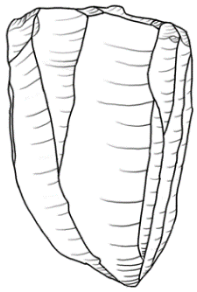
Maintaining craftsmanship

An investigation of the organisation of Middle Mesolithic blade technology at Hovland 3 in Vestfold, south-eastern Norway.



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Master's thesis in Archaeology

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Front page illustration:

A conical blade core from Hovland 3 in Larvik, Vestfold. Scale: 1,7 cm.

Drawing by author.

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DEPARTMENT OF ARCHAEOLOGY, CONSERVATION AND HISTORY
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Oslo, May 2015

Eirik Haug Røe

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ABBREVIATIONS

BCE – Before Common Era

MM – Middle Mesolithic

BP – Before Present

Chapter 1 Introduction

In recent years, archaeological discoveries has brought a new wave of research in Scandinavian Mesolithic archaeology. By emphasising the potential of explaining the development of prehistoric societies via the study of technology (e.g. Damlien 2014; Desrosiers 2012a; Knutsson and Knutsson 2011), it is now possible to further our understanding of this period. Throughout Scandinavia, researchers has been able to distinguish a distinct type of lithic blade technology, referred to by Sørensen et. al as the 'conical pressure blade concept', present during the Early and Middle Mesolithic (2013:20). The presence of this concept is believed to represent an influx of knowledge from the 'post-Swiderian sphere', which covered the western regions of Russia and the eastern Baltic, to the Scandinavian Peninsula (e.g. Rankama and Kankaanpää 2011; Sørensen, et al. 2013).

An important characteristic of the post-Swiderian sphere is its lithic blade technology. It features a prominent use of both indirect percussion (delivering impact with an intermediary tool struck by a mallet) and pressure flaking (detachment of flakes by applying pressure) on conically shaped cores. Experimental research on these modes of production has allowed their recognition in prehistoric assemblages, with diagnostic criteria involving extreme blade regularity and small exhausted blade cores with negative scars displaying equal regularity (see Inizan, et al. 1999; Pelegrin 2006). A typical 'post-Swiderian' lithic assemblage also includes perpendicularly snapped macroblades, characteristic retouch on blade edges, and symmetrically shaped tanged points (Sørensen, et al. 2013:24). Current views upholds that the transmission of this knowledge occurred as a result of direct migration of people and/or interactions between communities (Kankaanpää and Rankama 2009:43; Rankama and Kankaanpää 2008:885-886; Sørensen 2012a:237; Sørensen, et al. 2013:20). These perspectives on the development of cultural traditions in Northern Europe and the adaptation of knowledge in different regions has major implications for the present study. With the approach employed by these researchers, a clearly defined methodological and culture-historical platform has now been established.

To help researchers identify specific technologies and their inherent knowledge, methods such as refitting, technological classification and experimental knapping has been especially important. It is my intention to follow a similar approach to achieve the aim of this study. Of the specific methods that have been mentioned, technological classification will be the method applied in this study (Schild 1980; Sørensen 2006j, 2008). With this method, a classification of artefacts within an assemblage is made according to which stage of lithic production they belong. This in turn yields a general overview of the strategies of production present in the assemblage (Schild 1980:57; Sørensen 2008:109-110). In essence, the basic idea of the technological classification corresponds well with the principles of the theoretical concepts *schéma opératoire* and *chaîne opératoire* (e.g. Bleed 2001; Dobres 2000a; Edmonds 1990; Pelegrin 1990; Soressi and Geneste 2011). Recent years of research has seen the use of this method in combination with these theoretical concepts as a means to define the cognitive concepts structuring lithic production, within an approach referred to as the 'dynamic technological methodology' (e.g. Eriksen 2008; Sørensen 2006j, 2008, 2012a, n).

By current understanding of the social implications of technology (e.g. Apel 2001; Bleed 2001; Dobres 2000a; Eriksen 2000; Hayden 1998; Knutsson and Knutsson 2011; Pelegrin 1990; Schiffer and Skibo 1987; Sillar and Tite 2000; Skandfer 2012; Soressi and Geneste 2011; Sørensen 2006d), technological studies of the Middle Mesolithic (MM) in south-eastern Norway have been lacking, resulting in a lacuna in our understanding of the development of technological traditions during the period. Until recently, the approach of investigating this period (ranging from year 8250-6300 BCE), in SE Norway was characterised by regional research perspectives and chronological considerations largely based upon typological descriptions and the technological particularities of specific tools (see Ballin 1999; Mikkelsen 1975a; Mikkelsen, et al. 1999). Thus, regionality and chronology was determined by the presence or absence of tool types (e.g. Ballin 1995a, c; Ballin 1996, 1997). Furthermore, a lack of excavated sites from the MM must be considered of equal consequence. With new perspectives on the development of technology during the Mesolithic in Northern Europe and recently excavated MM sites in the Oslofjord, contributions to further understanding of the social factors that helped shape and maintain technological traditions during the period is now possible.

My investigation will follow the principles of the dynamic technological methodology, merging the method of technological classification with the principles of the *chaîne opératoire* in order to distinguish the concept of production (*schéma opératoire*) exhibited by an assemblage of blade material from the coast of south-eastern Norway. Furthermore, the recent research on the large-scale development of lithic technology during the Scandinavian Middle Mesolithic will serve as a platform for a discussion on how social life interplayed with the organisation of lithic blade technology.

In the present study, I will commit myself to an investigation of lithic blade technology from the Middle Mesolithic site Hovland 3, situated in the municipality of Larvik in Vestfold county, south-eastern Norway. This locality, excavated during the E18 Bommestad-Sky project in 2012, represents one amongst a plurality of recent excavations in south-eastern Norway. During the past decade, over 29 sites dated to the MM has been excavated in this particular region of Norway (Mansrud 2013:71). The locality Hovland 3 stands out amongst these, due to a wide range of radiocarbon datings, a relatively large lithic assemblage, and the presence of structures such as postholes, fireplaces and cooking pits. On this basis it has been argued that the site has seen continuous use during the period. The surrounding area also produced several other localities within the same range of datings, exhibiting a diversity of characteristics. This cluster of localities has already challenged our understanding of the regional development of settlement patterns during the Mesolithic (Solheim and Olsen 2013:217-230). However, despite the recent increase in MM sites in SE Norway, the technological aspects of their lithic assemblages has yet to be thoroughly investigated. As such, the present author has eyed the opportunity to promote the understanding of how lithic technology was organised during the Middle Mesolithic, and how this affected the development of social organisation during this period.

With the lack of comparable technological analyses of contemporary sites in the region, Hovland 3 will serve as a test case for discussing which factors might have determined technological practice in the region. The locality is considered especially suitable for investigation based on its favourable context. Its dating sequences, ranging between 7680-7200 BCE, sets it firmly within the chronological context of the Middle Mesolithic. The lithic assemblage features almost exclusively flint (99,9%), while the rest includes quartzite, sandstone, rock crystal and quartz. The diagnostic lithic material indicate that the prehistoric craftsmanship at the site relied on blade technology (Solheim and Olsen 2013:204).

Observations made by the excavators has already indicated use of indirect percussion and pressure flaking on conical cores as primary modes of blade production (Solheim 2013:261; Solheim and Olsen 2013:209), suggesting technological affinities with the conical pressure blade concept. A technological investigation of the blade material should resolve this relationship. Another important impetus for investigating lithic blade production, is that it will backed up by decades of experimental, ethnographic and archaeological research. A considerable amount of knowledge on the production, identification, social aspects and diffusion of lithic blade technology is thus available (Desrosiers 2012d:4-5; Inizan 2012:11). These important factors does not only have major implications for the aims of the present study, but also for its feasibility. The methodology of the present study has been chosen in accordance to these.

The research aim posed in this thesis has been made possible by three key factors: 1) newly excavated sites in south-eastern Norway from the Middle Mesolithic (e.g. Melvold and Persson 2013; Solheim and Damlien 2013), 2) the current state of research on the development of blade technology (e.g. Desrosiers 2012a; Knutsson and Knutsson 2011; Rankama and Kankaanpää 2011; Sørensen, et al. 2013), and 3) research on lithic industries employing a dynamic technological methodology (e.g. Eriksen 2008; Sørensen 2006j, 2008; 2012a:241; 2012n).

1.1 The aim of the present study

The main aim of this study is as follows:

- *Is it possible to discern the social organisation which contributed to consolidating and maintaining the tradition of blade technology at Hovland 3, and how can it be related to the development of social life during the Middle Mesolithic in south-eastern Norway?*

To pursue this question, it will be necessary to assess if the blade material represents a single or several traditions of blade production. Secondly, from the present author's perspective, a research question of this nature demands a consideration as to how the dialectic between scales is approached. It is my intention to acknowledge the dynamic relation between different scales in the discussion of my results (see Apel and Darmark 2009; Prescott and Glørstad 2012; Riede, et al. 2012), without neglecting the fact that my foundation for interpretations is a qualitative study of a selection of material from a single locality. In accordance to the aim of this study, it is therefore important that the investigated technological practice at Hovland 3 is understood as being a local and temporal segment of the larger geographical and chronological context that is the Middle Mesolithic Scandinavia and Baltic Europe. The dynamic technological methodology employed in the present study will aid in converting this intention into practice.

1.2 Structure of thesis

Following this chapter, I will introduce previous research on lithic assemblages from south-eastern Norway, along with the recent discourse on the development of lithic technology during the Mesolithic in Northern Europe. The purpose of this chapter is not only to contextualise the present study, but also highlight central issues which I believe must be confronted. The chapter is concluded by an introduction of the locality Hovland 3 and the material which will be studied.

Chapter 3 and 4 will in conjunction provide the theoretical and analytical parameters for dealing with the stated question of the thesis. Chapter 3 will feature the presentation of the theoretical framework and the method, which in turn will be synthesized into the methodology of the investigation. The analytical parameters of the technological investigation will be presented in detail in Chapter 4. This will include a presentation of the terminology, the explanation of particularly important terms, and the presentation and discussion of each attribute category of the technological classification. The analysis and interpretation of the material is the focus of the two following chapters.

Chapter 5 starts off by providing explanations of how and why the material has been divided and grouped, followed by the extensive presentation of results from the technological analysis. The purpose of Chapter 6 is to subject the results of my analysis to interpretation, and as such the technological organisation of blade making at the chosen locality will be elucidated. I intend to expand upon these interpretations in Chapter 7, and by doing so discuss the broader implications the organisation of blade making at Hovland 3 may represent.

Chapter 2 Research background and current status

I will now outline the research background relevant to the present study. The chapter will thus outline the research history, status, and culture-historical context of the Middle Mesolithic in south-eastern Norway, with special attention to the impact of lithic studies. The geographic context of the present study will be the Oslofjord region in south-eastern Norway, which spans the coast from Østfold county in the east to Telemark county in the west (see figure 2.1). The entire region of south-eastern Norway spans approximately 95 000 km², and is delimited by mountains to the north and west, by the Oslofjord and Skagerrak to the south, and by the Swedish border to the east (Damlien 2014:4-5).

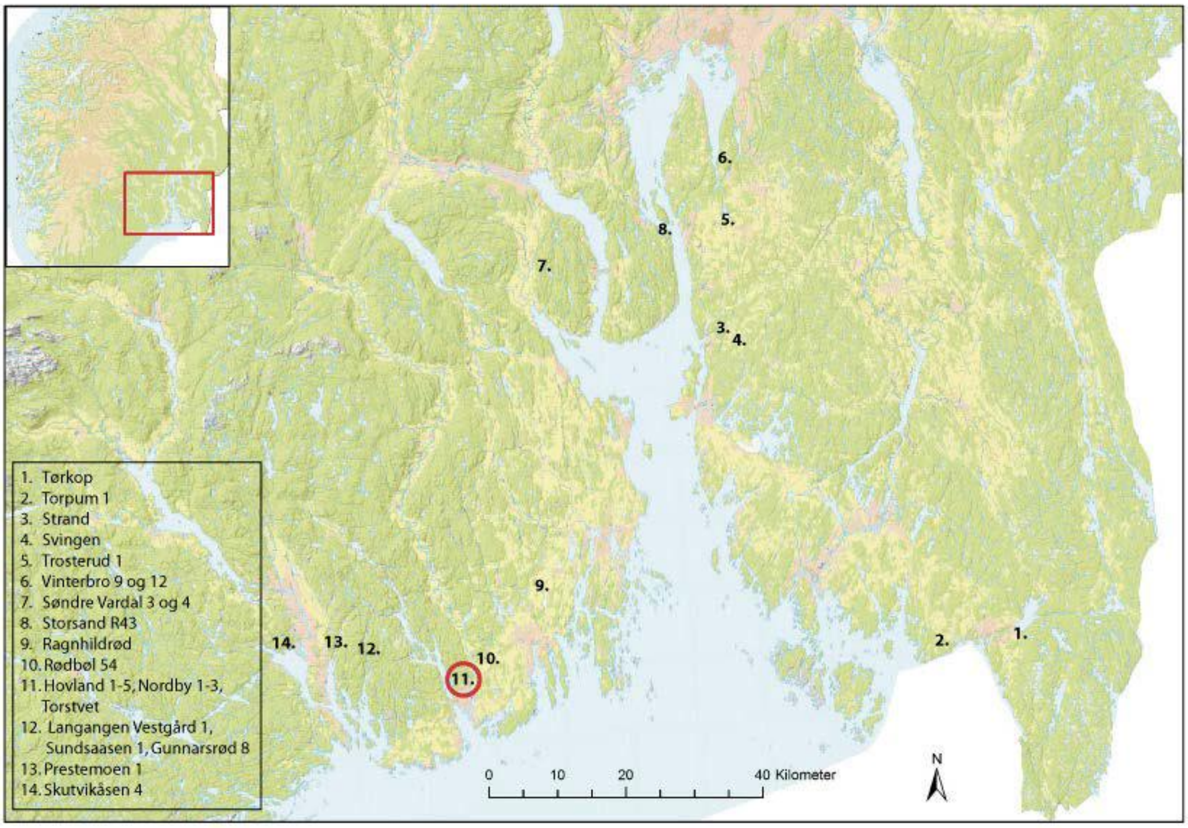


Figure 2.1: A map illustrating the present-day Oslofjord region in south-eastern Norway, ranging from Østfold County in the east to Telemark County in the west. The Middle Mesolithic sites that have been excavated up until 2013 are included. The area in which Hovland 3 was excavated is highlighted by the red circle. Illustration after (Damlien 2013b:25)

The current research state of the period in this region has recently been heavily influenced by studies focusing on how interregional interaction influenced changes in technology, and how this contributed to the development of prehistoric society during the MM (e.g. Damlien 2014; Knutsson and Knutsson 2011; Sørensen, et al. 2013). In accordance with the stated aim and intention of the previous chapter, it is necessary that the main aspects of the recent direction of research seen in the Scandinavian/Baltic area is introduced. As such, part 2.1 will focus on the regional research history, while part 2.2 will provide a short introduction to the recent international research on prehistoric lithic assemblages that has influenced the latest perspectives on the technological development of the MM period in Scandinavia and the Baltic. In part 2.3, I will again turn the focus to the Oslofjord region, with the presentation of Hovland 3 and the material from its assemblage that will be investigated.

