 63: 25-54.
- Jaguttis-Emden, M. (1983).** Die Radiokarbondatierung der Ausgrabung Petersfels. In: G. Albrecht, H. Berke & F. Poplin (Eds.) *Naturwissenschaftliche Untersuchungen an Magdalénien-Inventaren vom Petersfels, Grabungen 1974-76.* Archaeologica Venatoria, Tübingen, 47-57.
- Julien, M. (1982).** *Les harpons magdaléniens.* Supplément à Gallia Préhistoire 17. CNRS Editions, Paris.
- Kind, C. J. (2003).** Die absolute Datierung des Magdaléniens und des Mesolithikums in Süddeutschland. In: J.-M. Burdukiewicz, L. Fiedler, W.-D. Heinrich, A. Justus & E. Brühl (Eds.) *Erkenntnisjäger - Kultur und Umwelt des frühen Menschen [Festschrift für Dietrich Mania].* Veröffentlichungen des Landesamts für Archäologie Sachsen-Anhalt & Landesmuseum für Vorgeschichte 57 (1). Landesamt für Archäologie Sachsen-Anhalt & Landesmuseum für Vorgeschichte, Halle, 303-319.
- Kozłowski, S. K., Połtowicz-Bobak, M., Bobak, D. & Terberger, T. (2012).** New information from Maszycka cave and the Late Glacial recolonisation of Central Europe. *Quaternary International* 272-273: 288-296.
- Kuhnlein, H. V. & Turner, N. J. (1991).** *Traditional plant foods of Canadian indigenous peoples. Nutrition, botany and use.* Food and Nutrition in History and Anthropology 7. Gordon and Breach, Amsterdam.
- Kübner, M. (2009).** *Die späte Altsteinzeit im Einzugsgebiet der Saale.* Weimarer Monographien zur Ur- u. Frühgeschichte 42. Beier & Beran, Weimar.
- Lázničková-Galetová, M. (2010).** Le travail des matières d'origine dure animale dans le Magdalénien Morave: l'exemple des aiguilles à chas. *L'Anthropologie* 114 (1): 68-96.
- Langley, M. C. (2015).** Investigating maintenance and discard behaviours for osseous projectile points: A Middle to Late Magdalenian (c. 19,000 - 14,000 cal. BP) example. *Journal of Anthropological Archaeology* 40: 340-360.
- Langley, M. C., & Street, M. (2013).** Long range inland – coastal networks during the Late Magdalenian: Evidence for individual acquisition of marine resources at Andernach-Martinsberg, German Central Rhineland. *Journal of Human Evolution* 64: 457-465.
- Langley, M. C., Pétilion, J. M. & Christensen, M. (2016).** Diversity and evolution of osseous hunting equipment during the Magdalenian (21,000 - 14,000 cal BP). In: M. C. Langley (Ed.) *Osseous projectile weaponry: Towards an understanding of Pleistocene cultural variability.* Springer, New York, 143-158.

- Leesch, D. (1993).** Das späte Jungpaläolithikum – Zeitlicher Rahmen und Fundinventare. In: J. M. Le Tensorer (Ed.) *Die Schweiz vom Paläolithikum bis zum frühen Mittelalter* 1. Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, 153-164.
- Leesch, D., Müller, W., Nielsen, E. & Bullinger, J. (2012).** The Magdalenian in Switzerland: Re-colonization of a newly accessible landscape. *Quaternary International* 272 & 273: 191-208.
- Maier, A. (2015).** *The Central European Magdalenian. Regional Diversity and Internal Variability.* Springer, New York 2015.
- Mania, D. (1999).** *Nebra – eine jungpaläolithische Freilandstation im Saale-Unstrut-Gebiet.* Veröffentlichungen des Landesamtes für Archäologie Sachsen-Anhalt & Landesmuseum für Vorgeschichte 54. Landesamt für Archäologie Sachsen-Anhalt & Landesmuseum für Vorgeschichte, Halle.
- Mausser, P. F. (1970).** *Die jungpaläolithische Höhlenstation Petersfels im Hegau: Gemarkung Bittelbrunn, Ldkrs. Konstanz.* Badische Fundberichte, Sonderheft 13. Staatliches Amt für Ur- und Frühgeschichte, Freiburg.
- Müller, W. (2013).** *Le site magdalénien de Monruz 3. Acquisition, traitement et consommation des ressources animales.* Archéologie neuchâtoise 49. Office du patrimoine et de l'archéologie de Neuchâtel, Hauterive.
- Musil, R. (2002).** The fauna from Moravian Palaeolithic cave deposits. In: J. Svoboda (Ed.) *Prehistoric caves. Catalogues, documents, Studies.* AV ČR, Brno, 53-101.
- Napierala, H. (2008).** *Die Tierknochen aus dem Kesslerloch – Neubearbeitung der paläolithischen Fauna.* Beiträge zur Schaffhäuser Archäologie 2. Kantonsarchäologie Schaffhausen, Schaffhausen.
