The content is published under Creative Commons Attribution 4.0 International license (CC BY 4.0).

Reviewed Article:

Roe Deer as Raw Material for Middle Mesolithic Fishhooks? An Experimental Approach to the Manufacture of Small Bone Fishhooks

Persistent Identifier: https://exarc.net/ark:/88735/10526

EXARC Journal Issue 2020/3 | **Publication Date:** 2020-08-21

Author(s): Anja Mansrud [1] ✉, Morten Kutschera [2]

[1] Museum of Archaeology, University of Stavanger, Universitetet i Stavanger, 4036 Stavanger, Norway.

[2] Agder fylkeskommune, Tordenskjolds gate 65 4614 Kristiansand, Norway.

Bone fishhooks have occasionally been retrieved from bone assemblages at coastal sites dating to the Middle Mesolithic phase (8300-6300 cal. BC) in Southern Norway and Western Sweden (the north-eastern Skagerrak region, Figure 1). Several studies of fishhooks from these sites have been undertaken in recent years (Jonsson, 1996; Mansrud, 2017; Mansrud and Persson, 2017). Fishhooks can be manufactured from different osseous materials, including antler, ribs and shafts of different long bones of large ruminants (Bergsvik and David, 2015, p.208; Clausen, 2018; David, 1999, p.123). It has been assumed that species within the deer family (Cervidae) provided the raw material for the fishhooks in the north-eastern Skagerrak region. However, most of the bone assemblages are not well preserved. The animal bones and the fishhooks were heavily fragmented, often burnt and/or weathered (See Figures 2, 3). Thus, in many cases it was difficult to ascertain which osseous raw material was utilized, how the hooks were manufactured, and which skills were needed. Burnt fishhooks are neither suited for raw-material identification by ZooMS (Buckley, et al., 2009). Hence, in this paper, experimental replication was considered as a viable method to acquire novel information of fishhook manufacture and from which species and bone element they were made from.

> “...the unique qualities of the long-term history and its materiality that archaeology deals with, must be the focal point for archaeological research since it in fundamental aspects may contribute to understanding of how culture works” (Knutsson, 2009, p.150)

Introduction

Several researchers have demonstrated the usefulness of technological studies set within the *chaîne opératoire* (CO) framework for analysing Mesolithic bone industries. Different technical procedures generate specific types of production debris. Bone debitage, in combination with experimental replication, facilitate the identification of the different steps of the manufacture process, or *chaîne opératoires* and distinguish between different production concepts which are prerequisites for archaeological interpretations (David, 1999; 2007). The ultimate goals of CO-analysis are to explore the implications of technology for the social organization and reproduction of crafts in prehistoric societies. By employing the CO-approach systematically, we gain insight into the technical practice conducted at the site level. From this, we can gradually build knowledge of the regional and chronological distribution of raw materials and techniques (Bergsvik and David, 2015).

Bone debitage has been essential for identifying fishhook-manufacture and other forms of bone-tool production in archaeological assemblages from various geographical regions. The properties of bone as well as their morphological shape, size and thickness guides the transformation of a bone element into artefact (David, 2007, p.39). Bone fishhooks have previously been replicated from metapodials of red deer (*Cervus elaphus*) and elk (*Alces*

alces) (Bakkevig, 2003; Mansrud 2017; Clausen, 2018). The majority of hooks in the NE Skagerrak region are however small (c.3cm long). Taking the size of the fishhooks as our point of departure, we decided to conduct an experiment using a bone element that corresponded with the size of the hook; the metapodials of roe deer (*Capreolus capreolus*).

Preliminary results from experiments with the manufacture of bone fishhooks made from roe deer metapodials will be presented and discussed in this paper. The main objectives of the experiments were to (i) attain hands-on understanding of the properties of roe-deer bones and the production process, (ii) to test whether it was possible to manufacture small fishhooks from roe deer metapodials using Middle Mesolithic lithic tools, and (iii) to achieve knowledge of the time and skills needed for the task.

Fishhooks of the NE-Skagerrak area: types and manufacture technique

The Middle Mesolithic fishhooks vary slightly in size, but are overall considered small, measuring approximately 3 cm long on average (See Figures 3, 4). The hooks were barbless and often have several small notches at the shaft, presumably for fastening the line. As shown on Figure 3, few hooks were complete. Most of the hooks were fragmented, consisting either of the shaft or the bend. Most of the hooks from sites in south-eastern Norway were also burnt (Mansrud, 2017; Mansrud and Persson, 2017).

A large number of similar but better-preserved fishhooks, dated within the same period, have been retrieved from well preserved osteoarchaeological assemblages excavated from caves and rock shelters in Western Norway (Bergsvik and David, 2015; Bergsvik, 2016). These hooks have a rounded bend, a pointed shank with notches on the external side and a pointed, barbless tip. They were often asymmetrical in form – the tip measured approximately half the length of the shank. The length of the shank was commonly 1-3 cm, but individual hooks measured up to 6-7 cm (Lund, 1951, p.27). The barbless fishhook is sometimes referred to as the "Viste-type", named after a find from the Viste cave in Rogaland (Brøgger, 1908, p.546).

How were these tiny hooks manufactured?

Recent investigations based on the CO-approach have identified several different manufacture techniques for Mesolithic fishhooks in Scandinavia. These differences involved the whole process from blank production to finished hook (David, 1999; 2017a; Bergsvik and David, 2015; Clausen, 2018). In this paper we focused on the manufacture of the hooks.

Bergsvik and David (2015) suggest that the fishhook-manufacture of Viste-hooks in Western Norway involved a combination of fracturing and abrasive techniques, which leaves little debitage to be studied. The reconstructed CO suggests a method for serial manufacture of four hooks. The first step consists in drilling four holes symmetrically in the bone blank. Two holes opposite each-other were widened, and the inner part of the hooks shaped by scraping,

to make two fishhooks. The bone blanks were then segmented by sawing the tip and shank cut off, and the finished hook polished. It has been further suggested that the notches were made by sawing with a “plate knife made of schist (Bergsvik and David, 2015, pp.207-208). Traces of the drilling were identified on some of the Viste-hooks, by the use of a stereomicroscope. In most cases, these traces were removed during the final polishing (Bergsvik and David, 2015, p.199). Experimental replication of this CO has so far been unpublished.

The Viste-hooks have been replicated on several occasions by Kutschera (See Figures 6, 7, 8) using a different technique than the one suggested above (Mansrud, 2017). Metapodials from different species of deer were utilized. These bones have an anatomy suited for making a range of different bone tools (David, 2007, p.37). The metapodial in the foreleg is termed metacarpal and the metapodial in the hind leg is the metatarsal (See Figure 7). The metatarsal may be longer than the metacarpal in cervids. When the epiphyses are fused and the long bone fully grown, the metacarpal is D-shaped at the proximal aspect along the shaft to the distal end whereas the metatarsal is somewhat rounded proximally and along the shaft.

The first step in making a fishhook consisted of boring (by hand) or drilling (by bow drill) a hole through one end of the blank. Thereafter, two longitudinal and divergent grooves were incised towards the hole, to shape the inner curve of the hook. The removed bone resulted in a triangular piece of debitage (Jonsson, 1996, p.41; Mansrud and Persson, 2017, p.146, fig 5). In some cases, the hole remained visible at the bend of the hook, occasionally in tandem with a small barb-like protuberance on the inner side of the tip (as shown on the hook depicted in Figure 4). In most cases, the hole has subsequently been removed by later grinding and polishing, to make a U-shaped hook with a rounded bend (See Figures 5 and 3, upper left). Replication of Viste-fishhooks was made by Bakkevig (2003) using elk metapodials. Bakkevig suggested a yet another CO in which the whole hook, including the notches, was completed while still attached to the bone.