2.1 Microliths and microblades – regional research

Typologies of lithic projectiles have been an essential component of the chronological separation and geographic delineation of prehistoric cultures in Stone Age research. Scandinavian and Norwegian Mesolithic archaeology has been no exception (e.g. Damlien 2014:1; Sørensen 2012a:251; Sørensen, et al. 2013). Lithic studies of assemblages from the Middle Mesolithic in the mid- and southern regions of Norway have traditionally been characterised by a focus on the typology of microliths (e.g. Ballin 1995a, c, 1999; Ballin and Jensen 1995; Bjerck 1986; Mikkelsen 1975a; Mikkelsen, et al. 1999).

The construction of a Middle Mesolithic phase in south-eastern Norway occurred considerably later than the establishment of the Norwegian Mesolithic chronology. Until the 1970s, the Mesolithic of south-eastern Norway was defined by the two material complexes: 'Fosna' (Early Mesolithic) and 'Nøstvet' (Late Mesolithic) (Jaksland 2001:28). The MM period in the region would be eventually be established in 1975 by Egil Mikkelsen, after the discovery of the site Tørkop in the municipality of Halden, Østfold (Mikkelsen 1975a, e; Mikkelsen, et al. 1999). At the time, the site was of singular importance, in that it was the only one able to provide several radiocarbon datings together with diagnostic artefacts related the MM.

The discovery of the site enabled the construction of a chronological phase which separated the early Fosna and later Nøstvet phase of the Mesolithic (see table 1). The new middle phase was named Tørkop. By referring to Danish and western Swedish chronology and typology, the chronological phase was set within the period 8250-6350 BCE (9000-7500 BP) – a chronological frame still in use to this day (Glørstad 2006:17; 2010:36; Mansrud 2013:68). The leading artefacts found at the site were microliths, typologically categorised as single barbed points (*'hullingspisser'*) (Mikkelsen 1975a:28-29; Mikkelsen, et al. 1999:33). In Scandinavia, single barbed points have generally been found in western Sweden, but also found in assemblages from Denmark and Scania (Jaksland 2001:30-31; Mansrud 2013:68). The microliths were considered representative of an early stage of the Middle Mesolithic in south-eastern Norway, predating the later phase characterised by scalene triangles ('*skjevtrekanter*') (e.g. Ballin 1999; Ballin and Jensen 1995).

Table 2.1 The chronological framework of the Mesolithic in south-eastern Norway (after Glørstad 2006:17)

Period	Sub-period	Before present (BP)	Before current era (BCE)	Leading artefacts
Early Meslithic	Phase 1 – 'Fosna'	10 000-9000	9500-8250	Single edge points, lancet points
Middle Mesolithic	Phase 2 – 'Tørkop'	9000-7500	8250-6350	Scalene triangles, single barbed points
Late Mesolithic	Phase 3 – 'Nøstvet'	7500-5800	6350-4650	No points, but microblades
Late Mesolithic	Phase 4 – 'Kjeøy'	5800-5000	4650-3800	Transverse arrowheads

The lithic assemblages of the few Middle Mesolithic sites excavated between the 1970's and 2000 in south-eastern and south-western Norway featured predominantly lithic blade debitage and cores categorised as a conical core technology. Central characteristics of this technology was noted to be meticulously prepared cores with facetted platforms and regular negative scars, as well as a uniform and regular blade removals. The blade assemblages were primarily treated by attribute analysis, analysing metric attributes (see Ballin 1995c). An increased regularity and decreased size of blades were argued to represent a chronological development of technology during the MM (Ballin 1999:211-214). Similar core and blade characteristics from was also seen to be present in contemporary assemblages from western Sweden and Denmark. These technological characteristics and the microlith typology promoted the view of cultural and chronological affiliations with the contemporary Sandarna-culture in western Sweden and the Maglemose in southern Scandinavia (Jaksland 2001:28). The Middle Mesolithic society in south-eastern Norway was therefore considered a continuation of the Early Mesolithic colonisers that came to the area from the south, sharing the same trajectory of technological development. Later research would challenge this perspective.

The recent wave of research has been characterised by a change from cultural distinctions based on regional typologies, to the reliance on evidence rooted in methodological frameworks emphasising technological developments as being guided by human intentions and social interactions on different scales. As a result, broader research perspectives have been duly opened (Sørensen, et al. 2013:22).

2.2 Conical cores and macroblades – interregional research

In the discussion regarding the technological development of the Mesolithic period in Denmark, Mikkel Sørensen (2006j) emphasise a characteristic leap in lithic blade technology that is evident in the transition from Early to Late Maglemosian society, ca 7000 cal. BCE. The technological leap was characterised by the introduction of several innovations, including the use of indirect percussion for the production of macroblades, pressure techniques for the production of microblades, and mechanical clamping devices for the immobilisation of cores (Sørensen 2006j:74).

The innovations within this technological concept could not be explained as being a 'logical' continuation of the preceding tradition of blade production by direct percussion techniques. Two possible explanations were proposed, one which suggested that the prehistoric community in southern Scandinavia interacted with Mediterranean communities which had already established the use of these innovations, and another which related the innovations to the diffusion of pressure blade technology originating from Late Palaeolithic communities in northern Asia (Sørensen 2006j:68). The primary basis for this argument is that blade production by pressure technique is constituted by highly specific knowledge about devices for blade core immobilisation and compound tools for applying pressure (e.g. Inizan, et al. 1992; Morlan 1970; Pelegrin 1984, 2006, 2012; Sørensen 2006j, 2012a; Tabarev 1997). Researchers have considered it unlikely that pressure blade production was invented independently in different prehistoric hunter-gatherer societies, due to the high degree of continuity and conservatism generally seen in northern European lithic technologies from Paleolithic and Mesolithic societies (Sørensen, et al. 2013:23).

The research on the diffusion of this particular knowledge would soon have profound impact on the perspectives on the development of the Mesolithic era in both Scandinavian and Baltic regions. The discovery of the site Sujala in northern Fennoscandia in 2002 would also greatly contribute to the instigation of new and convincing perspectives on the technological development in Mesolithic Scandinavia. The site was dated to ca. 8300-8200 cal. BCE, and it remains to date the earliest presence of conical pressure blade technology in Scandinavia. It has also been argued to represent a direct migration of people from populations within the 'post-Swiderian' complex (e.g. Kankaanpää and Rankama 2009; Rankama and Kankaanpää 2008;

Rankama and Kankaanpää 2011). A hallmark of these cultures is the production of lithic blades with pressure techniques on conical and subconical cores with facetted platforms (see figure 2.2). The methods of production involve continuous rejuvenation of the striking platform, shaping of the core, and trimming of the platform edge (Hertell and Tallavaara 2011:24; Sørensen, et al. 2013:20). As was mentioned in the previous section, the presence of a core technology in south-eastern Norway sharing the characteristics of this technology was noted by both Mikkelsen and Ballin. The technological similarities with the post-Swiderian material culture was however not recognised, due to the focus on lithic typology. One of the main differences between the Middle Mesolithic assemblages in western Scandinavia and north-eastern Europe is the lithic armature typology – microliths made from microblades in the former, and tanged points made from macroblades in the latter.

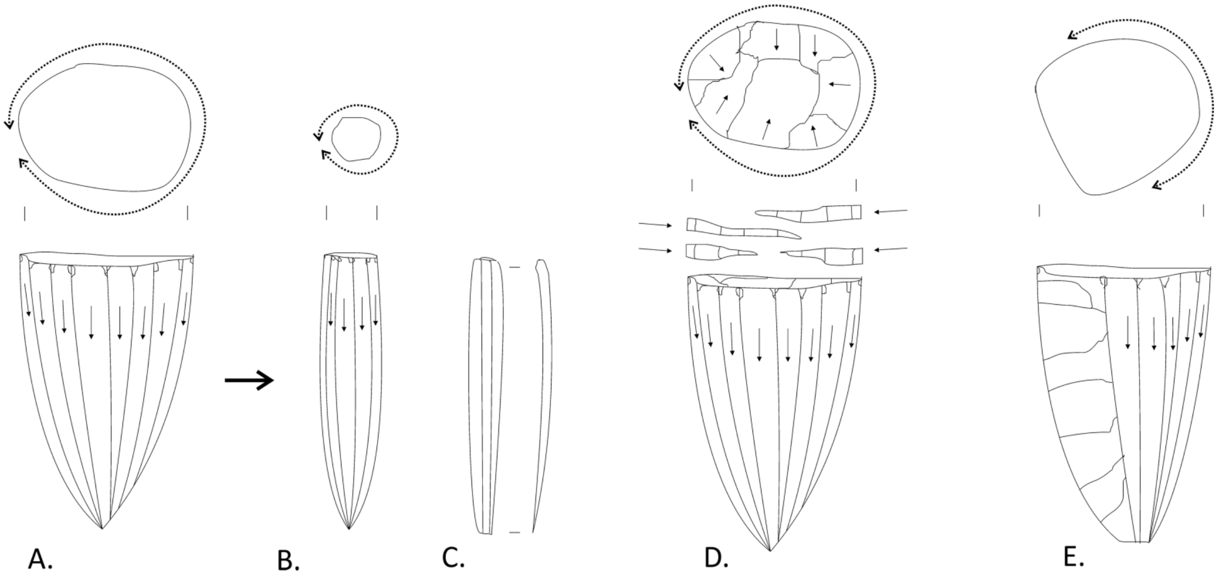


Figure 2.2: The conical core pressure blade concept and its variations. Schematized conical core morphologies are illustrated by stage of pressure blade production: A) conical core with a smooth platform; B) bullet or pencilshaped conical core with a smooth platform; C) the typical pressure blade morphology (note regularity, straightness, thinness and the small bulb/lip formation); D) conical core with faceted platform; E) conical core with unexploited back side (back side can be worked or with cortex) (after Sørensen, et al. 2013)

The blade technology identified at Sujala alongside the application of lithic research methodologies rooted in the principles of the *chaîne opératoire* has instigated re-evaluations of lithic assemblages throughout Scandinavia. In correspondence with radiocarbon datings, these lithic studies have been able to indicate that the spread of this technology happened gradually through Scandinavia during the transition between the Early- and Middle Mesolithic, from the north-west Russian plains to northern Fennoscandia, and concurrently along the Norwegian coast and through central Sweden to SE Norway (e.g. Damlien 2014; Knutsson and Knutsson 2011; Rankama and Kankaanpää 2011; Sørensen, et al. 2013).

The gradual spread of this technology along the Norwegian coast and through the interior of Sweden is believed to have been primarily caused by diffusion of knowledge through communities of prehistoric people that had already been established in the area during the Early Mesolithic. This would have slowed down the spread, and also explain the different tradition of lithic armature making. At the onset of the Middle Mesolithic, dramatic geographical and environmental changes were in progress following the inland recession of the Scandinavian ice-sheet. It is argued that these changes instigated the diffusion of the conical blade technology to southern parts of Norway. New biotopes and landscapes were opened, facilitating the establishment of new networks of interaction between different communities of hunter-gatherers (Damlien 2014:10; Knutsson and Knutsson 2011:23; Sørensen, et al. 2013:38-39, 46-47).