- Neruda, P. (2010).** Chronologische Position der paläolithischen Besiedlung der Balcarka-Höhle im mitteleuropäischen Kontext. In: Z. Nerudová (Ed.) *Die Balcarka-Höhle im Mährischen Karst. Eine interdisziplinäre Studie.* Anthropos 31, N.S. 23. Moravské Zemské Muzeum, Brno, 83-95.
- Nerudová, Z. (Ed.) (2010).** *Die Balcarka-Höhle im Mährischen Karst. Eine interdisziplinäre Studie.* Anthropos 31, N.S. 23. Moravské Zemské Muzeum, Brno.
- Nerudová, Z. & Neruda, P. (2014).** Chronology of the Upper Palaeolithic sequence in the Kůlna cave (Okr. Blansko/CZ). *Archäologisches Korrespondenzblatt* 44: 307-324.
- Owen, L. R. (2000).** Lithic functional analysis as a means of studying gender and material culture in prehistory. In: M. Donald & L. Hurcombe (Eds.) *Gender and material culture in Archaeological perspective.* Palgrave Macmillan, New York, 185-197.
- Owen, L. R. (2005).** *Distorting the past. Gender and the division of labor in the European Upper Paleolithic.* Tübingen Publications in Prehistory. Kerns Verlag, Tübingen.
- Pasda, C. (1998).** *Wildbeuter im archäologischen Kontext – Das Paläolithikum in Südbaden.* Archäologie im Südwesten 2. Folio-Verlag Dr. G. Wesselkamp, Bad Bellingen.
- Pasda, C. (2017).** Munzingen: a Magdalenian site in the Southern Upper Rhine plain (Germany). In: C. Bourdier, L. Chehmana, R. Malgarini & M. Połtowicz-Bobak (Eds.) *L'Essor du Magdalénien. Aspects culturels, symboliques et techniques des faciès à navettes et à Lussac-Angles.* Actes de la séance de la Société préhistorique française Besançon 17-19 octobre 2013. Séances de la Société préhistorique française 8. Société préhistorique française, Paris, 153-169.
- Peltier, A. (1992).** Fiche générale batons percés. In: H. Camps-Fabrer (Ed.) *Batons percés, baguettes.* Fiches typologiques de l'industrie osseuse préhistorique 5. Éditions du CEDARC, Treignes, 7-34.
- Peters, E. (1930).** *Die altsteinzeitliche Kulturstätte Petersfels.* Dr. Benno Filser Verlag, Augsburg.
- Pétillon, J. M. (2000).** Les pointes à base fourche Magdaléniennes: approche fonctionnelle. *Préhistoire Anthropologie Méditerranéennes* 9: 29-55.
- Pétillon, J. M. (2006).** *Des Magdaléniens en armes. Technologie des armatures de projectile en bois de cervidé du Magdalénien supérieur de la Grotte d'Isturitz (Pyrénées Atlantiques).* Artefacts 10. Éditions du CEDARC, Treignes.
- Pétillon, J. M. (2008).** First evidence of a whale-bone industry in the western European Upper Paleolithic: Magdalenian artefacts from Isturitz (Pyrénées-Atlantiques, France). *Journal of Human Evolution* 54: 720-726.
- Pétillon, J. M. (2009).** What are these barbs for? Preliminary reflections on the function of the Upper Magdalenian barbed weapon tips. *Paletnologie* 1: 69-102.
- Pétillon, J. M. (2013).** Circulation of whale-bone artefacts in the northern Pyrenees during the Late Upper Paleolithic. *Journal of Human Evolution* 65: 525-543.
- Pétillon, J. M. (2016).** Technological evolution of hunting implements among Pleistocene hunter-gatherers: Osseous projectile points in the middle and upper Magdalenian (19-14 ka cal BP). *Quaternary International* 414: 108-134.
- Pétillon, J. M. & Cattelain, P. (2004).** Nouvel examen de l'armature composite magdalénienne de Tuc d'Audoubert (Montesquieu-Avantès, Ariège). *Bulletin de la Société préhistorique française* 101: 45-53.
- Pétillon, J. M. & Ducasse, S. (2012).** From flakes to grooves: A technical shift in antler working during the last glacial maximum in southwest France. *Journal of Human Evolution* 62: 435-465.
- Pétillon, J. M. & Sacchi, D. (2013).** Deux spatules du type Pekárna dans la grotte Gazel (Sallèles-Cabardès, Aude, France). In: Marco de la Rasilla Vives (Ed.) *F. Javier Fortea Pérez. Universitatis Ovetensis Magister. Estudios en homenaje.* Universidad de Oviedo, Ménsula Ediciones, Oviedo, 305-315.
- Pfeifer, S. J. (2012).** Überlegungen zum organischen Gerätetyp "Vorschaft" des europäischen Magdalénien. *Ethnografisch-Archäologische Zeitschrift* 53: 35-49.
- Pfeifer, S. J. (2016).** *Die Geweihfunde der magdalénienzeitlichen Station Petersfels, Lkr. Konstanz – eine archäologisch-taphonomische Studie.* Forschungen und Berichte zur Archäologie in Baden-Württemberg 3. Dr. Ludwig Reichert, Wiesbaden.