Based on fishhooks and debitage from early Mesolithic Maglemose sites (dated between c. 8200-6000 cal. BC) in Zealand, Denmark, a third CO has been documented (Clausen, 2018, pp.6-13). In the initial stage the bone blank was punctured and left with a perforation at the end. From the perforation, a furrow was opened by using longitudinal grooving. This permits the placing of the shank. Thereafter the groove was widened by inner scraping to shape the inner part of the bend. Finally, the fishhook was detached from the blank at one end with a prepared flexion break, through the sawing of two grooves from opposing sides of the blank. While at the other end the shank is cut. The experiments undertaken by Clausen shows that the procedure of inner longitudinal grooving and scraping was a very time-consuming procedure. Still, this technique has been constantly applied for approximately 1900 years. This suggests that Middle Mesolithic crafters in this region were following a strict operational

schema and a tradition which was culturally, rather than functionally, prescribed (Clausen, 2018, p.13).

Availability of roe deer during the Middle Mesolithic period

The Middle Mesolithic sites with fishhooks in the NE-Skagerrak area were dated between 8300 and 6300 cal. BC. This corresponds to the Boreal (c. 8400-6700 cal. BC) and the first part of the Atlantic climate phase (6700-3900 cal. BC). During this time span, several ungulate species were accessible to the coastal groups in the area (See Table 1).

Red deer were the most common deer species identified in the faunal assemblages (See Table 1). Elk and red deer appeared in natural and anthropogenic bone assemblages already by the Preboreal (9500-8400 cal. BC) (Grøndahl, et al., 2010; Jonsson, 1995, p.150). In eastern Norway, the oldest finds of roe-deer are dated to c. 6300 cal. BC (Table 1, see also Hufthammer and Aaris-Sørensen, 1998). Roe deer have, however, been identified amongst the faunal remains from the Almeö site, which dated to the Preboreal (Mansrud and Persson, 2017, p.136), as well as from the Preboreal/early Boreal transition (c. 8000-7600 cal. BC) at Huseby Klev (Boethius, 2017, p.6; Jonsson, 2005). In Southern Scandinavia, roe deer was a common species throughout the Boreal and the Atlantic chronozone, appearing on inland as well as on coastal sites (Boethius, 2016, pp.160-162). The roe deer prefers mixed woodlands but can adjust to a variety of habitats. They are tolerant of climatic extremes, from hot and dry Mediterranean habitats to the cold boreal forests with deep snow (Sommer, et al., 2009; Tufto, et al., 1996). The lack of roe-deer in the faunal assemblages in South-Eastern Norway before the Atlantic climate optimum is therefore surprising. Since roe deer was targeted by coastal groups in Western Sweden, we find it probable that roe-deer was also present in South-Eastern Norway during the Boreal, but this is unproven by zooarchaeological assemblages. Overall, the number bones identified as roe deer in the faunal remains were very low. The low number of fragments from the cervids in general is possibly also related to the fact that these bone elements were heavily utilized for raw material for making of tools. Zooarchaeological reports rarely take into account the intense human utilization of cervid bone and antler during the Mesolithic, which have been demonstrated by current research into bone-technologies (David, 2017b; Elliott, 2012; Gummeson, 2018).

Site	Fishhooks	Ungulate species	Date cal. BC	Reference
Balltorp	Fishhook-debitage	Red deer, roe deer	8300-6400	Jonsson 1996
Huseby Klev, Sandarna phase	41 complete and fragmented fishhooks	Red deer, roe deer	8300-6900	Nordqvist 2005, Mansrud and Persson 2018

Bua Västergård	Fishhook-debitage	Possibly elk, red deer, roe deer	7900-6200	Wigforss et al. 1983
Prestemoen 1	11 fragments of fishhooks, fishhook debris	Red deer	7600-7300	Persson 2014; Mansrud and Persson 2018; Mansrud 2017:table 1
Skutvikåsen 3	1 fragmented fishhook, fishhook debris		7500-7000	Ekstrand 2013; Mansrud 2014, Mansrud 2017:table 1
Dammen	1 complete, 11 fragmented fishhooks, fishhook-debitage	Red deer, roe deer	7500-7000	Åhrberg 2007, Mansrud and Persson 2018
Søndre Vardal 3	Shaft of fishhook		7200-6800	Mansrud and Persson 2017; Mansrud 2017:table 1
Tørkop	Fishhook debris	Elk	7200-6600	Mansrud and Person 2017; Mansrud 2017:table 1; Hufthammer 1999
Vinterbro 3	Bend of fishhook		6300	Jaksland 2001, Mansrud 2017:table 1
Saugbruksforeningen 3	Fishhook debris (?)	Red deer (?), roe deer	6300	Melvold 2006: table 8, Hufthammer 1992

TABLE 1. MIDDLE MESOLITHIC SITES IN THE NE-SKAGERRAK AREA WITH FISHHOOKS, FISHHOOK-DEBITAGE, AND TYPE OF DEER SPECIES IDENTIFIED.

Experimental replication with roe deer metapodials

For the experiment, two metacarpals and two metatarsals of roe deer were utilized (See Figures 9, 10). The roe deer metapodials are considerably shorter and thinner than the metapodials of other deer species (See Figure 10a). One roe deer metapodial provided material for four blanks, which were then worked into fishhooks. The metapodial bones had been stored dry and were initially soaked in water for about five minutes in order to make the bone softer and easier to pierce. The first step in the manufacture sequence was the removal of the articular ends. The distal articular end was first removed. This was achieved by transversal sawing around the circumference of the bone, using a large flint blade (See Figure 9b) and followed by a flexion break through the use of a stone hammer. This initial procedure resulted in a characteristic piece of debitage: an articular end with transversal grooves and a small piece of bone still attached (See Figure 9b). The proximal epiphysis was then removed in the same way. If a younger individual with an unfused proximal epiphysis had been used, the splitting of the bone could have been performed without the initial removal of the proximal articular end.

Secondly, the metapodial was split in two, to make two rough outs for blanks (See Figure 9c). To split the bone, a deep groove was made on each side of the metapodial, following the natural longitudal groove on the diaphysis (*sulkus dorsalis*). Flint implements were then selected from a varied assemblage of blades, bladelets and microblades. The groove was incised using the corners of small, regular (intentionally or accidentally broken) bladelets, and during this procedure the bone was regularly soaked in water for 15-30 seconds. The splitting was performed by placing a sturdy blade of flint as a wedge at the top of the proximal end and hitting it gently with a stone hammer. During this stage of the production process, the roe deer metapodial tended to break or splinter inwards, rather than following the natural groove (See Figure 9d). The initial grooving, removal of articular ends and splitting of the bone into blanks took about 30 minutes.

The third step was to remove the excess bone on inside of the split metapodial, to make the blank pre-forms. We tried different ways to do this: twisting the excess bone out with a flint knife, removing it by a hard hammer blow, and by using a piece of flint as a wedge. However, as the roe deer metatarsus is thinner and much more fragile than bones of larger cervids, the bone tends to break or splinter. Thus, we found that the simplest way to proceed without breaking the bone, was by careful scraping/whittling with a flint blade, and then by grinding. A large grinding slab made from sandstone was used for this purpose (See Figure 9b-f). Water was mixed with crushed flint into powder on top of the slab to augment the grinding effect. The grinding method eventually formed the bone into an oval blank with a slightly U-shaped ventral side, formed by the medullar cavity. The medullar cavity was sometimes visible on the inner part of the bend of the archaeological fishhooks (See Figure 3, upper left).

