3.8. A POINT OF VIEW

Some reflections on Early Mesolithic projectile technology in Southeast Norway

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INTRODUCTION

The E18 Tvedestrand–Arendal project investigated twelve sites dominated by find material belonging to the Early Mesolithic. A common denominator for ten of the sites is the presence of lithic arrowheads. These come in a variety of forms, where the tanged and single-edged varieties have the most easily identifiable characteristics. Besides these, there are numerous finds of Høgnipen points, lanceolates and other kinds of microlithic forms, where a designation as arrowheads is more problematic. On one of the sites, Sagene B1, there was a rough spatial correlation between Høgnipen points and lanceolate microliths, which also covaried in a 1:1 relationship in one of the find areas. These observations indicated a functional relationship between these artefact categories.

In this article we wish to demonstrate an empirical, chronologically dependent, change in arrowhead design in Southeast Norway, during the period *c.* 9000–8300 cal. BC. We will also discuss possible reasons for this development. Hopefully, this study will serve to raise some questions and ideas that might prove fruitful avenues for future research on the material found during the project.

EARLY MESOLITHIC ARROWHEADS FROM THE E18 TVEDESTRAND–ARENDAL PROJECT

In this study, we have investigated all artefacts termed arrowheads from the Early Mesolithic sites investigated within the E18 Tvedestrand–Arendal project (for overview, see Reitan, chapter 2.1, this volume). From this group of objects, we have selected all arrowheads that give reliable length-width ratios, i.e. complete arrowheads. Such finds come from ten sites: *Kvastad A1* (Stokke *et al.*, chapter 2.2.5, this volume), *Kvastad A2* (Stokke & Reitan, chapter 2.5.5, this volume), *Kvastad A4* (Darmark *et al.*, chapter 2.2.6, this volume), *Kvastad A5-6* (Viken, chapter 2.2.7, this volume), *Kvastad A8* (Darmark 2017b), *Kvastad A9* (Darmark, chapter 2.2.4, this volume), *Sagene B1* (Viken, chapter 2.2.3, this volume), *Sagene B2* (Darmark, chapter 2.2.1, this volume), *Sagene B4* and *Sagene B6* (Darmark, chapter 2.2.2, this volume). The sites are located in Aust-Agder county in Southeast Norway, and situated at elevations between *c.* 55 and 47 m.a.s.l., which in the region roughly corresponds to shoreline datings to 9000–8300 cal. BC (*cf.* Romundset, chapter 3.2, this volume).

That the arrowheads are "complete" does not necessarily mean that they are in all cases unused. Certain specimens do indeed show distal or proximal damage that can be interpreted as deriving from use, such as bending and spin-off fractures (Bergman & Newcomer 1983; Fischer *et al.* 1984: 22–24; *cf.* Rots & Plisson 2014). The presence or character of damage has not been systematically described within the framework of this study, but a judgment has been made in each case as to whether the damage has rendered the arrowhead markedly smaller than it originally was.

The arrowheads amount to a total of 122 objects and are divided into four different categories: *tanged points, single-edged points*, *Høgnipen points* and *lanceolate microliths* (table 3.8.2).

Tanged points (fig. 3.8.1 a) are arrowheads produced from blades on which blunt retouch is applied to opposite sides in order to create a tang. The platform and percussion bulb, and sometimes even the distal end, of the blade are removed by *microburin technique* on Early Mesolithic specimens. The transition between tang and edge is marked by more or less pronounced shoulders. Tanged arrowheads might have retouched areas along the edge or at the tip, and the tip can be in the distal or in the proximal end of the blade (Ballin 1996: 49). A total of 36 finds are complete, tanged arrowheads and are included in the present analysis.

Single edged points (fig. 3.8.1 b) have two retouched sides. One side displays more or less continuous retouch from the basal area to the tip, while the opposite area is retouched in the basal area only, creating a tang. The short retouch is not to exceed 60 % of the length of the long retouch (Helskog *et al.* 1976: 25, Vang Petersen 1999: 77–78). Within this study, 31 finds are complete, single-edged arrowheads.