The recent large-scale excavations in the Oslofjord-region (e.g. Jaksland 2012; Melvold and Persson 2013; Solheim and Damlien 2013) have already been able to challenge the traditional understanding of the Middle Mesolithic in south-eastern Norway (see Damlien 2014). As a result of the continuous land rise in this area throughout the Mesolithic period following the deglaciation (Melvold and Persson 2013:79; Solheim 2013:255-256), coastal sites from this period are now found on dry land, high above the current sea level (59-155 m. asl). This has also resulted in little site disturbances from modern activity (Damlien 2014:5). The excavated sites in this region are thus generally characterised by being chronologically undisturbed occupations of various size. In light of the current research perspectives on the period, the Middle Mesolithic sites excavated during the E18 Bommestad-Sky project offers great potential for expanding the understanding of the cultural developments that took place during this era. One of the sites excavated during this project was Hovland 3, which has been chosen as a test case for the present study.

2.3 Hovland 3

Hovland 3 is located in Larvik municipality in Vestfold county, on the western side of the Oslofjord (see figure 2.2). The locality was excavated during the 2012 field season of the E18 Bommestad-Sky project. The project was organised by the Museum of Cultural History, University of Oslo. It was initiated as a result of the plans by The Norwegian Public Road Administration to construct a new highway between Bommestad and Sky in Vestfold county, south-eastern Norway. Throughout the 2011 and 2012 season, the project led the excavation of nine localities from the Middle Mesolithic (Damlien 2013a:8).

The initial survey of Hovland 3 suggested that only a limited amount of archaeological material was likely to be excavated. However, as it turned out during the excavation, it would yield far more. Of all the sites excavated during the project, it provided the largest assemblage of lithic material. It also yielded a number of radiocarbon datings, as well as structural remains of a hut. Access to the lithic material investigated in this study has been granted by the project leaders Steinar Solheim and Hege Damlien. The excavation covered 213 m², in an area surrounded by crag formations to the northwest, northeast, and southeast, as well as the peat area Breimyr to the southwest (figure 2.3). It was situated in a terrain sloping slightly downwards to the present-day E18 highway. The excavated lithic material was found in a gradual vertical distribution, with few indicators of post-depositional disturbances (Solheim and Olsen 2013:200-201).

Figure 2.3: The locality Hovland 3. The present E18 highway is situated directly south of the locality. To the southwest lies the peat Breimyr. Illustration after Solheim and Olsen (2013:199), modified by author.

A total number of 21 381 lithic artefacts was excavated. The variation of lithic raw material includes flint, quartzite, sandstone, rock crystal and quartz. 99,9% of the assemblage is produced from flint. 362 pieces of flint were documented as secondary worked. Various artefact types were documented, including debitage, cores and tools made from flakes and blades. Fragments of axes and hatchets, as well as grinding- and knapping stones were also found (Solheim and Olsen 2013:202-209).

The focus of the investigation will be on material related to blade manufacture. Artefacts documented as either blades or microblades constitutes 10,6% of the flint material, numbering a total of 2259 pieces. A total of 1430 pieces were documented as blades and 829 as microblades. The assemblage of blades was highly fragmented, yielding only 53 complete blades and 33 complete microblades. 314 blades/microblades were documented as being secondary worked, including blade tools. Documented blade tools include 27 microliths, 18 blade scrapers, and 19 borers. Core material numbered 133, which includes both cores (67 pieces) and core fragments (66 pieces) (Solheim and Olsen 2013:204-205). The well-documented archaeological assemblage from Hovland 3 has provided a favourable point of departure for a lithic analysis. The material which will be investigated includes all artefacts which has been documented as being related to blade technology. This includes blade debitage, tools, cores, and debitage associated with cores. I will go into more detail on the selection of material in Chapter 5.

The majority of finds were located within an area of the locality interpreted as a culture layer, formed by organic remains. Structural remains were found, among them several hearths, cooking pits, and postholes. In addition, 67 grams of hazelnut shells was found. 21 samples of macrofossils and 16 samples of coal from the structural remains were taken, alongside a series of pollen and micromorphological organic samples. The locality yielded a total of 24 radiocarbon datings. The datings were primarily sampled from charcoal found in the remains of structures, as well as the hazelnut shells. Eighteen of the datings were set to the MM, and they exhibited an evenly distributed dating sequence ranging from 7680 to 7200 cal BCE. The culture layer and the distribution of datings have therefore been interpreted as strong indicators of continuous use of the locality. Although it was been impossible to define stratigraphic variations or multiple phases of site use, the large amount of datings enabled the use of statistical modelling, which provided an estimated phase of site use. The model indicated that the site had been used between ca. 7620-7590 BCE and 7500-7450 BCE – a period of approximately 200 years (Solheim and Olsen 2013:216-231).

Summary

In the first part of this chapter I introduced earlier research on the Middle Mesolithic in south-eastern Norway. The knowledge of the period has been largely determined by regional research perspectives and limited methodologies. In the second part, I outlined the current research trends in northern European Mesolithic archaeology, and how these have influenced research on the Middle Mesolithic in the region. The impact of recent archaeological discoveries and new methodologies have been underscored. Among the recently excavated MM localities in SE Norway, Hovland 3 has been chosen as a test case. Its defined and well-dated lithic assemblage is believed to offer favourable conditions for an investigation of how traditions of blade making was consolidated and maintained in the Oslofjord region during the MM. In the following chapter, I will present the theoretical framework and method which will constitute the applied methodology.

Chapter 3 Methodology

With the employed methodology, I intend to identify and describe the concept of production (the *schéma opératoire*) visible in the blade material from Hovland 3. This will allow me to obtain an understanding of the technological tradition and its social implications. The ideology of the *chaîne opératoire* has been of vital importance for the research on the spread of pressure blade technology in Scandinavia. Sørensen et. al. (2013) and Knutsson & Knutsson (2011) have credited the fundamental principles of the *chaîne opératoire* for the recent perspectives on the development of Scandinavian Early- and Middle Mesolithic societies. These principles will be followed to enable a discussion of which factors maintained the technological practice at Hovland 3. In this chapter, these ideological principles will be presented, as well as the method of investigation, the technological classification.

3.1 Outlining the ideological basis

The theoretical principles underscoring the present study is found in the French methodology *chaîne opératoire*. After decades of development, this methodology is now a well-established research approach – especially within research on lithic technology. The history of the *chaîne opératoire* will not be covered here, as it can be found in detail elsewhere (e.g. Bleed 2001; Dobres 2000c; Soressi and Geneste 2011; Sørensen 2006a). Instead, I wish to highlight the aspects of this methodology that I will rely upon in the present study. Its most fundamental principle is the conceptual understanding of technology that it maintains. This concept of technology lies inherent in the term '*chaîne opératoire'*.

The name *chaîne opératoire,* which has been adopted in its original French form into the literature, derives from a term used for defining the successive processes of manufacture from raw material procurement to the eventual discard of an object (e.g. Eriksen 2000:76; Inizan, et al. 1999:14; Schlanger 1994). The process of manufacture is defined as sequential, and any individual manufacturing process is understood as a series of technical operations. The cognitive behaviour associated with every operation is emphasised, and each operation is considered a reflection of human knowledge and know-how (see part 3.1.2), which in turn reflects human sociality (Bleed 2001:114).

The concept of the *chaîne opératoire* will serve as an ideological platform, in which technology is considered a mediator between material and society (Dobres and Hoffman 1999:2-3; Edmonds 1990:56-57; Sørensen 2006a:32). This application of the *chaîne opératoire* is argued for based on the aim of this research and the applied method (see part 3.2). Consequently, the term will not feature within the analytical protocol, as it is not the aim of the investigation to identify individual sequences of operations. Instead, the related term *schéma opératoire* will be applied to discern general patterns and cultural hallmarks of the technological organisation exhibited in the material. Before this term is properly introduced, the purpose of the employed methodology will be explained.

3.1.1 Reconstructing cognition

Essentially, the purpose of the employed methodology is to envisage the tradition that guided the manner of which a society shaped and transformed its lithic material. This involves a range of requirements. First, it requires a general reconstruction of the technological operations visible in the material. This may only be achieved by inferred analogy. This leads to the second requirement: Knowledge of different methods of lithic (blade) production, provided by experimental research. As has been previously stated by Pelegrin (2006:40), one can only recognise what one already knows. The extensive experimental work on lithic technology contributed by researchers such as Pelegrin and many others (e.g. Bordes and Crabtree 1969; Callahan 1985; Crabtree 1967; Madsen 1992; Migal and Wąs 2006; Pelegrin 2003, 2006; Pelegrin 2012; Sørensen 2006j, 2012a; Tabarev 1997) has enabled this, and will thus be relied upon throughout the investigation.

Table 3.1: The principle layers of division in the present study (after Geneste 1985 (see also Sørensen 2006a)).

Step 0	Procurement. Locate raw materials, selection, testing, transport
Step 1	Production. Decortication of nodules. Initial shaping of core. Preparation of platform
Step 2	Production of blades
Step 3	Production of tools Hafting
Step 4	Utilization Use of retouched or unretouched tools Resharpening/reworking of tools
Step 5	Discard Breakage Terminal edge-wear/damage

The reconstruction of technological operations will be accomplished by assigning artefacts to specific steps of production. Each step represents its own link in the chain of production – the *chaîne opératoire*. When investigating lithic technology, the process of production is divided into six general steps (e.g. Bleed 2001; Geneste 1985; Soressi and

Geneste 2011; Sørensen 2006a). The division followed in the present study is presented in table 3.1.

The reductive process of lithic production is highly dynamic in character. A knapper may alternate between a variety of strategies to produce any particular type of artefact (Edmonds 1990:57). In order to illustrate this dynamic process, a subdivision of the different steps is necessary. Each subdivision represents an integrated strategy within the particular steps of production (Eriksen 2000:80). For example, step 1 includes several stages, such as decortication, shaping of the core and platform preparation – each involving a set of specific operations. A stage of production, e.g. platform preparation, may also occur within other steps of production. The subdivisions in table 3.1 illustrates typical strategies of lithic blade production. An important part of the analytical protocol is to add and elaborate upon relevant subdivisions of the operational procedure. In doing so, it will be possible to recognise the *schéma opératoire* which the prehistoric knappers followed (Pelegrin 1990:119-120).

3.1.2 Tracing the concept of production

The *schema opératoire* serves an important purpose in the present study. The *schema opératoire* represents the cognitive structure of a production strategy. It is the concept of the (ideal) process of production that a knapper follows in order to fashion a desired and standard product. Any technological concept consists of a range of technical operations a knapper may employ as means to a desirable end (see figure 3.1).

The process of lithic production is seen as an invocation of a concept of production (the *schéma opératoire*) into individual series of operations (a *chaîne opératoire*). With lithic technologies, these operations are often manifest as gestures, involving specific knapping methods, modes and techniques (see section 4.1 for the definition of these terms). It is not sufficient for a knapper to merely possess the knowledge of such operations, but also the mental and physical capabilities to execute them. Therefore, to successfully employ a specific lithic technology, a knapper must possess both *knowledge* and *know-how*. Knowledge (‘*connaissances*’) represents the knappers knowledge of the traditional concept of production. It is defined as the explicit mental representation of geometrical forms, and the register of actions necessary for shaping material into these (Pelegrin 1990:118; Sørensen 2012n:34-35). Two types of know-how are distinguished. The first is defined as ‘mental know-how’ (‘*savoir-faire*’), the second as ‘motor know-how’ (‘*savior-faire moteur’*). Mental know-how is defined as the ability to unremittingly evaluate the condition of the material during operations, and adjust further operations accordingly to achieve a desired result. Motor know-how refers to the physical capabilities that determine the precision and coordination of operations, which may only be achieved through experience from practical training or apprenticeship (Pelegrin 1990:118; Sørensen 2012n:35).