The fourth step was the manufacture of the hook itself. The shape of the hook was etched on to the blank. Initially a hole was drilled. The hole will eventually become the base of the inner part of the hook. The hole was drilled by using a flint drill bit. A morphologically shaped/retouched drill bit (borer) turned out to be best suited for this purpose, but a naturally shaped pointed blade also worked well. The blade eventually is shaped into the drill bit. The hole may be placed symmetrically in the middle or a little bit to one side. An asymmetrical placement of the hole makes it easier to cut out the shank. When the hole was placed, the shape of the hook was carved out. We found it more convenient to make the hole and groove out the V-formed piece first, and then shape the outer part of the bend into desired form by grinding it on the slab (See Figure 9e). This part of the production stage was very time-consuming, but it had an advantage in that the bend may be shaped into the desired thickness and shape. The bend was identified as a weak point, and often broke during manufacture (See Figure 10e). Such fragmented hooks were also observed within the archaeological assemblages. Presumably, this inherent weakness was the main reason why the bend of the Mesolithic hooks was usually rather broad (See Figure 3).

Finally, the inner part of the hook was carved out by the use of a small, sharp bladelet or microblade. This last stage of the process was very time-consuming, and the bladelet had to be renewed often, as it gets blunt. New, sharp bladelets were regularly made by placing the blade on the edge of the grinding slab and snapping the worn section with a blow. This constant renewal of the working edge resulted in many small sections of bladelets and microblades.

As noted, removal of the inner part of the hook resulted in a triangular piece of debitage with grooved sides. Also observed were perpendicular traces of grooving in the distal end and traces of a controlled flexion break in the proximal end (See Figure 9f, and Figure 10f, Figure 11). Similar pieces of debitage have been distinguished in the well-preserved archaeological assemblages such as Dammen (See Figure 11). Based on analogy, similar pieces have also been recognized among burnt bone fragments at other sites (Mansrud, 2017), thus supporting a conclusion that fishhook manufacture was undertaken at the sites.

With no articular ends preserved, determination of which species and which bone element was used for making the Middle Mesolithic hooks remains challenging. The morphological characteristics and morphometric differences as well as the thickness of the bone cortex makes it relatively easy to distinguish between different species of cervids when the bones are well-preserved. Conversely, when the faunal remains were fragmented, worked and/or worn, or burnt, as is the case with most archaeological assemblages in the NE-Skagerrak area (See Figure 2), species and element identification remain largely impossible. The size and thickness of the metapodial walls may give an indication, however size and thickness are affected by age as well as size dimporhism between males and females. Resolving this issue would require a large comparative study of cervid metapodials of different ages and sexes.

Results, discussion, and implications for future research

The experimental replications presented here have added some new “flesh on the bone” in the study of Mesolithic fishhook manufacture. We have shown that small fishhooks could have been made from roe deer metapodials, but these bone elements are rather fragile and were inclined to break and splinter throughout several stages of the manufacture process: during the initial splitting, when the removal of excess bone took place, and during the final stages of manufacture. At this point, it is difficult to determine whether this fragility is inherent to roe-deer bones or mainly caused by the fact that bones used in our experiments were dry. For further exploration of these issues, more experiments utilizing fresh bone is required. Well-preserved assemblages in Northern and Southern Scandinavia roe deer body parts were less frequently utilized compared to red deer and elk during the Boreal period (David, 1999, pp.123-124; David, 2007, p.37; Leduc, 2012, p.75; David and Sørensen, 2016). From this it can be concluded that in terms of properties, roe deer metapodials may not be the preeminent osseous material for bone manufacture.

Since one of the present authors have extensive experience with bone tool replication and the other was a beginner, the experiment provided some insight into the level of skill and know-how needed for crafting these bone implements. Small fishhooks made from roe-deer metapodials were challenging to accomplish for a novice. As shown on Figure 10g, the fishhooks made by the experienced crafter resemble the archaeological fishhooks, whereas the ones made by the novice were more diverse, and many of them broke during manufacturing. The lack of experience presumably also contributed to the high degree of breaking. Whether fishhooks were made by individuals with different levels of skill during the Middle Mesolithic is not possible to confirm based on the fragmented archaeological material presented in this study. Distinguishing between fishhooks broken during use and during production might be possible by combining traceological and morphometric analysis of the archaeological specimen in future studies (Olson, et al., 2008). Above all, the fishhooks were very time consuming to make. Even for the experienced practitioner, the production manufacture of each hook from blank production to a finished tool took 3-4 hours. If several small fishhooks were used in longline fishing, as previously suggested (Åhrberg, 2007) a considerable amount of time must have gone into producing them.

Experimental replication of osseous technology furthers experiential knowledge of the lithic tools and technologies that were used when the fishhooks were made, because these two technical systems were fundamentally entangled (David and Sørensen, 2016). As stressed by Bergsvik and David (2015), grinding and abrasion techniques characterized the fashioning of fishhooks at the examined sites in Western Norway. An informational experience from our experiment is the importance of the grinding slab. By means of the slab, several stages of the manufacture process were made with less effort. Larger grinding slabs appear in South-Eastern Norway alongside ground axes from c. 8000 BC and it is often assumed that these slabs were used for grinding axes (Eymundsson, et al., 2017). As shown here, grinding slabs were similarly functional for grinding and polishing bone. The utilization of these implements should be more thoroughly investigated by experiments. While performing this experiment we had no access to smaller grinding stones, i.e. 'plate knives' as were suggested by Bergsvik and David (2015, p.207) as a multi-purpose tool for manufacturing fishhooks in Western Norway. Hence it remains to be tested how such tools would have performed. The use of 'plate knives' has so far not been documented outside Norway and is suggested to represent a local adjustment (Bergsvik and David, 2015, p.215). The use of these tools is dated back to 7000 cal. BC in Western Norway. Similar items are termed 'sandstone knives' and appear in south-eastern Norway in the late Middle Mesolithic, around 7000 cal. BC (Reitan. 2016, pp.33-34). However, 'plate knives' never enter the Middle Mesolithic lithic repertoire in Western Sweden (Kindgren and Åhrberg, 1999; Nordqvist, 1999, p.242). This supports the conclusion that small bone fishhooks in this region of Skagerrak were manufactured with flint tools.

The experimental replications further shed light on the lithic implements that were used for manufacturing the blanks and the hooks. The lithic debitage which accumulated during the

manufacture of the hooks corresponded well with the sectioned bladelets of flint that commonly occur at the archaeological Middle Mesolithic sites in the NE-Skagerrak area (Nordqvist, 1999; Mansrud, 2013). These bladelets were associated with an overarching technological concept that were introduced to the NE-Skagerrak from Russia and the Baltic around 8300 cal. BC (Sørensen, et al., 2013). Bladelets could have functioned as lithic inserts in composite tools, but also were used for working bones at the coastal sites (Mansrud, 2013, p.245). As demonstrated here, unhafted bladelets and microblades were ideal working tools for fashioning small fishhooks. Systematic use-wear analysis on archaeological assemblages of bladelets to verify this interpretation is an important task for future research.