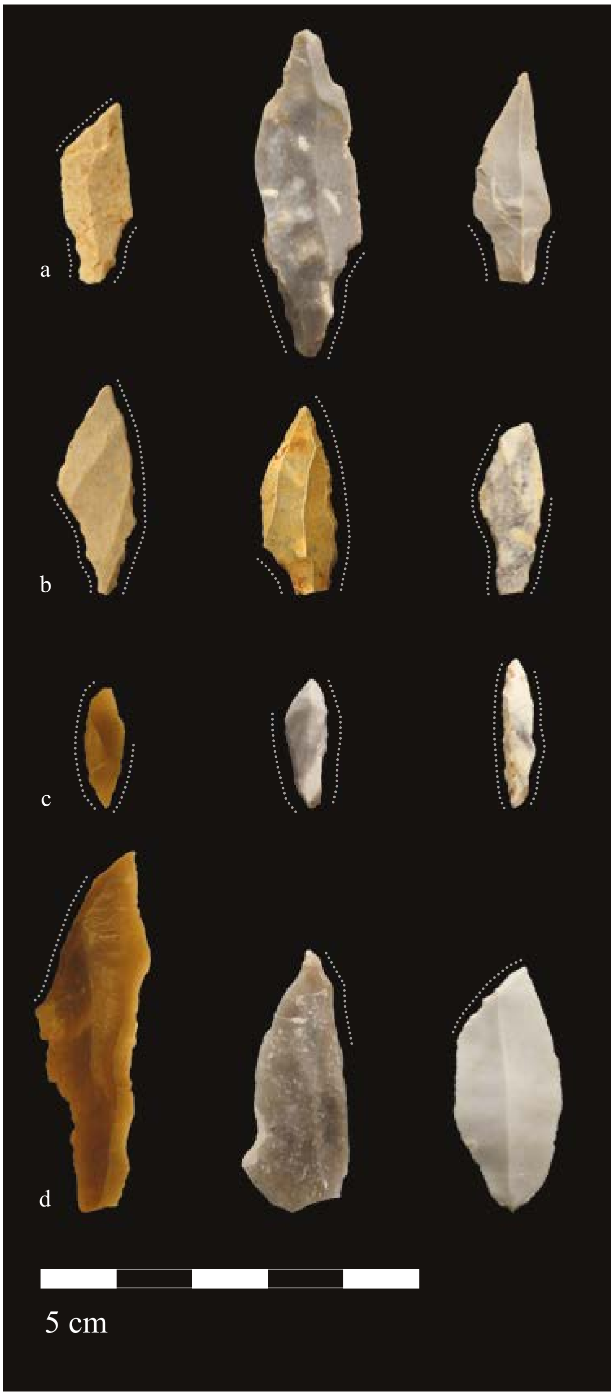

Figure 3.8.1: Examples of complete tanged points (a), single-edged points (b), Høgnipen points (c) and lanceolate microliths (d) found within the E18 Tvedestrand–Arendal project.

Høgnipen points (fig. 3.8.1 c) are a type of tool also referred to as "small points" or "drill-bits" (*cf.* Jaksland & Fossum 2014: 51, with references; Knutsson & Knutsson 2014), indicating a certain ambiguousness as to their function, and a tendency to confuse them with drills. However, the artefact type often lacks traces of being used in a rotating movement. Together with examples displaying characteristic microburin facets and damage usually connected to projectile points, this indicates that they were used as projectile points (Waraas 2001: 45). A use-wear analysis of 28 points from the *E18 Brunlanes project* in Larvik, Vestfold county, of which several were Høgnipen points, has shown that the majority have in fact been used as projectiles. However, there is also evidence of similar forms being used as drills (Knutsson & Knutsson 2014: 147–148), illustrating the difficulties involved in ascribing tool function based on typology. The artefact type is most often made on perpendicular blade segments using two-sided blunt retouch covering all or most of the length of the point. The tool can also be made from flakes (Fuglestvedt 2001: 79; Waraas 2001: 45). In this study we have isolated 26 finds as being complete Høgnipen points.

Lanceolate microliths (fig. 3.8.1 d) can occur in a variety of shapes, depending on degree and position of retouch (Helskog *et al.* 1976: 27). They are produced by severing blades (or flakes) from the platform and percussion bulb using microburin technique. (Helskog *et al.* 1976: 26; Jaksland 2001: 27–34). Most of the lanceolates included in this study have partial lateral retouch on one side only (*cf.* Helskog *et al.* 1976: fig 19a), and amount to a total of 29 finds.