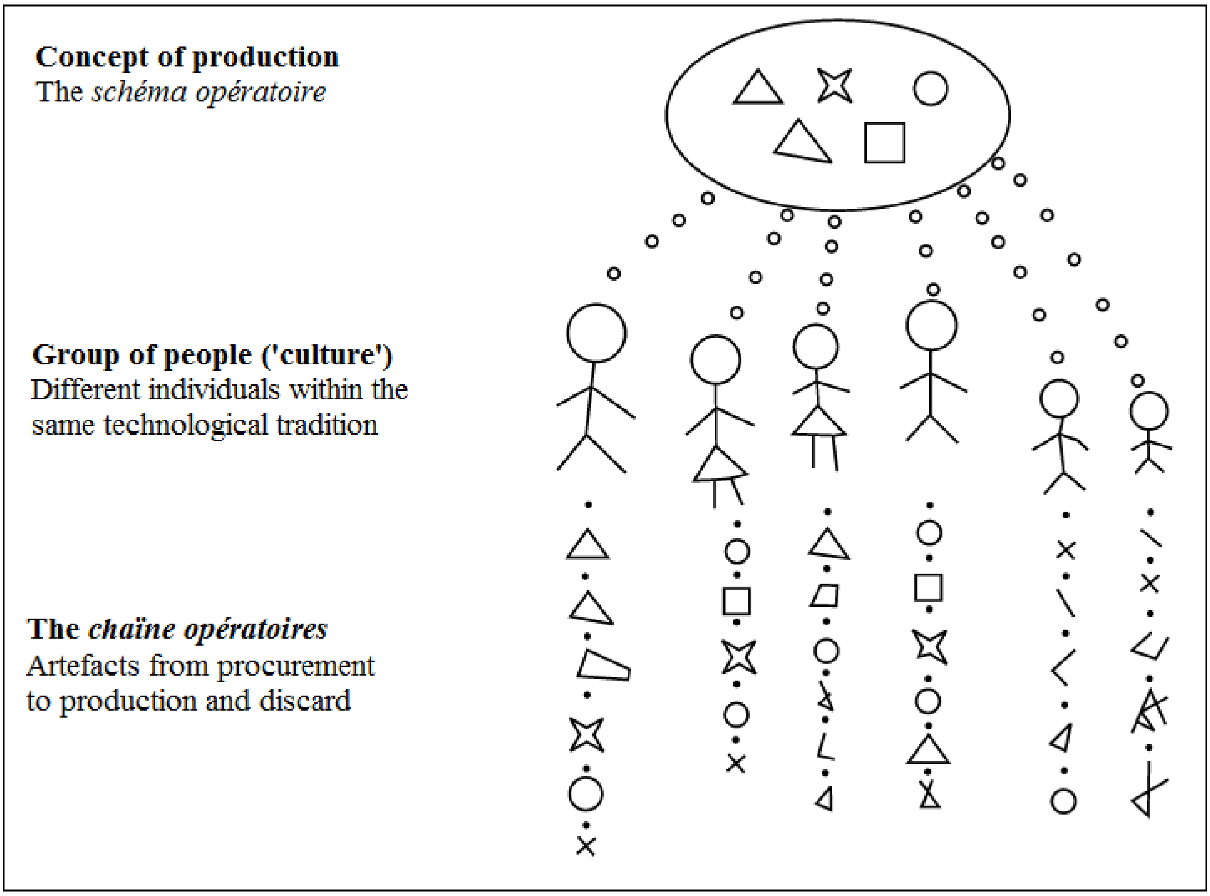


Figure 3.1: The relation between the concept of production, knappers and artefacts. This graphic illustrates how individuals of different age, sex and skill within a group may produce a variety of chaîne opératoires based on the same 'ideal' template for production (after Sørensen 2012b:37).

By acknowledging these definitions of knowledge and know-how, a methodological problem must be solved. Several technological studies of lithic assemblages have determined different level of skills, suggesting the presence of children imitating lithic production, or apprentices lacking the sufficient skill needed to carry out the typical *chaîne opératoires* of their technological tradition (see figure 3.1 for a graphic illustration) (e.g. Finlay 1997; Sternke and Sørensen 2009; Sørensen 2006d). Therefore, an individual *chaîne opératoire* within an assemblage may not always represent its technological concept (Sørensen 2006d:293). The solution for this methodological problem is a fluent correspondence between research aims and the applied method.

3.2 Technological classification

Within lithic studies following the principles of the *chaîne opératoire*, several research methods have been frequently applied. Arguably, four particular methods have been especially important: refitting (e.g. Bodu, et al. 1987; Cziesla 1990; Pigeot 1990; Skar and Coulson 1987), experimental research (e.g. Apel 2001; Pelegrin 2003; Sternke and Sørensen 2009), use wear analysis (e.g. Knutsson and Knutsson 2013; Pyzewicz and Gruzdz 2014; Sjöström and Nilsson 2009), and technological classification (e.g. Geneste 1985; Schild 1980; Sørensen 2006j, 2012a). Several contributions to lithic studies have employed a combination of these methods, with good results (e.g. Eriksen 2008; Sørensen 2012n; Sørensen, et al. 2013). It should also be noted that regardless the research approach employed within a *chaîne opératoire* study, building upon the work and experiences of other researchers employing different methods is regarded as highly necessary (Soressi and Geneste 2011:338, 344). For the investigation of the blade material from Hovland 3, the present author will rely upon the method of technological classification.

When the research method for investigating the blade material was to be selected, two issues had to be addressed. The first was a practical issue: the size of the assemblage. The technological classification is believed to provide the most favourable conditions for processing a relatively large body of material, due to its combined quantitative and qualitative approach to archaeological material. Conversely, conjoining artefacts within a refitting study of an assemblage of this magnitude would be practically impossible. At best, only a spare portion of the material would have been described. Considering the aim of the present study, this could lead to an increased likelihood of biased results (Sørensen 2008:121). In this regard, approaching a sizeable assemblage with a technological classification is not only a means to negate a practical issue. A larger body of material is considered more likely to be representative of a prehistoric group, unlike smaller assemblages which may have been created by anecdotal and idiosyncratic events (see section 3.1.2) (Soressi and Geneste 2011:341). As such, the possibility of gaining a broader diachronic and/or synchronic perspective of the prehistoric technological organisation is granted by investigating a relatively large and well-dated assemblage.

The second issue is related to the aim of the study. Unlike the specificity of the conjoining of artefacts in refitting studies, technological classifications emphasises the general and conceptual aspects of lithic production (Sørensen 2008:122). It is not the purpose of this method to identify specific lithic *chaîne opératoires*. Instead, the purpose of a technological classification is to identify the general methods of manufacture within a specific type of production. Instead of conjoining pieces by refitting, I will employ *mental refitting* (Pelegrin 2006:39). This will enable me to conceptually reconstruct methods of knapping, by comparing and relating technological characteristics of various groups of material. Mental refitting will therefore synergise with the technological classification, helping me to infer the *schéma opératoire* of the material.

The general analytic protocol of the technological classification is as follows: A classification list is made, accumulated by describing individual artefacts. Diagnostic lithic material (which includes both waste and tool material) is classified according to macroscopic features. These features may involve technical, metric and raw material stigmata. In the following chapter, I will go into detail on how the classification list will be constructed, as well as other important aspects of the analytical procedure.

Chapter 4 Parameters of the technological analysis

In the previous chapter, I outlined the methodological framework which has set the premises for both the analytical procedure and interpretation. This chapter will expand upon the analytical procedure. In correspondence with the technological classification, empirical and analytical parameters will be set for the present study. In the first part of the chapter the terminology applied in the analysis, and the definition of terms that are of special significance will be presented. The second part will present the attributes of the technological classification.

4.1 Terminology and definitions

The terminology for lithic technology found in the work of Inizan et. al (1999) will be followed in the present study.

4.1.1 Blades

Since the focus of this investigation is specifically lithic *blade* technology, I find it pertinent to clarify the technological definition that will be tied to this term. Morphologically defined, a blade is a removal that is twice as long as it is wide, has parallel edges, as well as parallel dorsal scars (Inizan, et al. 1999:130-131). The definition of lithic blades have varied throughout research history, and have been adjusted more-or-less according to various traditions of research (Sørensen 2006d:277). A relevant example of this is the treatment of Middle Mesolithic blades by Norwegian researchers, which traditionally have been defined by metric attributes (see Chapter 2).

This definition was employed in order to enable the construction of a diachronic development of material culture, which would be characterised by a gradual decrease of blade size. However, the later research following the principles of the *chaîne opératoire* (as was presented in the previous chapter) refuted this definition. Instead, blades would now have to be defined according to their relation to a sequential production determined by human intentionality (Sørensen 2006d:288). As such, blades are defined by diagnostic technological attributes, relating each removal to a specific tradition of material manufacture (after Sørensen 2006d:289). This means that broken, irregular, or otherwise atypical removals will be considered to be blades if they, by technological blade attributes, can be directly related to blade production. The diagnostic technological attributes of blades will be expanded upon in section 4.2.1.

Metric size will not be used as a diagnostic feature *per se*, as it has been shown that the size of blades produced by different techniques may overlap (Sørensen, et al. 2013). However, the size of blades can be considered technologically relevant, as will be explained in section 4.2.1. Metric values will also be used to separate between macroblades and microblades, by which microblades are blades that are less than 8 mm wide (Helskog, et al. 1976:14).

4.1.2 Levels of manufacture

To allow for an analysis and description of the manufacture of lithic products, a hierarchy of the different levels of manufacture requires definition. As such, experimental research may be used to describe the archaeological material. The three terms for describing lithic manufacture will be *method*, *mode*, and *technique*, following the division of lithic manufacture outlined by M. H. Newcomer (1975). This division was made by Newcomer in order to enable a more accurate application of experimental research on archaeological material (1975:97). The following sections will expand upon the intended use of these terms in the analysis.

Method

Method is in the present study defined as a strategic series of actions used for accomplishing specific goals and intentions. The method employed to create a prehistoric tool is thus an orderly sequence of actions manifested as techniques guided by a rational plan (Inizan, et al. 1999:30, 145; Sørensen 2012n:29). In the present study, I will distinguish between two types of methods: overall method and sub-method (following Sørensen 2012n). Overall method refers to the general process of production, from start to end. Sub-methods refer to specific methods within each production phase i.e. the subdivisions of the general steps of production (see part 3.1.1).

Mode

The term mode is used to bridge the gap between the terms method and technique. The use of this term should allow for a safer application of experimental research to help investigate a lithic assemblage (Newcomer 1975:98). Three modes of lithic flaking are used: *hard hammer mode*, *soft hammer mode*, and *pressure*. These modes involve a variation of techniques and tool material. In a recent publication, Jacques Pelegrin (2012) use the term ‘mode’ to separate different techniques of pressure blade production. I do not wish to disregard this use of the term, but I do however wish to emphasise that my use is different, in that it serves the purpose of generalising rather than specifying abstracted levels of manufacture. With this use of the term mode, the definition of the term technique will be restricted. The separation of modes are largely based on the assumed tool material involved in the technique (i.e. stone or antler hammers), but also gesture (direct blow to the core, applying pressure etc.). I will expand upon the different modes and techniques below.

Technique

In the present study, technique refers to the specific means a knapper employs in order to transfer energy to stone. This includes the action of applying force to a lithic object, the working position, and immobilisation of the object (Inizan, et al. 1999:30; Newcomer 1975:98; Sørensen 2012n:28). I have added heat treatment and intentional breakage as possibly identifiable techniques as well. The following presentation will also relate techniques to their associated modes of production. The characteristics enabling the identification of knapping techniques will be presented in the following section, in association with the technological attributes.

Hard hammer modes:

- Direct hard techniques: A direct blow onto a core, involving hard rock types, like quartz or granite.
- Direct medium hard technique: A direct blow with soft stones, such as sandstone or limestone.

Soft hammer modes:

- Direct soft technique: A direct blow with a tool of organic material, i.e. antler, bone, tooth, or hard wood.
- Indirect soft technique: A blow with an intermediary tool of organic material.

Pressure modes:

- Applying pressure with a tool made of soft material. The material can be antler, bone, tooth, or a soft metal like copper (Inizan, et al. 1999:32; Sørensen 2012n:28). A variety of prehistoric pressure blade production techniques has been proposed (figure 4.1) (Pelegrin 2012).

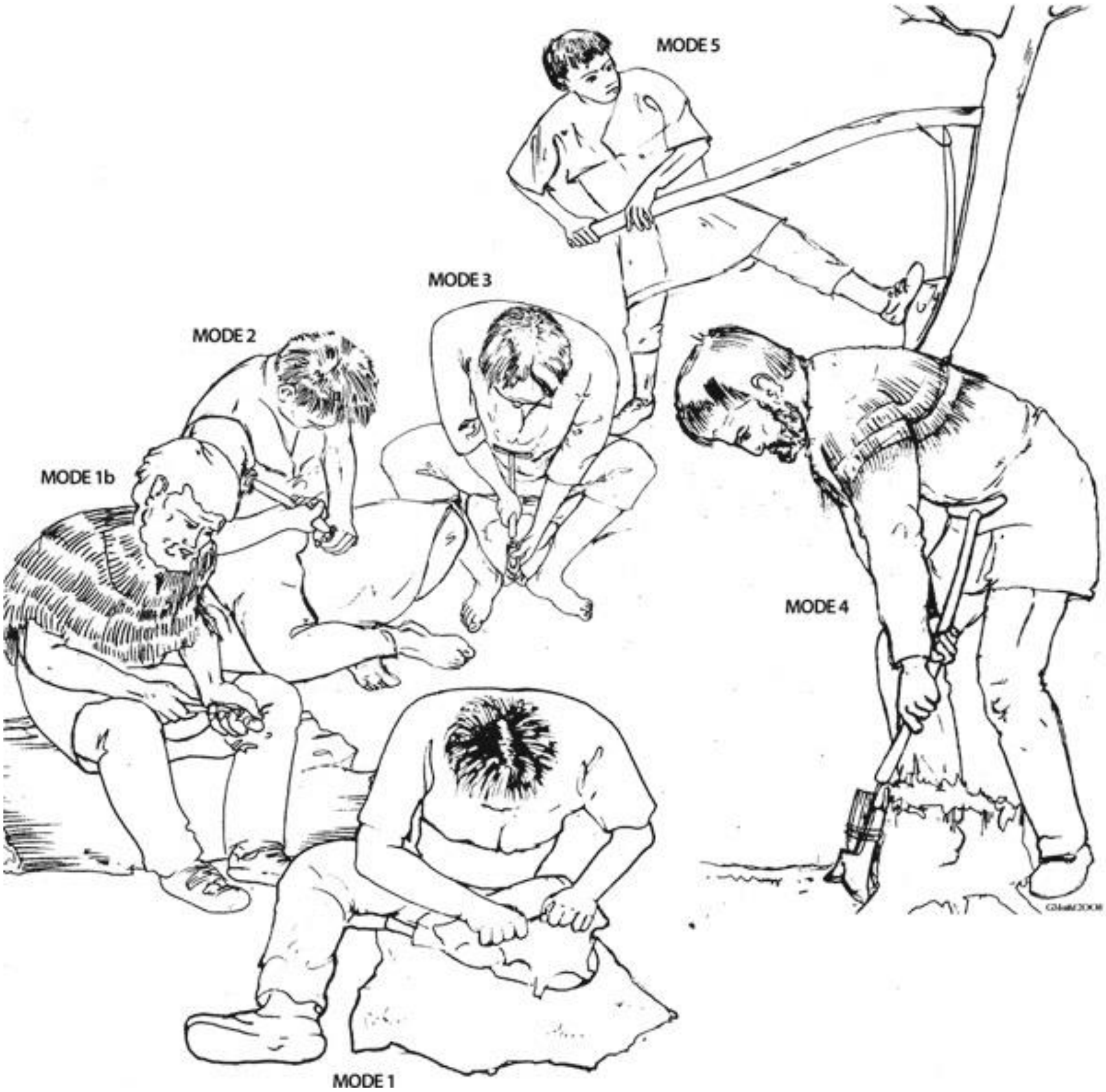


Figure 4.1: Five different modes of pressure, proposed by J. Pelegrin (2012). Mode 1: pressure blade production using a hand-held antler baguette and holding the core directly in the other hand. Mode 1b: pressure blade production using a hand-held baguette and holding the core with a grooved device. Mode 2: pressure microblades using a shoulder crutch and holding the core with a grooved device. Mode 3: pressure blade production using a short crutch in a sitting position, the core being held with a grooved device against the ground. Mode 4: pressure blade production using a long crutch in a standing position, the core being held with a grooved device against the ground. Mode 5: pressure blade production using a lever to act on a wood or antler pressure stick, the core being held in a single piece of wood (after Pelegrin 2012:491).