As initially stated, the CO-approach is a bottom-up approach, aiming to study technology from the microscale of singular sites and gradually build empirical knowledge of larger regional and inter-regional scales. The ultimate objective is however to explore the implications of technology for the social organization in prehistoric societies – and essentially contribute to understanding how culture works and reproduces, as pointed out by Kjel Knutsson (2009) in the introductory quote. Traditional technologies are guided by ideology – decision making, ecological knowledge, and transmission of knowledge are entwined in tool production and social traditions, values, and worldviews, are communicated and mediated through everyday craft production (Lemonnier, 2013). Fishhooks are first and foremost functional tools. Their design needs to be adjusted to the size and feeding habits of the fish and their manufacture is further governed by raw material properties. But as demonstrated in this paper, there were many ways to manufacture a bone fishhook and their manufacture is also guided by traditions; cultural conceptions and expectations (i.e. David, 2009). Different techniques have been employed and persistently reproduced by Mesolithic crafters in Scandinavia. These preliminary results indicated at least three regional traditions during the period 8300-6300 cal. BC: Western Norway, the NE Skagerrak area, and Zealand. As such, technology is a process mediating mind, society, and the material environment. If we accept that technical processes are also socially meaningful (Lemonnier, 2013), actualistic experimental replications provide a fruitful road for future exploration of the interface between individual and society, ideology and nature in the Mesolithic.

Acknowledgements

The authors wish to thank prof. emeritus Kjel Knutsson (University of Uppsala) and Dr. Helena Knutsson for their contributions to Scandinavian Mesolithic archaeology in general and for their friendship continued support and help.

Keywords fishing
bone
tools

Country Norway
Sweden

Bibliography

Åhrberg, E. S., 2007. Fishing for storage: Mesolithic short-term fishing for long term consumption. In: N. Milner, O.E. Craig and G.N. Bailey, eds. *Shell Middens in Atlantic Europe*. Oxford: Oxbow Books. pp.46-53.

Bakkevig, S., 2003. På fisketur med steinalderkroker. *Fra Haug og Heidni*, 1-2, pp.9-19.

Bergsvik, K. A., 2016. Fiske i eldre steinalder på Vestlandet. *Årbok for Universitetsmuseet i Bergen*, Universitetet i Bergen, pp.6-14.

Bergsvik, K. A. and David, E., 2015. Crafting Bone Tools in Mesolithic Norway: A Regional Eastern-Related Know-How. *European Journal of Archaeology*, 18(2), pp.190-221.

Boethius, A., 2016. Something rotten in Scandinavia: The world's earliest evidence of fermentation. *Journal of Archaeological Science*, 66, pp.169-180.

Boethius, A., 2017. Huseby klev and the quest for pioneer subsistence strategies: diversification of a maritime lifestyle. In: P. Persson, F. Riede, B. Skar, H.M. Breivik and L. Jonsson, eds. *The Early Settlement of Northern Europe: An Ecological Approach*. (Vol. 1). Sheffield: Equinox Publishing, LtD. pp: 99-128.

Brøgger, A.W., 1908. *Vistefundet, en ældre stenalders kjøkkenmødding fra Jæderen*. Stavanger: Stavanger Museum.

Buckley, M., Collins, M., Thomas-Oates., and Wilson, J.C., 2009. Species identification by analysis of bone collagen using matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry. *Rapid Communications in Mass Spectrometry*, 23, pp.3843-3854.

Clausen, S.C., 2018. Reconstructing Maglemose bone fishhooks – a craftsmanship from Zealand. *Danish Journal of Archaeology*, pp.1-17. < https://doi.org/10.1080/21662282.2018.1551982 >

David, É., 1999. *Technologie osseuse des derniers chasseurs préhistoriques en Europe du Nord (Xe-VIIIe millénaires avant J.-C.). Le Maglemosien et les technocomplexes du Mésolithique.* PhD.

David, É., 2007. Technology on bone and antler industries: A relevant methodology for characterizing early post-glacial societies (9th-8th millennium BC). In: C. Gates St-Pierre and R. B. Walker, eds. *Bones as tools: current methods and interpretations in worked bone studies.* BAR International Series 1622. Oxford: Archaeopress. pp.35-50.

David, É., 2009. Show Me How You Make Your Hunting Equipment and I Will Tell You Where You Come From: Technical Traditions, an Efficient Means to Characterize Cultural Identities. In: S. MacCartan, R. Schulting, G. Warren, and P. Woodman, eds. 2005. *Mesolithic Horizons. Papers presented at the seventh international conference on the Mesolithic in Europe*. Oxford and Oakville: Oxbow Books. pp.362-367

David, É., 2017a. No Maglemosian bone tools in Mesolithic Norway so far! In: M. Mărgărit & A. Boroneanț, eds. *From hunter-gatherers to farmers: Human adaptations at the end of the Pleistocene and the first part of the Holocene*. Târgovişte.

David, É. 2017b. Were prehistoric communities really free to choose how they wanted to realize things? The importance of debitage techniques for indicating the cultural origin of technical change. In: M. Sørensen and K.B. Pedersen, eds. *Problems in Palaeolithic and Mesolithic Research.* University of Copenhagen. pp.207-225.

David, É. and Sørensen, M., 2016. First insights into the identification of bone and antler tools used in the indirect percussion and pressure techniques during the early postglacial. *Quaternary International*, 423, pp.123-142.

Elliott, B., 2012. *Antlerworking Practices in Mesolithic Britain*. PhD. University of York.

Eymundsson, C., Fossum G., Koxvold L., Mansrud og A. and Mjærum A., 2017. A bifocal view on axe technology in the Oslofjord area, Norway, c. 9200-6350 cal. BC. In: K. Knutsson, H. Knutsson, J. Apel, and H. Glørstad, eds. *The Technology of Early Settlement in Northern Europe. Transmission of Knowledge and Culture*. Vol. 2. Sheffield: Equinox Publishing. pp.201-229.

Grøndahl, F. A., Hufthammer, A. K., Dahl, S.O., and Rosvold, J., 2010. A preboreal elk (*Alces* alces L., 1758) antler from south-eastern Norway. *Fauna Norvegica*, 30, pp. 9-12.

Gummeson, S., 2018. *Points on production. Taphonomic research on Mesolithic osseous assemblages in Sweden*. PhD. University of Stockholm.

Hufthammer, A. K., and Aaris-Sørensen, K., 1998. Late-and postglacial European roe deer. In R. Andersen, P. Duncan and J.D.C Linnell, eds. *European Roe Deer. The Biology of Success*. Scandinavian University Press AB. pp.47-70.

Jonsson, L., 1995. Vertebrate fauna during the Mesolithic on the Swedish west coast. In: A. Fischer, ed. *Man and Sea in the Mesolithic*. Oxford: Oxbow Monograph, 53, pp.147-160.

Jonsson, L., 1996. *Fauna och landskap i Göteborgstrakten under boreal tid. Djurbensfynden från den boreala kustboplatsen vid Balltorp, Mölndal kommun, Västergötland*. Kungsbacka: Riksantikvarieämbetet. Avdelningen för arkeologiska undersökningar, UV Väst.

Jonsson, L., 2005. Rapport över inledande osteologisk undersökning. In: *Huseby klev. En kustboplats med bevarat organiskt material från äldsta mesolitikum till järnålder.* Bohuslän, Morlanda socken, Huseby 2:4 och 3:13, RAÄ 89 och 485. Mölndal: Riksantikvarieämbetet. Avdelningen för arkeologiska undersökningar, pp.96-103.

Kindgren, H. and Åhrberg, E. S., 1999. From Sandarna to Lihult: Fredsjö's Enerklev Phase Revisited. In: J. Boaz, ed. *The Mesolithic of central Scandinavia*. Universitetets Oldsaksamlings Skrifter, 22, pp.217-235

Knutsson, K., 2009. Culture and long term history: the handle core tradition as a possible prehistoric institution and its materialized context. In: K. Darmark, M. Guinard, L. Sundström and P. Vogel, eds. *Svartkärret 1-3 Tre mellanmesolitiska lägerplatser i Närke*, pp.150-165. SAU Rapport 2009:5. Societas Archaeologica Upsaliensis, Uppsala.