Even though these categories are in general fairly distinct, there are instances where tanged points might have been called single-edged ones and *vice versa*. A similar relationship exists between single-edged points and Høgnipen points. A majority of the Høgnipen points in our study have parts of the edge left without retouch, making them resemble small single-edged points (fig. 3.8.1 c). The study of microlithic arrowheads (the focus of this study) is greatly facilitated by the fact that they are associated with fewer source critical problems than, for example, bifacial arrowheads. Unlike these, the Early Mesolithic arrowheads seem to have a shorter formative chain, in that they are not necessarily resharpened and reused in the way that bifacial arrowheads are (Flenniken & Raymond 1986). This means that there is little risk of, for example, a Høgnipen point being a reused tanged arrowhead. Thus we stipulate that the artefacts deemed as complete arrowheads within this study are indeed designed to have the morpohology they do, rather than this being a product of their use life. However, it has to be borne in mind, that there is a reason why complete, unused arrowheads are left behind at the sites. As suggested by Fischer *et al.* (1984: 42–43), this reason could well be that arrowheads are produced *en masse* and selected according to shaft compatibility. Thus, there can be a bias towards unsuitable points in the data set analyzed here.

Dating	Sites	Points (N)	Tanged (%)	Single-edged (%)	Høgnipen (%)	Lanceolates (%)
9000 BC	B2, B4	44	41 %	45 %	0 %	14 %
8900-8700 BC	B6, B1, A9	42	31 %	10 %	38 %	21 %
8600-8400 BC	A8, A1, A4, A2, A5-6	36	14 %	19 %	28 %	39 %

Table 3.8.2: Complete points found at Early Mesolithic sites within the E18 Tvedestrand–Arendal project, sorted according to type and shoreline displacement dating.

As table 3.8.2 demonstrates, there is a tendency for tanged and single-edged points to be more common in assemblages from assumed older sites, whereas Høgnipen points and lanceolate microliths are more common on the sites presumed to be younger.

Table 3.8.3 shows some basic statistics regarding the different types of points. Tanged points are on average larger than single-edged ones, which in turn are larger than Høgnipen points. This naturally holds true for all dimensions, since these are interrelated. The table also demonstrates that the arrowheads presumed to have functioned as tips can be very small, regardless of type. This is in line with results from a study on Early Mesolithic arrowheads from Central Norway, where tanged arrowheads and microliths fall within a similar size range (Breivik & Callanan 2016: 584). The coefficient of variation (*standard deviation/average*) is slightly smaller for the length and width of the Høgnipen points in relation to the other point types, but most significantly smaller for weight. This is a sign of the Høgnipen points being more uniform than the other types of points.

There is no significant chronological size-related change within the different arrowhead categories.

A scatterplot of the length and width of all the points is a more visual way of presenting the data in table 3.8.3, and clearly reveals how the categories of points relate to each other regarding size (fig. 3.8.4). Tanged points and lanceolate microliths have the widest distribution, which overlap to a large degree, though with lanceolates tending to be longer than tanged points. The single-edged points have a more constrained distribution, but they still fall roughly within the same range as the tanged points. For these

	Length (cm)			
	Tanged (N=36)	Single-edged (N=31)	Høgnipen (N=26)	Lanceolates (N=29)
Min	1,3	1,1	1,3	1,6
Max	4,3	3,5	2,4	5,9
Average	2,5	2,1	1,7	3,1
Stdev	0,7	0,5	0,3	0,8

	Width (cm)			
	Tanged (N=36)	Single-edged (N=31)	Høgnipen (N=26)	Lanceolates (N=29)
Min	0,6	0,5	0,4	0,5
Max	1,6	1,2	0,6	1,6
Average	1	0,9	0,5	1,1
Stdev	0,3	0,2	0,1	0,3

	Weight (grams)			
	Tanged (N=36)	Single-edged (N=31)	Høgnipen (N=26)	Lanceolates (N=29)
Min	0,1	0,2	0,2	0,2
Max	2,3	2,5	0,8	3,1
Average	0,7	0,6	0,3	0,9
Stdev	0,5	0,4	0,1	0,6