Orientation and immobilisation of a core

The production of lithic blades, especially when applying indirect percussion and pressure, may involve certain measures for immobilising a core. These techniques can sometimes be identified and interpreted in lithic material (Sørensen 2012n:29) (also see Bordes and Crabtree 1969; Callahan 1984; Clark 2012; Flenniken 1987; Gryba 2006; Healan and Kerley 1984; Pelegrin 1984, 2003; Semenov 1964; Tabarev 1997). Below are two examples of such techniques:

- Basal support of a blade core at the moment of the blow: The supporting of a blade core during the detachment of blades may produce certain diagnostic characteristics.
- Mechanical immobilisation of the core: In certain stages of production, such as the production of microblades, the small size of a core may deny detachment without a proper means of immobilisation. This issue is solved by firmly immobilising the core (see figure 4.1 for examples). Immobilisation of cores is often associated with pressure modes of production (e.g. Flenniken 1987; Tabarev 1997).

Heat treatment

Heat treatment of raw material has been observed in both ethnographical (Roux and Pelegrin 1989) and archaeological contexts, often in association with pressure modes of production (e.g. Crabtree and Butler 1964; Eriksen 1997; Flenniken 1987; Inizan and Tixier 2001). The purpose of subjecting raw material to heat treatment is to alter the crystalline structure of the material, increasing fracturing properties (Sørensen 2012n:28).

Intentional breakage

The intentional breakage of flakes and blades have been seen in a diversity of lithic assemblages from different regions and eras (e.g. Bergman, et al. 1987; Bordes 1953; Lamdin-Whymark 2011; Rankama and Kankaanpää 2011; Sjöström and Nilsson 2009). The purpose of intentional breakage may be tool production or rejuvenation. Indicators of intentional breakage are difficult to identify, but are separated into two types: contact features and flexion features (see Bergman, et al. 1987; Lamdin-Whymark 2011). Contact features occur from direct percussion on the surface of a flake, resulting in the presence of a bulb or cone of percussion. Flexion features occur from breaking by 'bending' the flake. This results in wedge-shaped fracture lines, lips on the edge of the breaks, as well as conchoidal fracture marks.

4.2 Technological attributes

The following section will introduce the technological attributes included in the classification. For a schematic overview including illustrations of every attribute type, see appendix B. The schema is based on the workshop manual that has been developed by the Nordic Blade Technology Network[1] for use in their workshops (see Appendix A). In the present study, only

[1] The Nordic Blade Technology Network is an inter-Nordic research group, aiming at re-evaluating the pioneer settlement of Scandinavia following the melting of the Scandinavian ice-sheet.

minor modifications have been made by the author. Each attribute category is identified by a letter. Refer to figure captions for the individual numbers of attributes within each group.

4.2.1 Blade classification

Dorsal features (A)

The negative scars featured on the dorsal face of blades are critical indicators of stages of production, as well as technological concept (figure 4.2). Dorsal scars featuring cortex are produced during the initial stages of blade production. The presence of dorsal features A4, A5 and A6 generally indicate later stages of production, implying long sequences of lithic reduction (Sørensen 2006j:25). Dorsal faces featuring cresting may, when considered in combination with the cores, indicate the method of frontal core preparation.

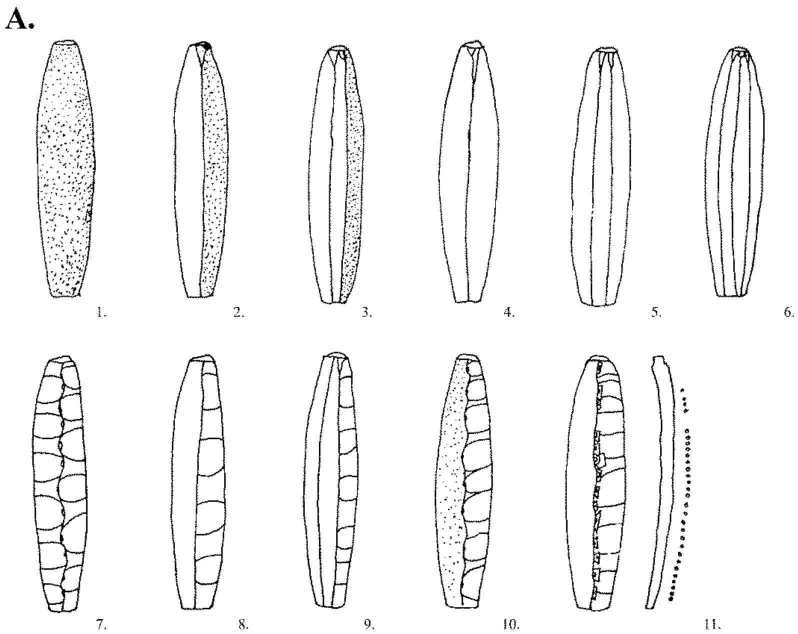


Figure 4.2: Dorsal feature attributes. A1: Dorsal cortex. A2: Two scars, one cortex. A3: Three scars, one cortex. A4: Two scars. A5: Three scars. A6: Multiple scars A7: Bilaterially crested. A8: Two scars, one crested. A9: Three scars, one crested. A10: Two scars, one cortex, one crested. A11: Two scars, one crested w/ trimming.

Blade termination (B)

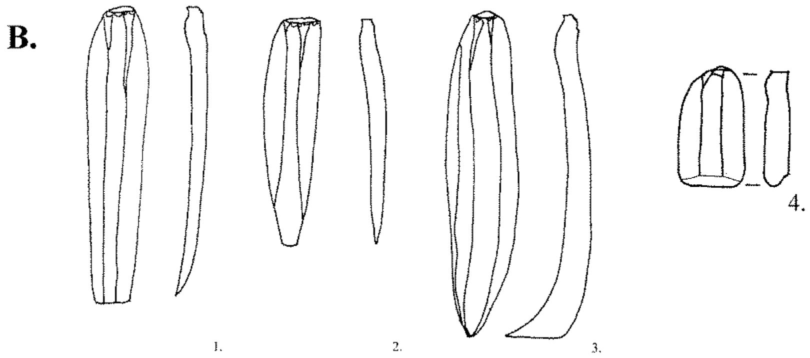


Figure 4.3: Blade termination attributes. B1: Ideal. B2: Feathered. B3: Plunged. B4: Hinged.

Blade termination (figure 4.3) may indicate regularity in production as well as the shape of the core. A large number of blades with an ideal termination testifies to a production capable of continuously producing series of blades without errors. This is usually determined by either skill or technological concept. If the blade population features a significant amount of feathered, plunged or hinged blades, the production can be termed irregular. The presence of such blades may also indicate strategies of error correcting or preparation.

It should be stated that what makes a blade termination 'ideal', should be considered within the context of the technological concept. The ideal termination referred to in the present classification is ideal in the context of a lithic technology producing blades from conical/sub-conical cores. Prehistoric knappers within other traditions of lithic technology may well have considered the ideal termination to have been feathered, plunged or hinged removals. There must always be a constant evaluation as to what the prehistoric knappers considered ideal, or else it will be impossible to differentiate between indicators of technological concept, the knappers' preferences, and level of skill. A blade will only be considered a knapping accident if it is clear that it would have impeded the continuation of the typical knapping sequence of the technological concept (Inizan, et al. 1999:34).

Blade curvature (C)

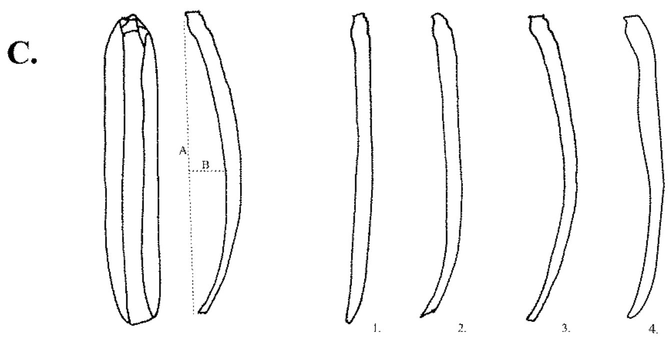


Figure 4.4: Blade curvature attributes. C1: Straight. C2: Distal curvature. C3: Even curvature. C4: Curved with a ventral 'belly'.

The curvature of blades (figure 4.4) is often influenced by the size and shape of the nodule. However, technique and shaping the core may allow a knapper to regulate curvature (Sørensen 2006j:28). Careful considerations should be taken when classifying blade curvature. The original curvature of a specific blade may be lost even with a seemingly insignificant reduction of its length. For example, a blade with an original distal curvature would likely be classified as straight if the distal end was lacking.

Regularity (D)

In this classification, lateral edges and dorsal ridges have been the two determining criteria for blade regularity (figure 4.5). Blades with irregular lateral edges and dorsal ridges that runs out laterally or together are termed irregular. Blades with parallel dorsal ridges from the proximal to the distal end are considered regular. If a blade exhibits a high level of regularity and a fine symmetry, it is termed extremely regular. An irregular blade usually indicates previous removals with direct percussion, while regular and extremely regular blades indicate the use of either soft or pressure modes of production (Pelegrin 2006:42).

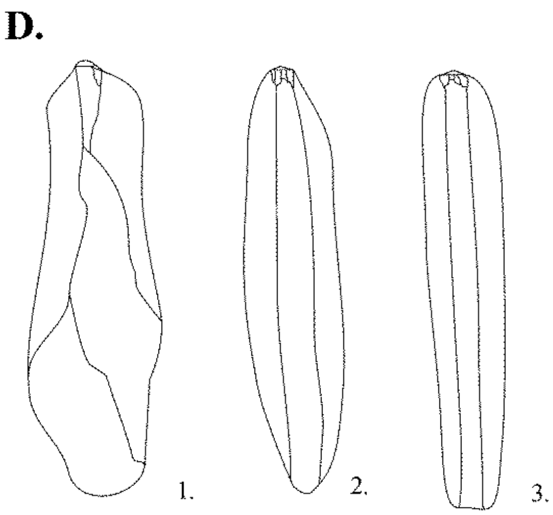


Figure 4.5: Blade regularity attributes. D1: Irregular. D2: Regular. D3: Extremely regular.

Ventral ripples (E)

The visibility of ventral face ripples (figure 4.6) on lithic material is determined by the physical effects of the applied technique combined with the physical properties and dispositions of the raw material (Inizan, et al. 1999:152). Generally, pronounced ripples on a blade indicate detachment by a hard hammer mode of production. Ventral ripples on blades produced by soft hammer modes are fewer and less pronounced. Ventral ripples are seldom found on blades detached by pressure modes. They most often exhibit a smooth ventral surface.

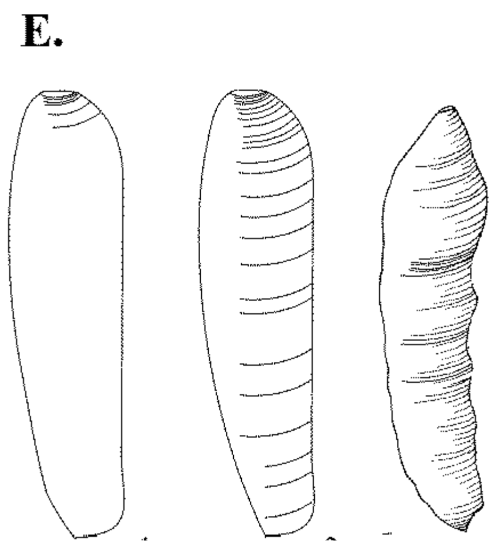


Figure 4.6: Blade ventral ripple attributes. E1: Smooth ventral surface. E2: Visible ripples. E3: Pronounced ripples.