- Pfeifer, S. J. (2017).** Ornamented osseous projectile points from the Balcarka and Pekárna caves: Evidence of direct interrelations between two Magdalenian sites in the Moravian Karst (Czech Republic). *Archäologisches Korrespondenzblatt* 47: 141-152.
- Provenzano, N. (1998a).** Fiche générale des objets à biseau distal. In: H. Camps-Fabrer (Ed.) *Biseaux et tranchants.* Fiches typologiques de l'industrie osseuse préhistorique 7. Éditions du CEDARC, Treignes, 5-16.
- Provenzano, N. (1998b).** Objet à biseau distal unifacial sans débitage longitudinal pris sur bois de cervidés. In: H. Camps-Fabrer (Ed.) *Biseaux et tranchants.* Fiches typologiques de l'industrie osseuse préhistorique 7. Éditions du CEDARC, Treignes, 17-24.
- Rast, T. (2011).** Copper Inuit harpoon reproduction. <https://www.elfshotgallery.blogspot.com/2011/03/copper-inuit-harpoon-reproduction.html> (access 27.09.2018).
- Rigaud, A. (2001).** Les bâtons percés: Décors énigmatiques et fonction possible. *Gallia Préhistoire* 43: 101-151.
- Rigaud, A. (2006).** Étude technologique des baguettes demi-rondes de Labastide (Hautes-Pyrénées). *Archéologie des Pyrénées Occidentales et des Landes* 25: 229-246.
- Rousselot, J. L. (1983).** *Die Ausrüstung zur Seejagd der westlichen Eskimo, untersucht in ihrem kulturellen Kontext.* Münchner Beiträge zur Amerikanistik 11. Renner, Hohenschäftlarn.
- Schuler, A. (1994).** *Die Schussenquelle. Eine Freilandstation des Magdalénien in Oberschwaben.* Materialhefte zur Archäologie in Baden-Württemberg 27. Theiss, Stuttgart.
- Schuler, A. (2009).** Im Hinterhalt – Das Rentierjägerlager an der Schussenquelle. In: Archäologisches Landesmuseum Baden-Württemberg & Abteilung Ältere Urgeschichte und Quartärökologie der Eberhard Karls Universität Tübingen (Eds.) *Eiszeit. Kunst und Kultur.* Thorbecke, Ostfildern, 138-141.

- Stahl Gretschn, L. I. (2006).** *Les occupations magdaléniennes de Veyrier: histoire et préhistoire des abris-sous-blocs.* Cahiers d'archéologie romande 105/Documents préhistoriques 20. CTHS, Paris/Lausanne.
- Stodiek, U. (1993).** *Zur Technologie der jungpaläolithischen Speerschleuder. Eine Studie auf der Basis archäologischer, ethnologischer und experimenteller Erkenntnisse.* Tübinger Monographien zur Urgeschichte 9. Archaeologica Venatoria, Tübingen.
- Stordeur-Yedid, D. (1979).** *Les aiguilles à chas au Paléolithique.* Supplément à Gallia Préhistoire 13. CNRS Editions, Paris.
- Street, M. (2000).** Aspects of Late Upper Palaeolithic settlement and chronology in northern Central Europe, In: B. Valentin, P. Bodu & M. Christensen (Eds.) *L'Europe Centrale et Septentrionale au Tardiglaciaire. Confrontation des modèles régionaux.* Actes de la Table ronde de Nemours, 13-16 mai 1997. APRAIF, Nemours, 55-71.
- Street, M., Jöris, O. & Turner, E. (2012).** Magdalenian settlement in the German Rhineland – An update. *Quaternary international* 272/273: 231-250.
- Tinnes, J. (1994).** *Die Geweih-, Elfenbein- und Knochenartefakte der Magdalénienfundplätze Gönnersdorf und Andernach.* Ph.D. dissertation, University of Cologne, Cologne.
- Valoch, K. (2001).** Das Magdalénien in Mähren – 130 Jahre Forschung. *Jahrbuch RGZM* 48: 103-159.
- Weniger, G. C. (1982).** *Wildbeuter und ihre Umwelt, ein Beitrag zum Magdalénien Südwestdeutschlands aus ökologischer und ethno-archäologischer Sicht.* Archaeologica Venatoria, Tübingen.
- Weniger, G. C. (1987).** Der kantabrische Harpumentyp. Überlegungen zur Morphologie und Klassifikation einer magdalénienzeitlichen Widerhakenspitze. *Madridrer Mitteilungen* 28: 1-43.
- Wild, M., Pfeifer, S., Lund, M., Paulsen, H., Weber, M. J., Henneken, H., Funke, C., Velispahic, E. & Lettenmayer, R. (2018).** Composite projectiles in the Hamburgian facies of the Final Magdalenian – technological, experimental and macro-wear study of their flint, antler, and adhesive components. *Archäologisches Korrespondenzblatt* 48: 7-2.