Table 3.8.3: Descriptive data for complete tanged and single-edged arrowheads, Høgnipen points and lanceolate microliths within the E18 Tvedestrand–Arendal project.

types, length and width are strongly positively correlated, with tanged arrowheads having a correlation coefficient of $r = 0.65$, lanceolates $r = 0.7$ and single-edged $r = 0.81$ for these variables. The same is not true for the Høgnipen points, with $r = 0.07$. The Høgnipen points also cluster together, forming a distinct group in the lower part of the diagram, being significantly smaller than the other types of arrowheads.

DISCUSSION

Judging from the analyzed arrowheads from the E18 Tvedestrand-Arendal project sites, it seems that the centuries around *c.* 8800 cal. BC witness a transition from tanged and single-edged points towards Høgnipen points and lanceolate microliths. The transition seems to be gradual but archaeologically relatively rapid, and the projectile technology changes focus in a rather fundamental way over a window of *c.* 200 years. This development is simultaneously one of a general decrease in arrowhead tip size, since Høgnipen points are considerably smaller than tanged and single-edged variants.

A similar process has been observed earlier in neighbouring regions: Bang-Andersen (1990: 218–222) noticed an increase in microliths and a corresponding decrease in tanged points within the timeframe 8900–8250 cal. BC in Southwest Norway. His sites were situated approximately 250 km from the Kvastad/Sagene sites following the coast towards the west. He based his tentative conclusions on only two sites, and more recent investigations (albeit much further to the north, in Møre og Romsdal county) seem not to support a bias towards microliths until the very end of the Early Mesolithic (Åstveit 2014a: 92). However, a very comparable tendency has been pointed out by Jaksland & Fossum regarding the *Pauler* sites in Larvik, Vestfold county, approximately 100 km to the northeast of the region studied here. At the Pauler sites, single-edged points drop from 50 to 15 % over time, while Høgnipen points and lanceolates gradually become more common (Jaksland & Fossum 2014: 56–57). The