However, ripples may appear on blades detached by pressure if the core is not firmly immobilised, resulting in movement during detachment. If a knapper has not sufficiently prepared the core front or platform, this may also contribute to inducing ripples (Pelegrin 2006:42).

Bulb morphology (F)

The morphology of bulbs (figure 4.7) may offer valuable insight into the fracture dynamics of blade detachment, thus indicating which technique was employed. Relatively large and pronounced bulbs usually indicate direct percussion with a hard stone hammer. Direct percussion with a soft stone/organic hammer will generally induce less pronounced bulbs, while lip formations will be more frequent. The presence of both a bulb and lip formation are considered results of either indirect percussion or pressure (Sørensen 2006j:27). Experimental research has shown that it is possible to distinguish between indirect percussion and pressure based on the morphology of the bulb.

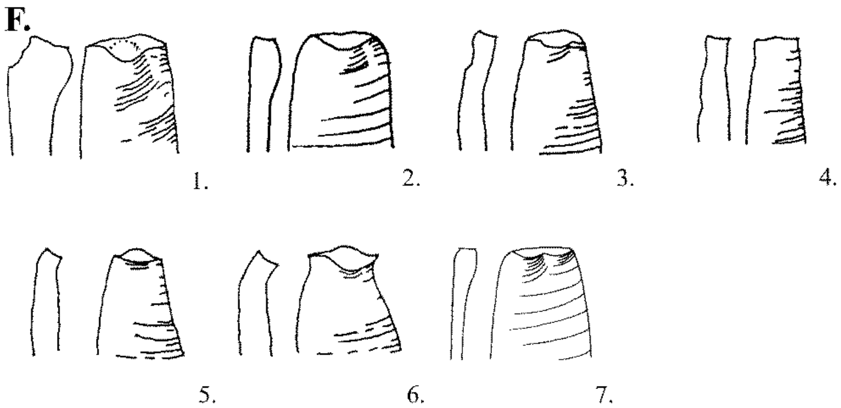


Figure 4.7: Bulb morphology attributes. F1: Pronounced bulb. F2: Bulb. F3: Bulb and lip formation. F4: No bulb or lip. F5: Lip formation. F6: Pronounced lip formation. F7: Double bulb.

A short, thick bulb indicates pressure, while a longer, more diffuse bulb indicates indirect percussion (Newcomer 1975:98; Pelegrin 2006:47). The formation of a double bulb typically indicates a broad hammer that has created a double impact, or a consecutive impact following a failed detachment (Sørensen 2006j:27).

Bulbar scars (G)

A common hallmark of fracture dynamics is bulbar scars (figure 4.8). Any technique can produce a bulbar scar. Bulbar scars on blades detached with direct hard percussion are usually pronounced (Inizan, et al. 1999:74).

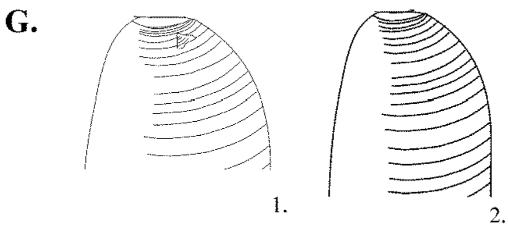


Figure 4.8: Bulbar scar attributes. G1: Scar. G2: No scar.

When comparing products of indirect percussion and pressure, it has been shown that scars occur more frequently when employing indirect percussion (Pelegrin 2006:47). Experimental research on pressure blade production has also shown that the presence of bulbar scars on pressure blades may differentiate according to the mode of production (Pelegrin 2012:487).

Conus formation (G)

This formation of this attribute is associated with impact and fracture dynamics (Inizan, et al. 1999:131). A conus formation (figure 4.9) is typically associated with the use of hard stone hammers (Sørensen 2006j:27), and unlike bulbar scars always starts at the point of impact. The appearance of conus formations is very much dependant on material quality. These formations appear more frequently on glassy, fine-grained material. If a material is glassy enough, a conus formation may appear as a ringed crack on the butt or ringed crack with ventral fissures when using soft hammer modes of production. The most severe conus formations cause a detachment of the bulb (*esquillement de bulbe*). This might occur during production with hard hammer modes. The production of blades by pressure modes of production does not yield conus formations (Newcomer 1975:98).

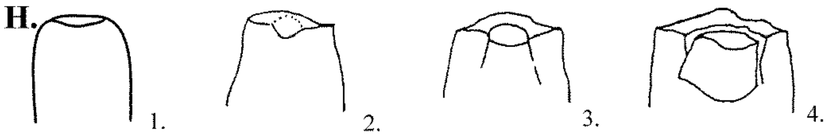


Figure 4.9: Conus formation attributes. H1: No conus formation. H2: Ringed crack on butt. H3: Ringed crack on butt with ventral fissures. H4: Detached bulb.

Butt morphology (I)

The size and shape of a butt is a signifier of mode of force (figure 4.10). Butt morphology is attributed relative to the size of the blade. This attribute must be analysed in relation to blade frontal edge and butt preparation attributes, in order to infer methods and techniques employed by the knapper (Sørensen 2006j:27). A large butt surface is typical for hard hammer modes. Soft hammer modes, specifically direct soft percussion, can be related to punctiform (I6), thin oval or broken butts. Small and thick, and thin oval butts may indicate indirect percussion. Butt size can also

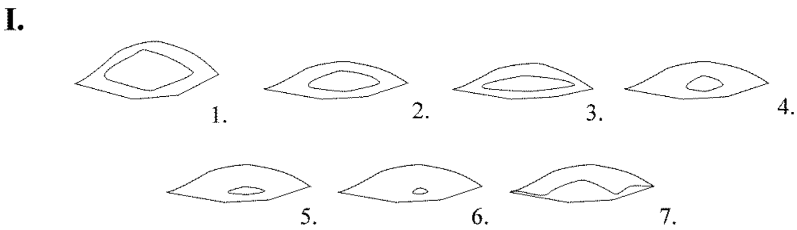


Figure 4.10: Butt morphology attributes. I1: Large butt. I2: Large oval butt. I3: Thin oval butt. I4: Small thick butt. I5: Small butt. I6: Punctiform butt (less than 1 mm). I7: Broken butt.

be determined by the weight and stiffness of a punch/pressure tool. A typical trait for pressure blades is small, orthogonal butts (Pelegrin 2012:484).

Butt preparation (J)

An important aspect of any knapping method is the shaping and preparation of the platform (figure 4.11).

Figure 4.11: Butt preparation attributes. J1. Plain butt. J2. Two facets. J3. More than two facets.

Examining the butt of a blade can supply information as to how the knapper prepared the core platform prior to the detachment. The relative amount of plain versus facetted core platforms should not be inferred based on blade butts. A possibility that small blades with a minute plain butt have been detached from facetted platforms is assumed.

Blade preparation (K)

This attribute category (figure 4.12) entails any frontal edge preparation of a core prior to detachment of a blade. The purpose is to strengthen the platform edge, removing overhangs from previous blade removals, and adjust the angle between the platform and the face of the core. Blade preparation can offer information on technique and method (Sørensen 2006j:27-28). A minute abrasion of the overhang on small blades is associated with modes of pressure technique (figure 4.1) (Pelegrin 2012:483).

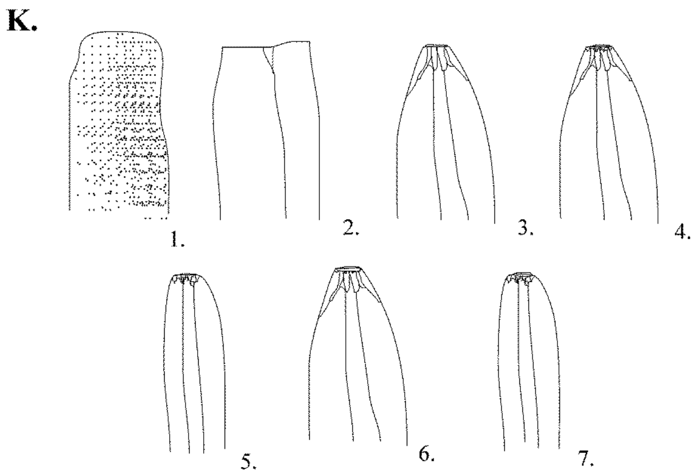
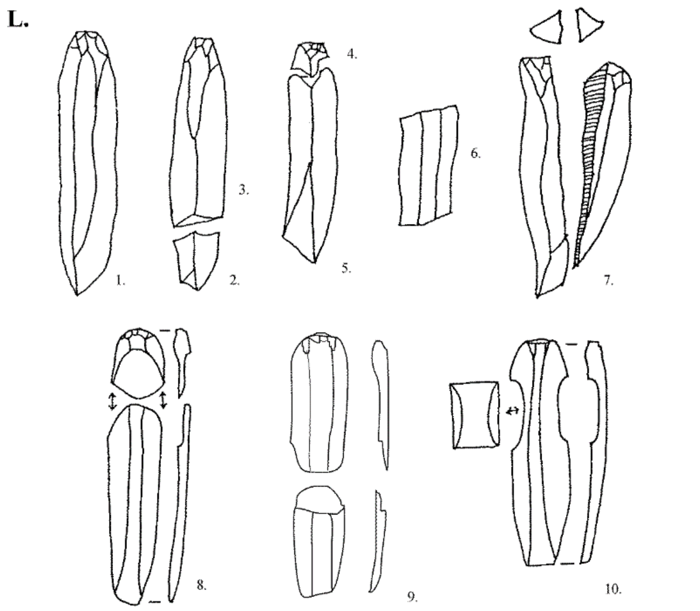


Figure 4.12: Blade preparation attributes. K1. Unprepared w/ cortex. K2. Unprepared. K3. Dorsal trimming. K4. Dorsal trimming and abrasion. K5. Dorsal abrasion. K6. Dorsal trimming, abrasion and grinding. K7. Dorsal abrasion and grinding.

Blade fragmentation (L)



Distal. L3: Long proximal. L4: Small proximal. L5: Long distal. L6: Medial. L7: Split cone fracture. L8: Proximal fracture languette. L9: Distal fracture languette. L10: Fracture nacelle.

The fragmentation of blades (figure 4.13) may be related to skill, mode of production, techniques for core fixation, or post-depositional events such as trampling. Distal fragmentation is commonly seen on thin blades that have been detached by a soft mode, due to vibrations occurring during detachment (Sørensen, personal communication 2015). A split cone fracture may occur when employing hard hammer modes of production (Sørensen 2006j:32). Fractures *en languette* may occur as a result of several factors, such as an unfavourable spreading of the impact wave resulted by material heterogeneity, detachment from a distally supported core, or by an excessive amount of force delivered at impact (Bordes 1970; Lenoir 1975:132; Sørensen 2006j:32). Fragmentation resulted by a *nacelle* fracture are rare, but has been related to soft modes of production (see Bordes 1970).

Measurements (M)

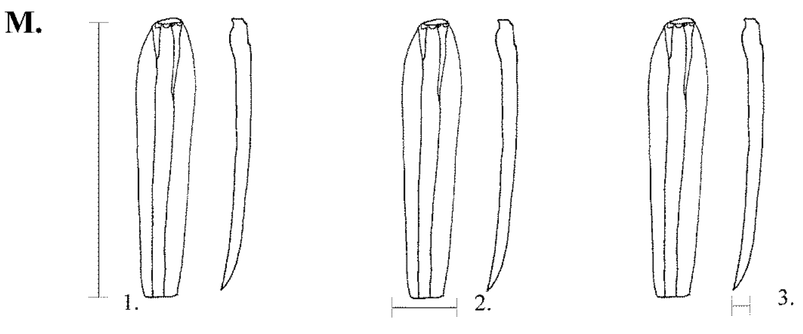


Figure 4.14: Blade measurement attributes. M1: Maximum blade length. M2: Maximum blade width. M3: Maximum blade thickness.

Blade measurements (figure 4.14) may be related to the goals of the knapper in relation to the *schéma opératoire*. Although blade measurements is considered a poor diagnostic trait to identify different modes of force (see section 4.1), research on pressure modes of production has indicated a relation between specific pressure techniques and the width and length of blades (Pelegrin 2012). As such, the measurements of blades may help to indicate variations within pressure blade production.

Raw material availability and quality may also influence blade size. The size of the blades should be able to give an idea of how large the cores may have been at an earlier stage of reduction. By comparing the average measurements of the different material groups, inferences on why certain blades were selected for modification should be possible (Andrefsky 1994:23; Manninen and Knutsson 2013:95). However, recent experimental research suggests that raw material qualities and availability does not automatically determine the outcome of lithic production (see Eren, et al. 2014)

4.2.2 Core classification

Platform preparation (N)

The preparation of a blade core platform (figure 4.15) can be an integral part of its production method, as well as a strategy for correcting errors during production. The faceting of platforms occurs frequently between the detachments of blades (Inizan, et al. 1999:151). Facetted blade core platforms is a diagnostic feature of the pressure blade concept (Sørensen, et al. 2013:6).