Leduc, C., 2012. Ungulates exploitation for subsistence and raw material, during the Maglemose culture in Denmark: the example of Mullerup site (Sarauw's Island) in Sjælland. *Danish Journal of Archaeology*, 1(1), pp.62-81.

Lemonnier, P., 2013. *Mundane Objects. Materiality and non-verbal communication*. UCL Institute of Archaeology Critical Cultural Heritage Series 10, First paperback edition 2013. Walnut Creek, California.

Lund, H.E., 1951. *Fangstboplassen i Vistehulen på Viste, Randaberg, Nord-Jæren.* Undersøkelsene i 1939 og 1941, med bidrag av Magnus Degerbøl. Stavanger Museum, Stavanger.

Mansrud, A., 2013. En mikrolitt til besvær? Kronologi, typologi og kompositttredskaper i østnorsk mellommesolitikum. *Viking*, 76, pp.63-86.

Mansrud, A., 2017. Untangling social, ritual and cosmological aspects of fishhook manufacture in the Middle Mesolithic NE Skagerrak. *International Journal of Nautical Archaeology*, 46, pp.1-16.

Mansrud, A. and Persson, P., 2017. Waterworld: Environment, animal exploitation and fishhook-technology in the north eastern Skagerrak area during the Early and Middle Mesolithic (9500-6300 BC). In: P. Persson, F. Riede, F., B. Skar, H.M. Breivik and L. Jonsson, eds. *The Early Settlement of Northern Europe: An Ecological Approach*. Vol 1. Sheffield: Equinox Publishing. pp.129-165.

Nordqvist, B., 1999 The chronology of the Western Swedish Mesolithic and late Palaeolithic: Old answers in spite of new methods. In: J. Boaz, ed. *The Mesolithic of Central Scandinavia*. pp.203-216. Universitetets oldsaksamlings skrifter, Ny rekke, Nr. 22. Universitetets oldsaksamling, Oslo.

Olson, C., Limburg, K. and Söderblom, M. 2008. Stone Age fishhooks–how were they dimensioned? Morphology, strength test, and breakage pattern of Neolithic bone fishhooks from Ajvide, Gotland, Sweden. *Journal of archaeological science*, *35*(10), pp. 2813-2823.

Reitan, G., 2016. Mesolittisk kronologi i Sørøst-Norge – et forslag til justering. *Viking*, 79, pp.23-51.

Sommer, R. S., Fahlke, J. M., Schmölcke, U., Benecke, N. and Zachos, F. E., 2009. Quaternary history of the European roe deer Capreolus capreolus. *Mammal Review*, 39(1). pp.1-16.

Sørensen, M., Rankama, T., Kankaanpää, J., Knutsson., K, Knutsson., J., Melvold, S., Eriksen, B. V. and Glørstad, H., 2013. The first eastern migrations of people and knowledge into Scandinavia. Evidence from studies of Mesolithic technology, 9th-8th millenium BC, *Norwegian Archaeological Review*, 46 (1). pp.19-56.

Tufto, J., Andersen, R. and J. Linnell., 1996. Habitat use and ecological correlates of home range size in a small cervid: the roe deer. *Journal of Animal Ecology*, 65. pp.715–724.

Share This Page

Corresponding Author

Anja Mansrud
Museum of Archaeology
University of Stavanger
4036 Stavanger
Norway
E-mail Contact

Gallery Image

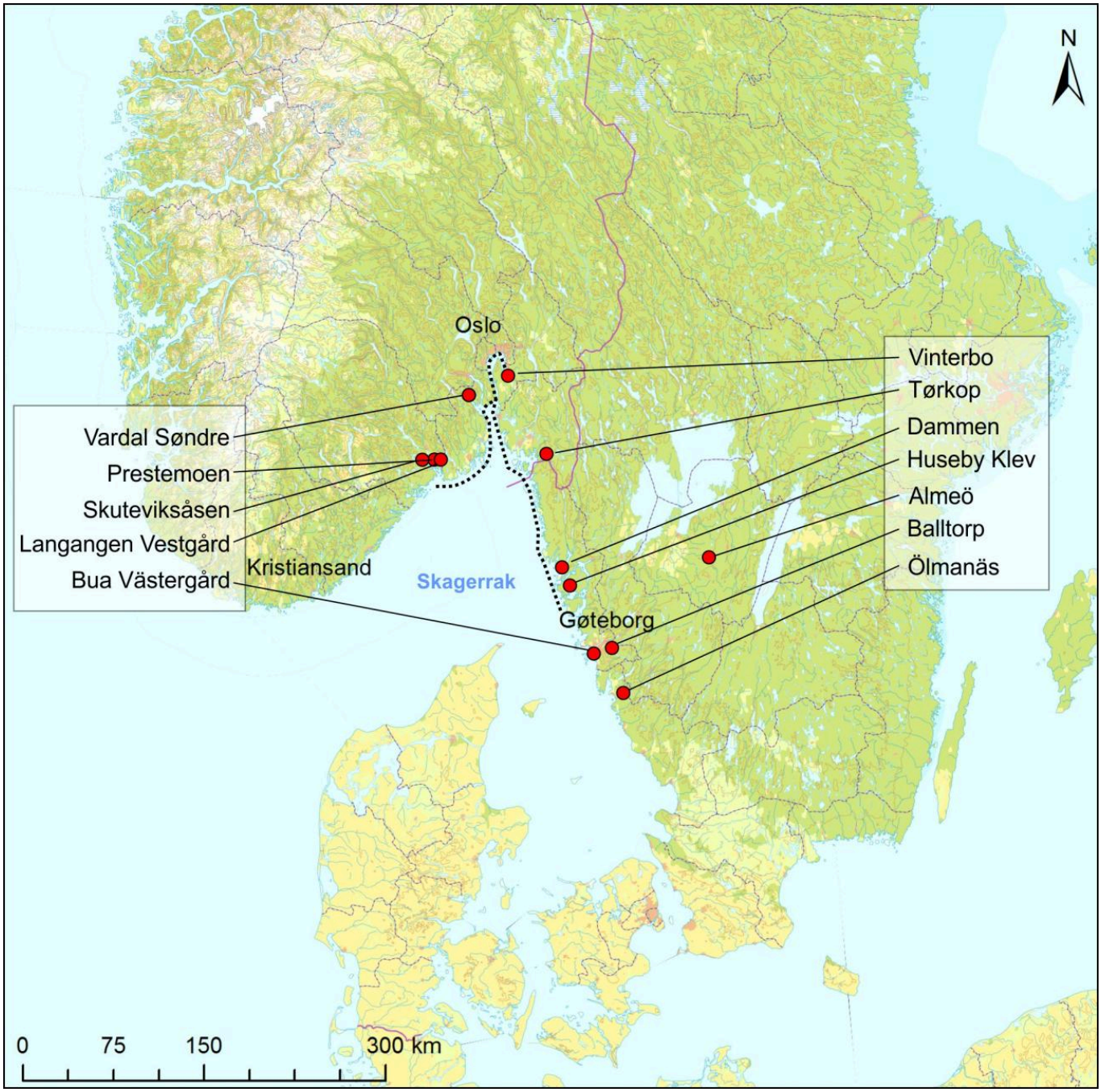

FIG 1. MAP OF MIDDLE MESOLITHIC COASTAL SITES (8300-6300 CAL. BC) WITH PRESERVED BONES IN SOUTH-EASTERN NORWAY AND WESTERN SWEDEN (THE NE-SKAGERRAK AREA). MAP: PER PERSSON/MUSEUM OF CULTURAL HISTORY/UIO