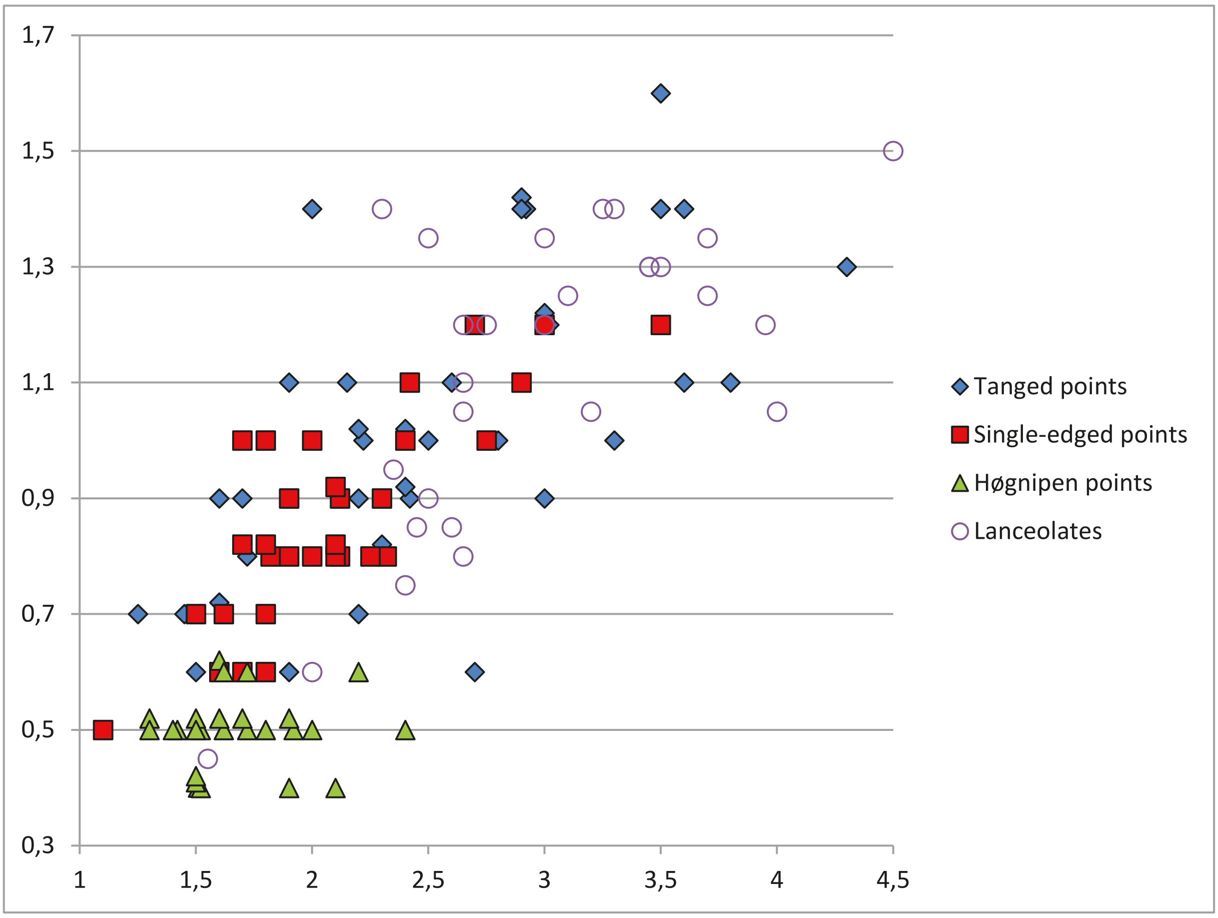

Figure 3.8.4: Scatterplot of length (x-axis) and maximum width (y-axis) of complete tanged, single-edged and Høgnipen points from the Early Mesolithic sites within the E18 Tvedestrand-Arendal project. One outlying (unusually large) lanceolate microlith is excluded from the diagram.

Pauler-sequence ranges from *c.* 9200–8900 cal. BC to 8850–8550 cal. BC (Jaksland 2014: 39–40), and the transition to a high dependency on Høgnipen-points and microliths seems to have been "completed" between 8950 and 8550 cal. BC. This process should be viewed as archaeologically simultaneous in these two regions. According to our results, the transition from tanged and single-edged points towards Høgnipen points and lanceolate microliths could therefore be narrowed down to 8900–8700 cal BC.

Other parallel developments exactly matching this are hard to find. The neighbouring contemporary Maglemose culture is characterized by a process of microlithization (Blankholm 1990; Riede 2008:186), which in its early phase is defined by simple oblique microliths and Zonhoven points (Sørensen & Sternke 2004: 109; *cf.* Johansen & Stapert 1998: 38–41). The Early Mesolithic of Northern Germany similarly displays a variety of microlith forms, where oblique truncation and triangular forms are prominent (Street *et al.* 2001: 420). The tanged and single-edged points present at the sites in this study do not seem to be part of the repertoire in these contemporaneous regions (Damlien 2016: 40), neither have Høgnipen points or similar forms been drawn attention to, with the possible exception of the later *mèche de foret*-borers (Street *et al.* 2001: 408; Gronenborn 2003: 48).

What could such a development in Southeast Norway represent? We would like to propose that it is a sign of a local trajectory towards a higher reliance on composite projectile point design. The composite tool tradition is believed to have originated as early as during the Upper Palaeolithic, with the insertion of microblades on osseous points, which takes advantage of the cutting capabilites of flint as well as the impact resistance of bone/antler (Pétillon *et al.* 2011). The presence of such lateral elements/barbs clearly enhances the shredding capabilities of the weapon, increasing bleeding, while it is also evident that some form of cutting tip is needed to penetrate thick skin (Gaillard *et al.* 2016; *cf.* Cattelain 1997: 229). The presence of lateral elements on projectiles significantly improves the penetrative capability of the point, although the lateral elements also seem to need frequent replacement (Pétillon *et al.* 2011), but this varies with the type of adhesive (Gaillard *et al.* 2016), birch bark pitch being a frequent choice (Aveling & Heron 1998; Pétillon *et al.* 2011).