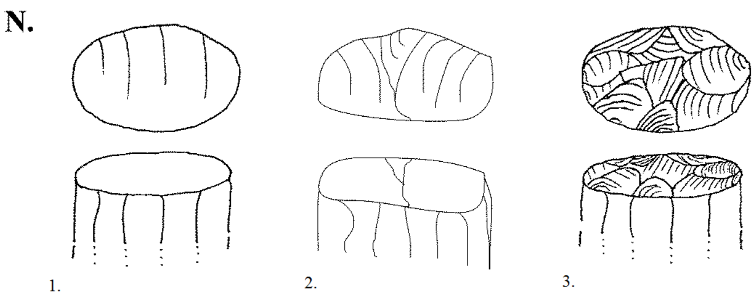


Figure 4.15: Platform preparation attributes. N1: Smooth platform. N2: Platform with large facets. N3: Systematically multifaceted platform.

Core morphology (O)

For the classification of core morphology (figure 4.16), it is important that I address the issue of the dynamic nature of core shapes throughout production. The core shape throughout the production of blades is determined by both applied knapping methods and the *schéma opératoire*. Raw material size and condition are other factors that should be

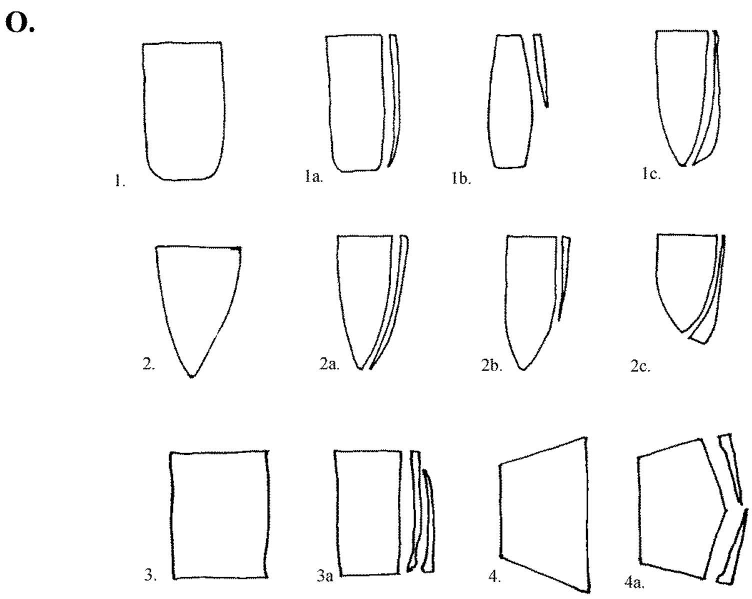


Figure 4.16: Core morphology attributes. O1 (a-c): Single platform, subconical blade core. O2 (a-c): Single platform, conical blade core. O3 (a): Dual platform, cylindrical blade core. O4 (a): Dual platform, prismatic blade core.

considered when analysing the size of cores (see Eren, et al. 2014; Manninen and Knutsson 2013).

It is important that core morphology and the technological characteristics seen in the associated debitage is related. This may be achieved by comparing the cores with other diagnostic materials from blade production, mainly the blade debitage/tools and core rejuvenation flakes. The optimal way of ascertaining the morphology of the core through the process of production would be to refit blades and/or rejuvenation flakes with the cores. I will, however, rely upon *mental refitting* to establish the relationship between the cores and debitage (see part 3.2).

Core front exploitation (P)

Core front exploitation (figure 4.17) simply refers to the area of the core where continuous blade removals have been made. The area for frontal exploitation may have been chosen due to the original morphology of the raw material, as well as its quality. Frontal exploitation is also closely related to concept of production, and the means by which knappers exploit the front of cores often comes to define technological traditions (e.g. conical cores, keeled cores, wedge shaped cores etc (Sørensen, et al. 2013; Tabarev 1997; Vang-Petersen 1993)). For this reason, corresponding the observations of raw material morphology, core morphology and core front exploitation should allow valuable insight into the knappers' desired methods of production. As such, frontal exploitation will indicate to which degree a knapper adhered to a concept of production, even in face of variable raw material quality.

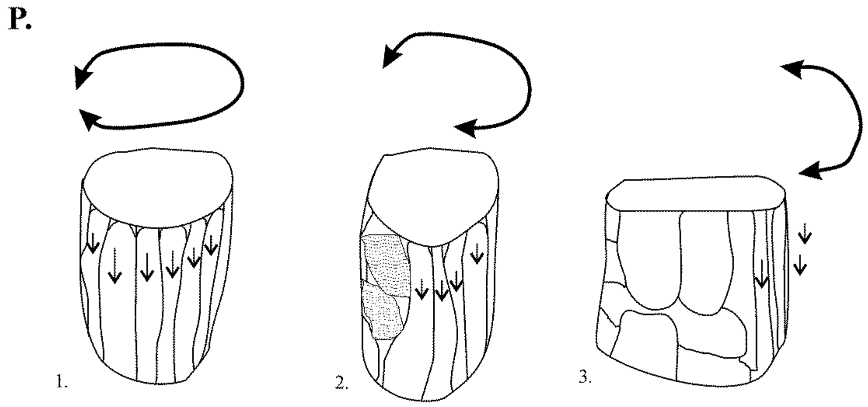


Figure 4.17: Core front exploitation attributes. P1: Circular exploitation. P2: 3/4 circular exploitation. P3: Single front exploitation.

Core platform-front angle (Q)

The angle of the core platform relative to the core front (figure 4.18) may help to identify possible methods, modes and techniques of blade production (e.g. Altınbilek-Algül, et al. 2012; Callahan 1984). Cores that have been subjected to pressure modes of production often exhibit an angle of over 90°. A core angle of ca. 90° may be the result of any technique, although it has been suggested as an indicator for indirect percussion. An angle less than 90° are usually considered indicative of either hard or soft modes of production (Eigeland 2014:236; Sørensen 2006j:32), but may also be associated with pressure (Altınbilek-Algül, et al. 2012:168-170).

Q.

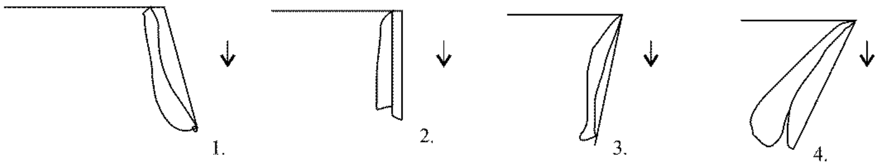


Figure 4.18: Core platform-front angle attributes. Q1: >90. Q2: 90. Q3: c. 80. Q4: <70.

Core platform rejuvenation (R)

Typical waste material from platform rejuvenation is dependent on the desired platform surface (figure 4.19). To produce a smooth platform, a single removal is performed. This diagnostic removal is termed a core tablet. When a facetted surface is preferable, several small flake removals are made. These flakes are typically hinged (Sørensen 2012a). In the present study, I will not include preparation/rejuvenation flakes in the classification database. I will instead follow the classification of these artefacts made by the excavators (Solheim and Olsen 2013), and look over the material in order to produce a subjective general observation.

R.

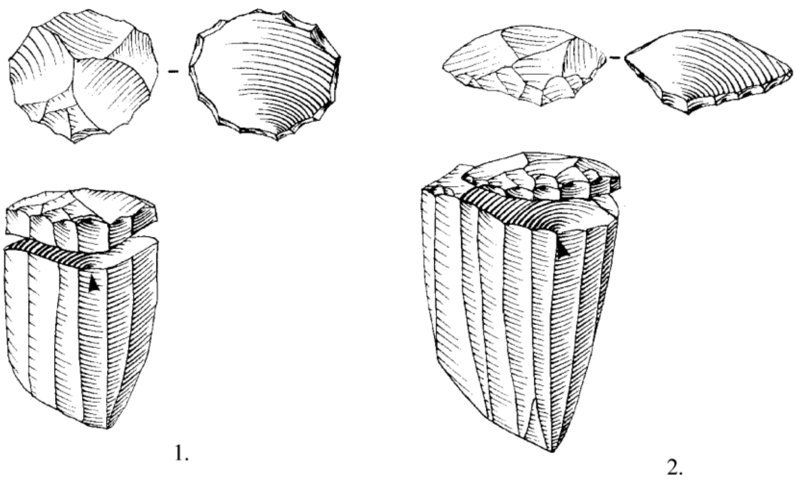


Figure 4.19: Platform rejuvenation attributes. R1: Core tablet R2: Platform preparation flake.

Core front rejuvenation (S)

This category refers to any form of core rejuvenation except platform rejuvenation. The purpose of core rejuvenation may be to repair and correct mistakes, or to reorient the core between sequences of blade production. Several types of flakes can result from this (figure 4.20), defined as front, distal and side rejuvenations. Rejuvenation flakes can be valuable indicators of core type or production method/concept. As with platform rejuvenation/preparation flakes, I will not classify these artefacts Instead I will rely upon the documentation made by the excavators (Solheim and Olsen 2013), as well as my own observations of the material.

S.

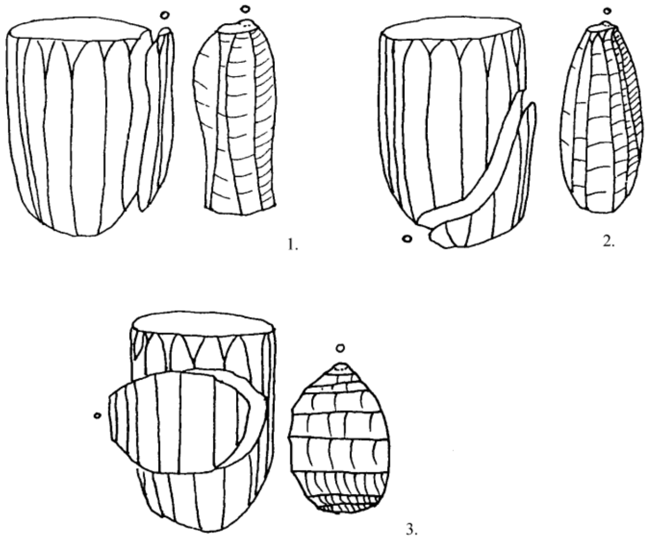


Figure 4.20: S1: Front rejuvenation flake. S2: Distal blade core rejuvenation flake. S3: Side rejuvenation flake.

Core measurements (T)

The size of cores (figure 4.21) does not necessarily indicate which technological concept they belong to, due to cores often being exhausted in one way or another when left. The size of cores may help indicate raw material availability and exploitation at the site. Cores classified as being preforms may provide information on the earlier stages of blade production. Preforms may have been left behind by the knappers for later use, or it might be that the condition of the nodule did not meet the standards of the knapper. In turn, this could indicate the availability of raw material (Eigeland 2014:141, Figure 6.12).

T.

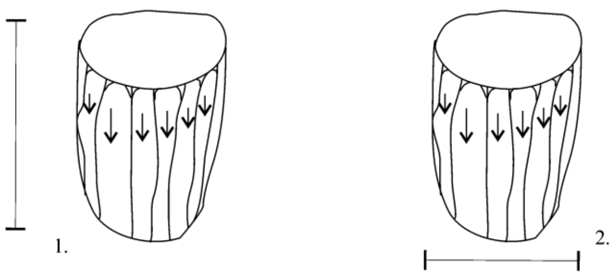


Figure 4.21: Core measurement attributes. T1: Maximum core height. T2: Maximum core width.

Summary

In this chapter I have introduced the employed terminology and definitions that will serve as the analytical parameters of the present study. The first part presented terms of special significance along with their definitions and hierarchy. Part two of the chapter saw the introduction of every single attribute category of the employed classification. By now, I have outlined and organised both the conceptual and analytical framework of the study. The next step will be to present the results of the material analysis. This will be the purpose of the following chapter.

Chapter 5 Results of the technological analysis

In this chapter, the results of the technological classification will be presented. As stated earlier, only material related to blade production and associated debitage have been included in the present analysis. The classified material was sorted into four groups, according to stage of production: unmodified blade debitage, modified blade debitage, tools (microliths, borers, scrapers), and cores. Each piece of the selected material was registered in a database with its own number. The complete database can be acquired upon request. A table over the raw material variations observed in the investigated material is available in Appendix B.

The following sections will present the results according to the relevant technological attributes. The technological attributes are identifiable macroscopic features, as described in the previous chapter (also see Appendix A).

During the analysis, certain attribute categories of the classification demanded strict criteria to be set. This impelled considerations as to which pieces should be included. As a result, there will in some cases be a discrepancy between the total amount of pieces of a material group and the amount included in specific attribute categories. The selection criteria will be explained within each respective section.

5.1 Blade debitage

The classification of debitage has been separated into two groups: unmodified blade debitage and modified blade debitage. I wish to stress the possibility that seemingly unmodified material may well have served a material purpose similar to various artefacts one would typify as tools (see e.g. Clarkson, et al. 2014; Jensen 1986). The division is merely an analytical measure, in order to allow additional patterns within the material to be distinguished. Each attribute category within the will feature a graphic presentation of the results, complemented by a short summary.

5.1.1 Unmodified blade debitage

Due to the highly fragmented material (figure 5.1), an appraisal of which pieces should be included was considered necessary As such, only specimens that have retained a proximal extremity have been classified in this material group. This decision was made to mitigate the chance of duplicate counts. The selection of unmodified blade debitage would then represent a minimum amount of produced blades. The amount of classified unretouched blade debitage numbered 560.

Figure 5.1: A selection of unmodified blade debitagé from Hovland 3 in Larvik, Vestfold. Photo by author.