FIG 2. HEAVILY BURNT AND FRAGMENTED BONE FRAGMENTS FROM THE SITE PRESTEMOEN 1 IN SOUTH-EASTERN NORWAY. THE STATE OF PRESERVATION OF ANIMAL REMAINS AND BONE IMPLEMENTS OFTEN MAKES IT DIFFICULT TO ASCERTAIN WHICH SPECIES WAS UTILIZED, HOW THE FISHHOOKS WERE MANUFACTURED, AND WHICH SKILLS WERE NEEDED TO ACCOMPLISH THE TASK. PHOTO BY KIRSTEN HELGELAND/MUSEUM OF CULTURAL HISTORY/UIO

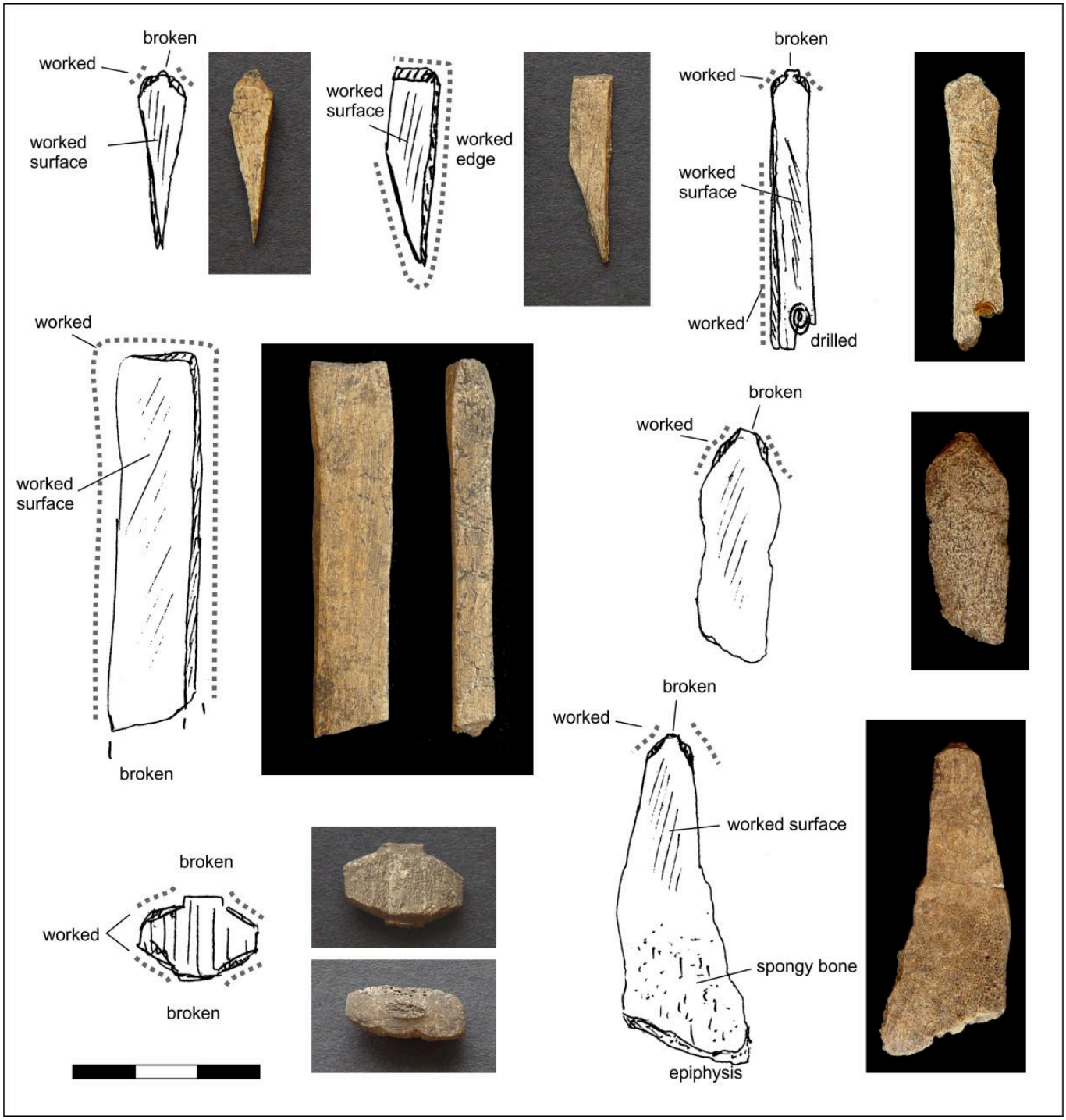

FIG 3. BONE DEBITAGE FROM FISHHOOK MANUFACTURE FROM THE MIDDLE MESOLITHIC SITE DAMMEN IN BOHUSLÄN, WESTERN SWEDEN. PHOTO BY ANDERS ANDERSSON. ORIGINAL SKETCHES: ANJA MANSRUD. COMPOSED ILLUSTRATION: PER PERSSON