The fact that composite arrows constitute an integral part of the later Mesolithic is evidenced by finds of complete arrows and arrowshafts. Due to preservation, such finds are unusual in Norway: two fragments of slotted bone points with V-shaped, 2.0–2.5 mm deep, bi-lateral grooves were unearthed at *Frebergsvik B* in Horten, Vestfold county, dated 6000–5000 cal. BC (Mikkelsen 1975b: 80–81; *cf.* Jaksland 2005: 31–32). Two small fragments of slotted bone points are also recorded from *Prestemoen 1* in Porsgrunn, both with unilateral grooves, dated *c.* 7800–7550 cal. BC (Persson 2014a: 218–220). These two, both open-air settlement sites, are the only known contexts in Southeast Norway where organic traces of Mesolithic composite arrows have been identified, but none of them have any remains of inserts or adhesive in the grooves. The material from western Norway is more comprehensive, with several finds of osseous points with both uni- and bilateral grooves from excavated rock shelter sites with more protected milieus, *i.a.* the *Viste cave* in Randaberg north of Stavanger, Rogaland county, dated *c.* 7000–6500 cal. BC (Egenæs Lund 1951; Bergsvik & David 2015, with references; see also e.g. Bøe 1934; *cf.* Gjessing 1945: 116–120). In recent years, a number of arrowshafts have been found in thawing snow patches and melting glaciers in mountain areas in southern Norway, but the oldest of these are Neolithic (Callanan 2013; Julian Post Martinsen, *pers. com.*). Better insight into shaft technology thus has to be sought for elsewhere. In Denmark a few examples of arrows, predominantly from the Late Mesolithic, are known. *Ertebølle arrows* are known from *Gamborg fjord*, *Vedbæk*, *Muldbjerg* and *Tybrind Vig*, while *Maglemose arrows* are known from *Lilla Loshult* and *Rönneholm* in Scania, southern Sweden, and from *Vinkelmose* and *Holmegård IV* in Denmark.

Two arrows (*c.* 8000 cal. BC) were found at Lilla Loshult. One of these is complete, 92 cm long, with two microliths fastened by the use of birch bark pitch. One microlith has been used as an arrowhead, and one as a lateral element. The arrowshaft measures between 5.5 and 9.5 mm in thickness, and thinnest towards the point. Another fragmented arrow and two microliths were also found (Junkmanns 2013: 121–122). An arrow from the Maglemose/early Kongemose site at Rönneholm has been dated to 7000–6800 cal. BC. This find is a 10.2 cm long and 0.9 cm wide fragment of a shaft with a V-shaped groove, into which four triangular microliths have been attached using resin. A fifth microlith found nearby, described as an intermediate between a triangle and a lanceolate, could, it has been proposed, have functioned as the arrow's tip (Larsson & Sjöström 2011a, 2011b).

At Vinkelmose (*c.* 8000–6500 cal. BC) a single, complete arrowshaft lacking arrowhead was found. The shaft was 10 mm at the thickest, but thinner towards both ends. Traces at the tip of the shaft suggest that the arrow was of the same type as at Lilla

Loshult (Junkmanns 2013: 136). At Holmegård IV (*c.* 8000–6500 cal. BC) two fragments of bows and fragments of at least four arrows (7–9 mm thick), were found. Along the front of the shaft, a slot for lateral elements, i.e. microliths, is visible (Junkmanns 2013: 123–136).

The Maglemose arrows described above are clearly separate from the earlier examples of arrowshafts from *Stellmoor* (10 700–9600 cal. BC) in northern Germany. At Stellmoor two bow fragments and at least 105 arrow shafts were found. These arrowshafts were made for single arrowheads of *Ahrensburgian type*, and the shafts were 5–10 mm thick (Junkmanns 2013: 109–113). A similarity between the oldest shafts from Stellmoor and the younger Maglemose arrowshafts is that they are slightly barrel-shaped: the shafts are thicker in the middle than towards the ends. This enhanced the penetrative effect of the arrow, since it decreased the friction between the arrow and the body tissue of the prey (Junkmanns 2013: 112). The design also serves to increase the *spine* of the shaft, i.e. the ability to withstand compression and wave oscillations (Hughes 1998: 360–361).