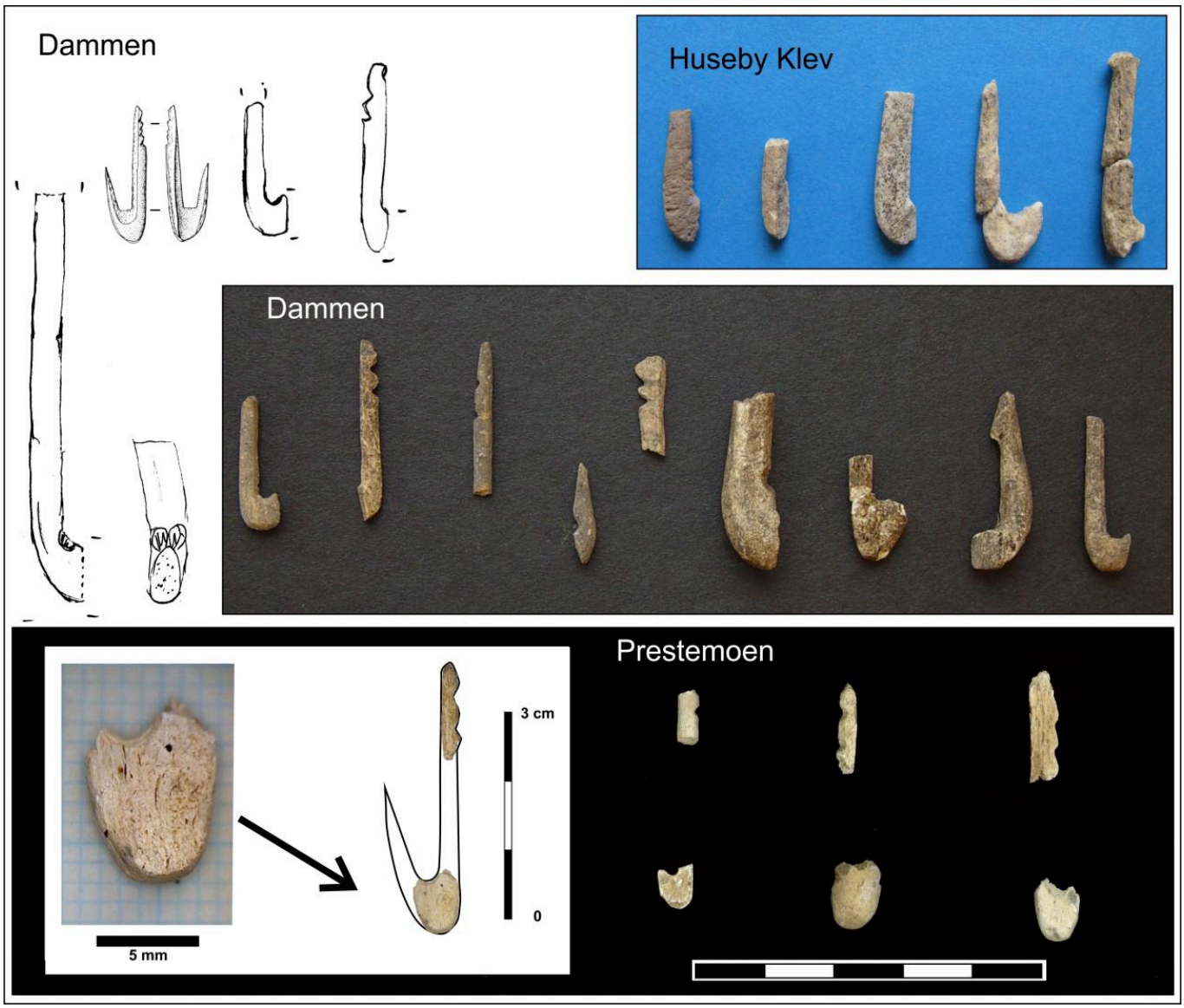

FIG 4. FRAGMENTS OF FISHHOOKS FROM MIDDLE MESOLITHIC SITES (8300-6300 CAL. BC) IN THE NE SKAGERRAK AREA. MOST OF THE HOOKS ARE FRAGMENTED BUT NOTE THE SIMILARITY BETWEEN THE COMPLETE FISHHOOK FROM DAMMEN (DRAWING, UPPER LEFT) AND THE VISTE-TYPE FISHHOOK. SEVERAL FRAGMENTS OF TIPS WITH NOTCHES HAVE ALSO BEEN FOUND. PHOTO BY ANJA MANSRUD (UPPER RIGHT), ANDERS ANDERSSON (MIDDLE), PER PERSSON (LOWER). ORIGINAL SKETCHES: ANJA MANSRUD. COMPOSED ILLUSTRATION: PER PERSSON

FIG 5. A VERY SMALL AND EXTREMELY WELL-PRESERVED BONE FISHHOOK IN THE HAND OF AN ARCHAEOLOGIST. THE HOOK WAS RETRIEVED FROM AN EXCAVATION IN SOLA AIRPORT, ROGALAND COUNTY. PHOTO BY TERJE TVEDT/ARCHAEOLOGICAL MUSEUM/UNIVERSITY OF STAVANGER

FIG 6. A SELECTION OF MIDDLE MESOLITHIC FISHHOOKS OF THE VISTE-TYPE REPLICATED BY M. KUTSCHERA. NOTE THE ROUNDED INNER PART OF THE HOOK, INDICATING IT WAS MADE FROM A LONG BONE RATHER THAN A RIB. PHOTO BY NICOLE BRODY

FIG 7. UPPER PHOTO: MORTEN KUTSCHERA DURING EXPERIMENTAL REPLICATIONS, ABOUT TO SKIN A RED DEER METAPODIAL WITH A FLINT BLADE. LOWER: NEWLY SKINNED RED DEER METAPODIALS, AND THE FLINT BLADES USED FOR THE SKINNING. MIDDLE: ANTERIOR VIEW OF THE SHORTER AND MORE ROUNDED METACARPALS FROM THE FRONT LEG. FAR LEFT: ANTERIOR VIEW OF THE LONGER METATARSAL FROM THE BACK LEG. FAR RIGHT: POSTERIOR VIEW OF THE METATARSAL. THE SINEWS RUN THROUGH THE CHANNEL ON THE POSTERIOR SIDE. HERE, THEY HAVE BEEN REMOVED FOR THE PURPOSE OF MAKING A FISHING LINE. PHOTO BY ANJA MANSRUD

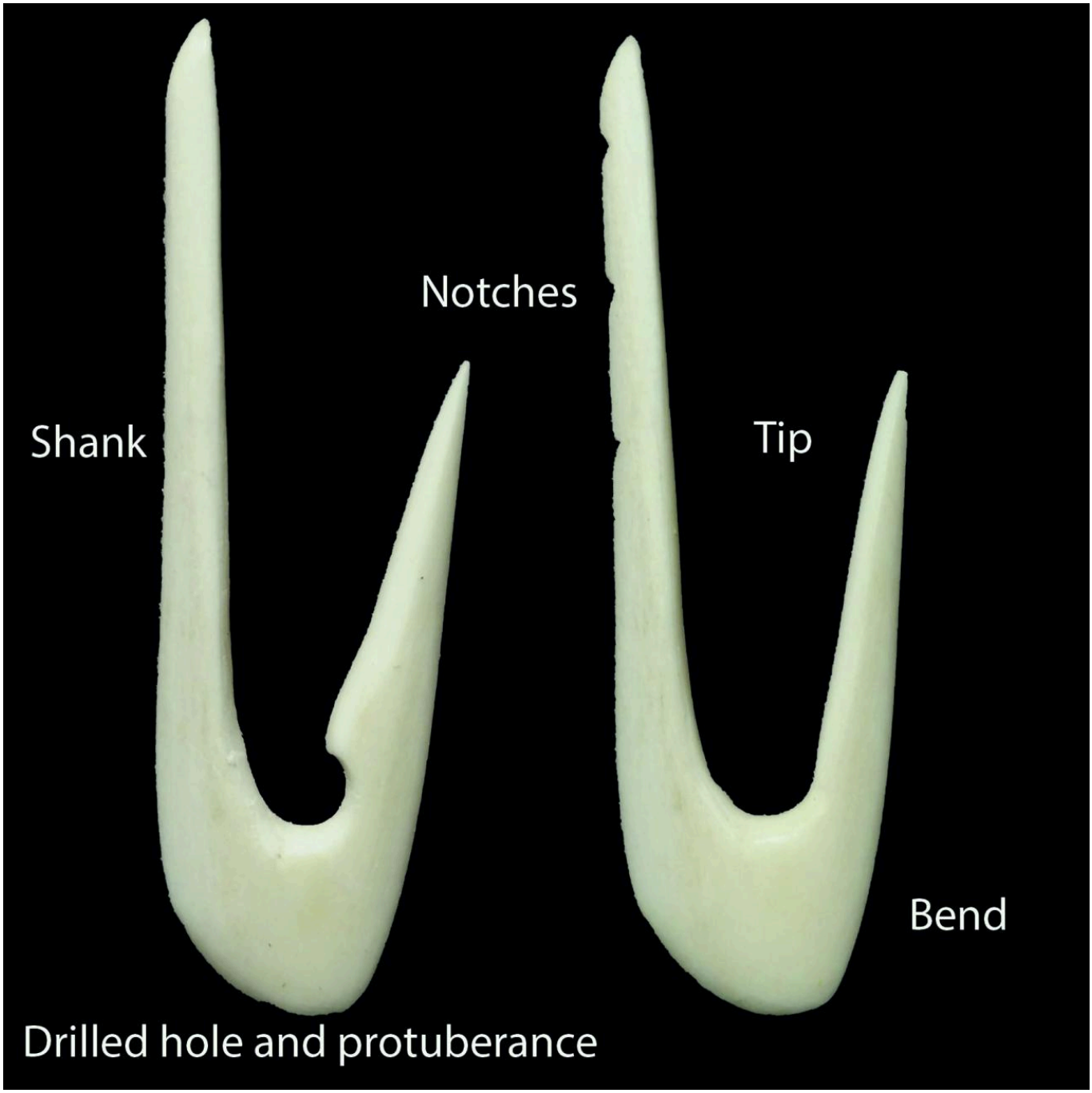

FIG 8. THE ANATOMY OF A MIDDLE MESOLITHIC BONE FISHHOOK OF THE 'VISTE-TYPE'. THE DEPICTED HOOK WAS EXPERIMENTALLY REPLICATED BY M. KUTSCHERA ON A YOUNG RED DEER METATARSAL. THE INNER PROTUBERANCE, OR "BARB" ON THE TIP AT THE LEFT SPECIMEN, IS NOT PURPOSELY MADE TO FUNCTION AS A BARB BUT STEMS FROM THE MANUFACTURE TECHNIQUE. IN MOST OF THE ARCHAEOLOGICAL HOOKS, THE TRACES FROM THIS MANUFACTURE STAGE HAVE BEEN REMOVED AS THE SURFACE OF THE HOOKS HAVE BEEN GROUND AND POLISHED, AS SEEN ON THE FINISHED SPECIMEN TO THE RIGHT. PHOTO BY ANJA MANSRUD

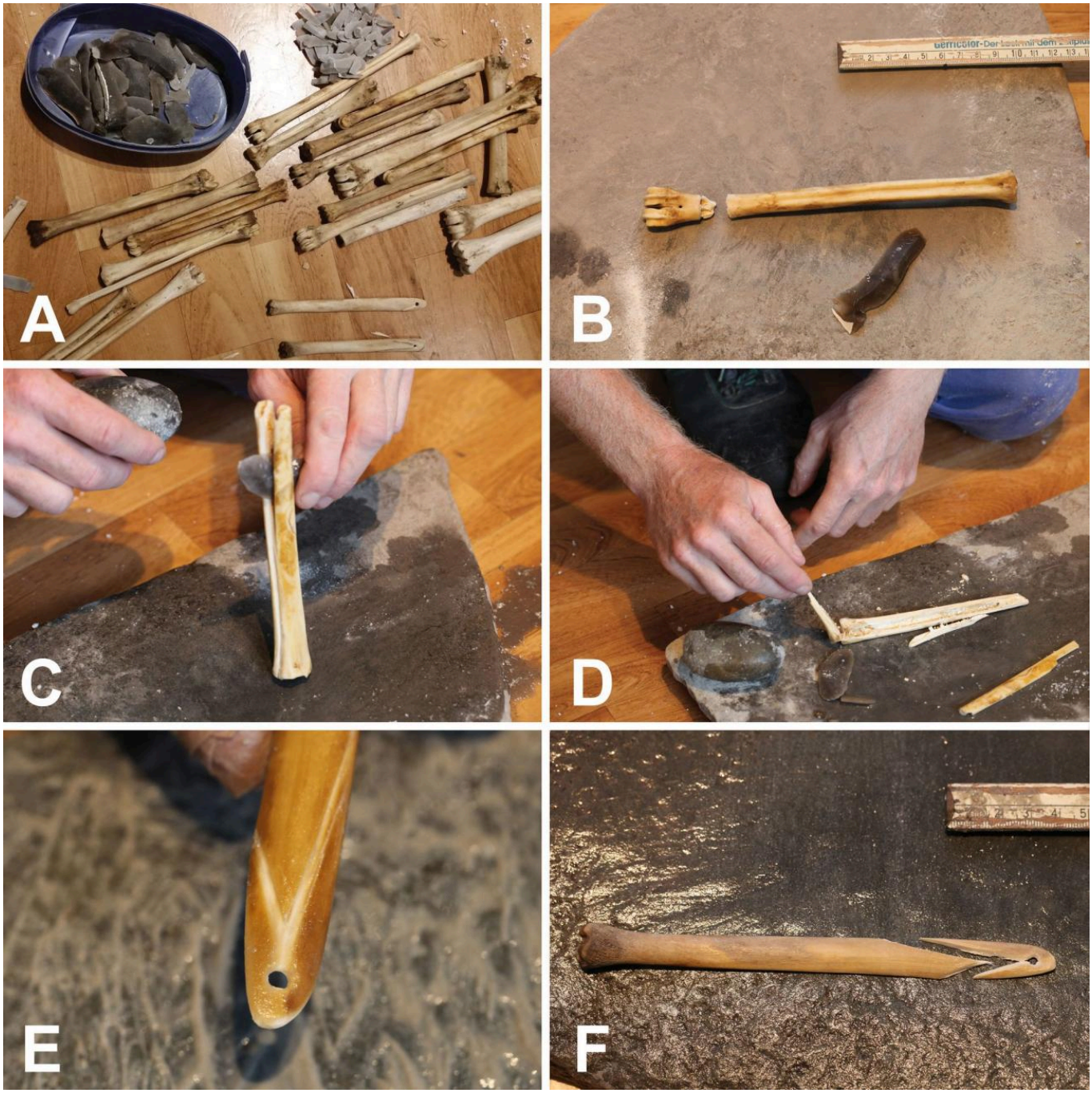

FIG 9. THE MANUFACTURE PROCEDURE FOR EXPERIMENTAL REPLICATION OF MIDDLE MESOLITHIC FISHHOOK USING ROE DEER METAPODIALS, DESCRIBED IN THE TEXT. PHOTO BY ANJA MANSRUD

FIG 10. FISHHOOKS AND DEBITAGE FROM THE EXPERIMENTS. A: RED DEER METAPODIAL, SPLINTERED USING THE GROVE- AND SPLINTER TECHNIQUE. B1: BLANK MADE FROM SPLINTERED ROE DEER METAPODIAL. NOTICE THE DIFFERENCE IN SIZE BETWEEN THESE TWO SPECIES/ELEMENTS. B2: ARTICULAR END B3: PROXIMAL ARTICULAR END, B4: FISHHOOK MADE FROM DISTAL PART OF THE BLANK BY EXPERIENCED BONE CRAFTER. C: ROE DEER METAPODIAL, BROKEN DURING MANUFACTURE, D: ROE DEER METAPODIAL BLANKS WITH FISHHOOKS REMOVED FROM THE DISTAL END. E: ROE DEER METAPODIAL WITH OUTLINE OF FISHHOOK ETCHED ONTO IT. F: MANUFACTURE DEBRIS. SPLINTERS REMOVED FROM ARTICULAR END OF THE DEER METAPODIA. F3: BONE SPLINTERS FROM ATTEMPTS FROM THE WEDGE-SPLINTER TECHNIQUE, STRUCK BY INDIRECT PERCUSSION, G: BROKEN AND POOR LOOKING FISHHOOKS MADE BY THE NOVICE. PHOTO BY ANJA MANSRUD

FIG 11. TRIANGULAR BONE DEBITAGE FROM THE DAMMEN SITE IN WESTERN SWEDEN. BOTH PIECES HAVE TRACES OF GROOVING IN THE DISTAL END AND TRACES OF A CONTROLLED FLEXION BREAK IN THE PROXIMAL END, STEMMING FROM THE REMOVAL OF THE INNER PART OF THE FISHHOOK. THE THICK-WALLED PIECE OF TUBULAR BONE TO THE LEFT IS PRESUMABLY FROM RED DEER, THE THINNER TO THE RIGHT FROM ROE-DEER. PHOTO BY ANJA MANSRUD