It thus seems that the use of tips and lateral elements (composite arrows) was quite common around 8000 BC. There is a gap of approximately 2000 years between the single-pointed arrows from Stellmoor and the arrows with tips and lateral elements from the Swedish and Danish sites. Exactly when composite arrows came into use in northern Europe and Scandinavia is therefore unclear, but it must have happened before 8000 BC. The possibility of identifying this development in the projectile technology of Mesolithic Southeast Norway should therefore be expected.

Further evidence pointing in this direction comes from the tendency towards an increased use of the very narrow Høgnipen points. The Late Palaeolithic and Early Mesolithic arrowshafts described above have diameters between 5 and 10 mm, but with 7–9 mm being most common (*cf.* Friis-Hansen 1990; Cattelain 1997). This range in shaft diameter is further evidenced by finds of shaft smootheners (Riede 2012). Experiments have shown that, if the arrowhead is narrower than the shaft to which it is attached, a "hilt effect" takes place. This causes the point to bounce from its target (Hughes 1998: 357–359; Pétillon *et al.* 2011), thereby dramatically lowering the efficiency of the weapon. Therefore it is hardly surprising that studies of both Late Glacial and ethnographically documented projectile points (Dev & Riede 2012), clearly demonstrate that the average width of arrowheads is slightly above 1 cm. This is also true for arrowheads produced within (considerably later) bifacial traditions (Shott 1997; Devaney 2005).

In light of this, many of the arrowheads encountered on the E18 Tvedestrand–Arendal sites are somewhat diminutive in size. Arrowheads with a width of 8 mm should be considered as extremely small, and the 5 mm width that is characteristic of the Høgnipen points is unparallelled. The Høgnipen points would not be practical without the aid of lateral elements. Shafts with a diameter of 7–9 mm would make most of the tanged and single-edged arrowheads from the sites at Kvastad and Sagene, suitable as tips (i.e. not resulting in a hilt effect). However, a large portion of the tanged and single-edged arrowheads in the analysed data set are narrower than 1 cm. This could indicate that these types were also used in connection with lateral elements during this transitional period.

There is a significant relationship between tip weight and draw strength of the bow, which indicates that arrowheads with a weight in excess of five grams are not to be expected to have been used in hunting. Known Mesolithic bows would allow for tips weighing between *c.* 2 and 4 grams (Dev & Riede 2012: 43). Looking at the weight of the tanged, single-edged and Høgnipen arrowheads in our data set, the maximum weight being 2.5 grams, but the average weight being 0.7 gram or less, it is evident that most arrows could bear the additional weight of a lateral element (lanceolate microliths having an average weight of 0.9 gram).

Figure 3.8.5: Proposed reconstruction of an Early Mesolithic composite arrow. The arrow has a Høgnipen point as tip and a lanceolate microlith as lateral element. Ill.: J. Jäger.

CONCLUDING REMARKS AND IMPLICATIONS FOR FUTURE RESEARCH

We propose that the analysed data illustrates a transition emanating from single-pointed arrows related to an isolated Ahrensburgian tradition remaining in the area of Southeast Norway and western Sweden. The process results in a heavier reliance on composite, "barbed" arrowheads, where Høgnipen points constitute the tip element and lanceolate microliths the lateral element (fig. 3.8.5) (*cf.* Damlien 2016: 253). This proposition does not mean that lanceolates could not have functioned as tips as well, but that the group comprises both tips and barbs. To what extent lanceolates functioned as one or the other, is a matter for future research, where use wear analysis should play an integral part.

It still remains unclear what motivated this transition to composite arrowheads. A more extensive study is needed in order to clarify whether this was a local development triggered by, for example, economic changes, fluctuations in population density (Breivik 2014) leading to an increased variance in tool design (Eerkens 1997) or/and an increasing regionalisation (Jaksland & Fossum 2014: 59; Damlien 2016: 400–408). It has been shown ethnographically (Wiessner 1983) as well as argued archaeologically (Ambrose 2002) that arrowheads can form an important part in exchange networks. As Cattelain (1997: 224) puts it "*...arrows are the object of exchanges and gifts, and a single village can contain an assemblage of arrows that are highly varied in terms of type and dimension.*" Therefore, future enquiries into this subject need to be interregional in order to accommodate the possibility of horizontal transmission.