Dorsal features

The blades display parallel scars struck from a single direction, in addition to a tendency for the scars to intersect at the distal end. A number of artefacts feature scars from opposing removals. The blades feature a wide variety of dorsal features, with nine out of eleven categories

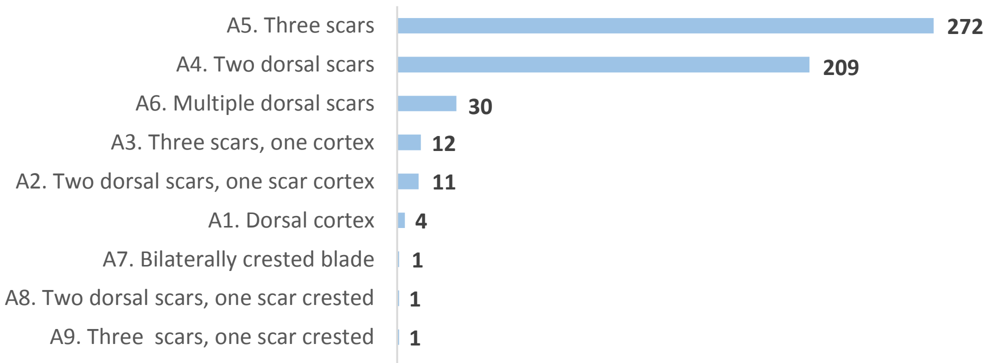


Figure 5.2: Dorsal features seen among investigated unmodified blades from Hovland 3 in Larvik, Vestfold (n=560).

represented (see figure 5.2). The majority of blades feature a dorsal face with two, three or multiple scars. Crested blades were few, but did however provide information about frontal core preparation. There is a significant discrepancy between the number of blades with several dorsal scars, and blades with cortex and/or cresting.

Blade termination

Very few blades allowed classification according to blade termination, due to the high level of fragmentation in the assemblage. A total amount of 23 specimens was classified – all of them complete.

Figure 5.3 illustrates that the majority blades were classified as having an 'ideal' termination. Four specimens were classified as being feathered, three specimens as plunged, and only a single specimen is hinged. In addition to the classification, a general examination of the assemblage was made. Few blades exhibited knapping errors. However, a tendency for distal extremities to narrow towards the end of the removal could be observed.

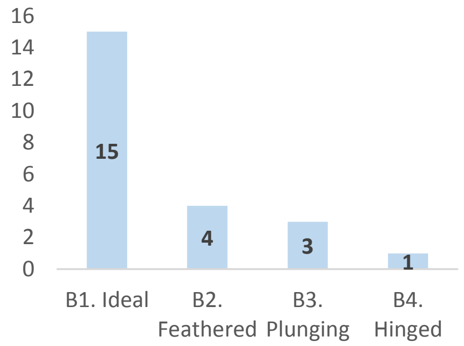


Figure 5.3: Blade termination seen among unmodified blades from Hovland 3 in Larvik, Vestfold. (n=23).

Blade curvature

In the investigated material, the absence of distal extremities on blades is considerable (see section below on fragmentation). Thus, careful considerations was made when choosing specimens suitable for classifying curvature. Only specimens classified as a complete or long proximal piece are included in this category (n=85). Figure 5.4 illustrates that the majority of blades are straight, while distal curvature is least represented. Eighteen blades feature a ventral 'belly'.

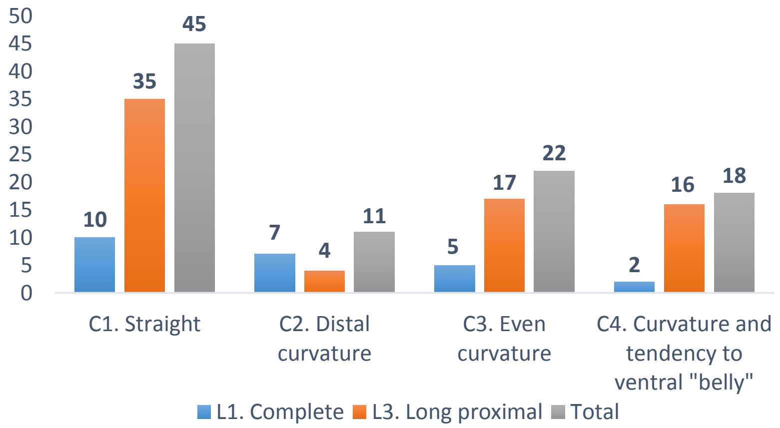


Figure 5.4: Blade curvature featured by investigated unmodified blades from Hovland 3 in Larvik, Vestfold (n=85).

Regularity

A number of proximal specimens (129) could not be classified in this category, due to fragmentation. The blade assemblage from the locality displays almost exclusively regular or extremely regular blades, as seen in figure 5.5. Thus, the classification corresponds well with the observations made by the excavators (Solheim and Olsen 2013:209).

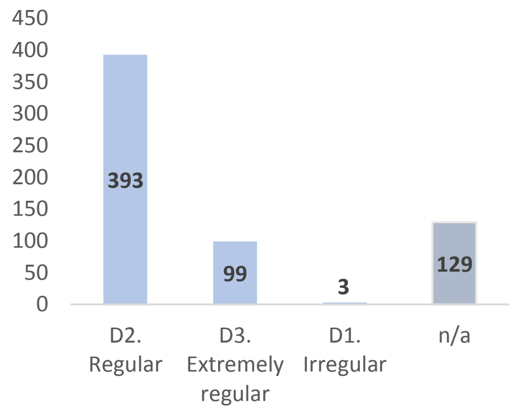


Figure 5.5: The regularity among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Ventral ripples

Blades with a smooth ventral surface constitutes a significant majority (figure 5.6). A fair amount of blades with visible ripples was identified. Conversely, the amount of blades featuring pronounced ripples is almost insignificant.

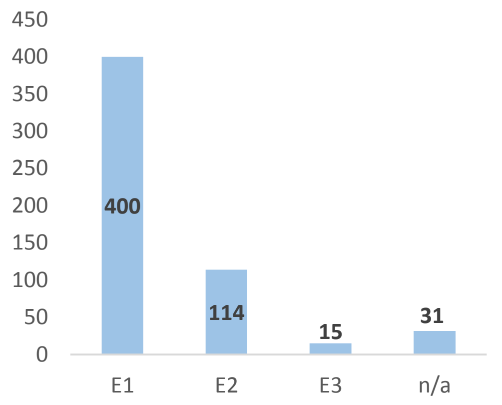


Figure 5.6: Ventral ripples featured among investigated unmodified blades from Hovland 3 in Larvik, Vestfold (n=560).

Bulb morphology

In the investigated material, a lip formation is featured on the majority of unmodified blades (figure 5.7). A significant number of blade with lips also have a bulb.

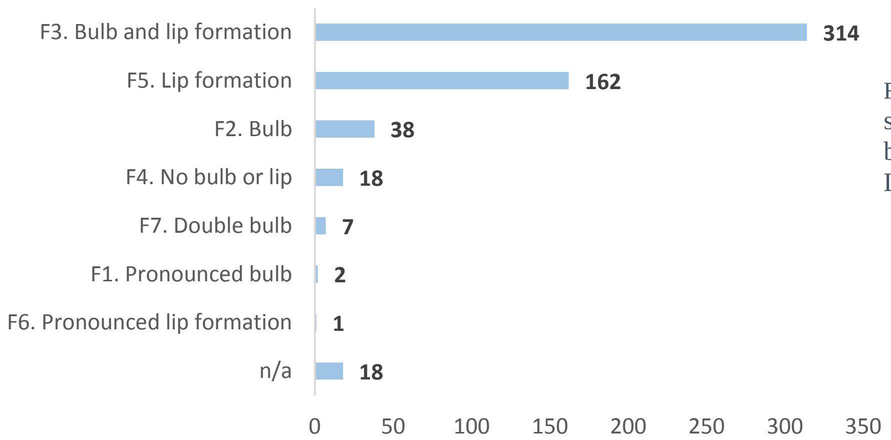


Figure 5.7: Bulb morphologies seen among unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Bulbar scars

The investigated unretouched blades featured almost as many blades with and without bulbar scars (see figure 5.8).

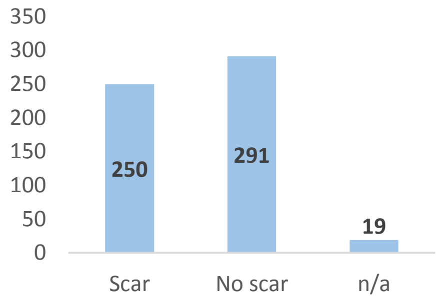


Figure 5.8: The presence of bulbar scars among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Conus formation

The absence of conus formations is notable, as seen in figure 5.9. A relatively small number of blades featured any traces of fracture damage. 32 pieces could not be classified in this category, due to raw material quality or alteration.

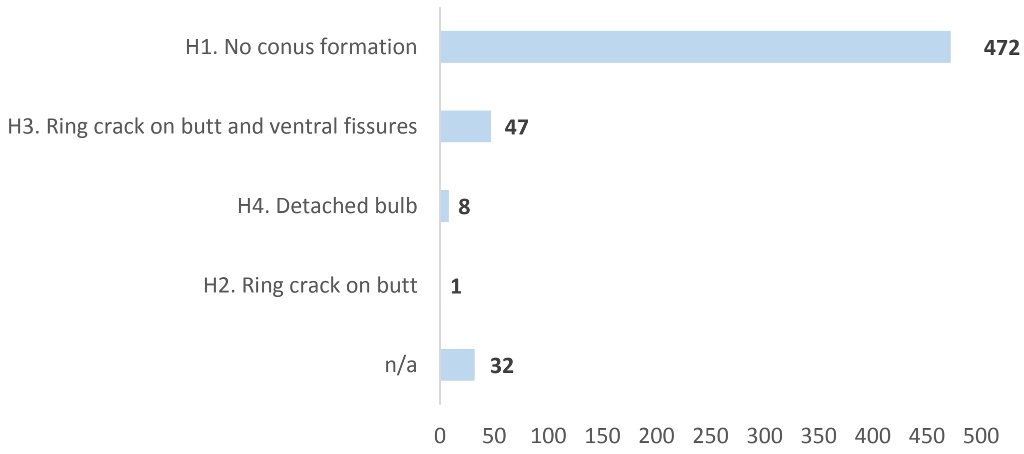


Figure 5.9: Conus formations seen among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Butt morphology

A variety of butts was observed among the unmodified blades, as can be seen in figure 5.10. The butts are generally of a small size. Oval/orthogonally shaped butts were commonly observed.

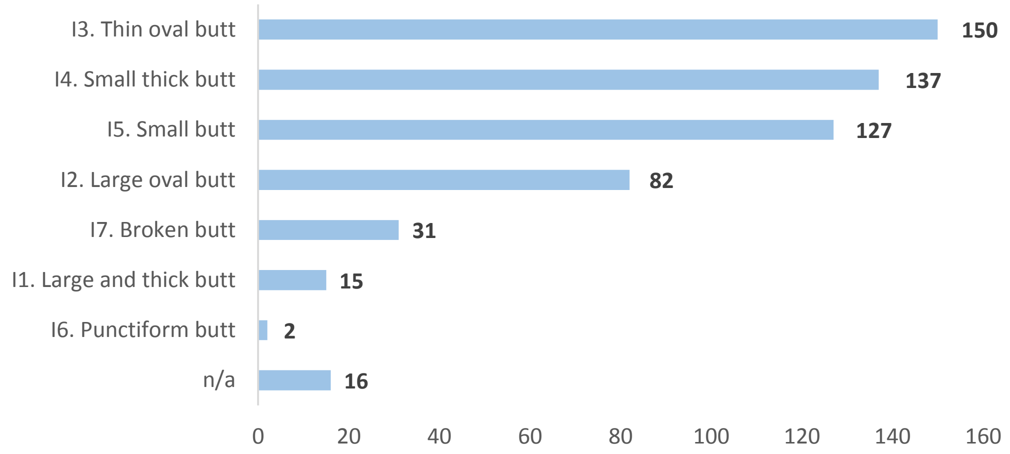


Figure 5.10: Butt morphologies seen among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Butt preparation

Figure 5.11 shows that the majority of blades feature plain butts. A total of 124 blades feature butts with two or more facets. At face value, these results would indicate that cores were not facetted as part of platform preparations. However, the size of the blades must be taken into consideration (see M. Measurements).

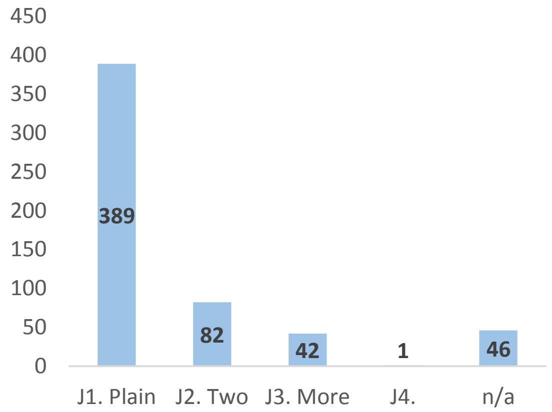


Figure 5.11: Butt preparation seen among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

Blade preparation

The most common means of blade preparation is abrasion of the overhang (figure 5.12). Trimming is also seen, but almost exclusively in combination with abrasion. Only 15 specimens was classified as having no frontal blade preparation. The frontal edge preparation of blades is generally observed as being slightly rounded.

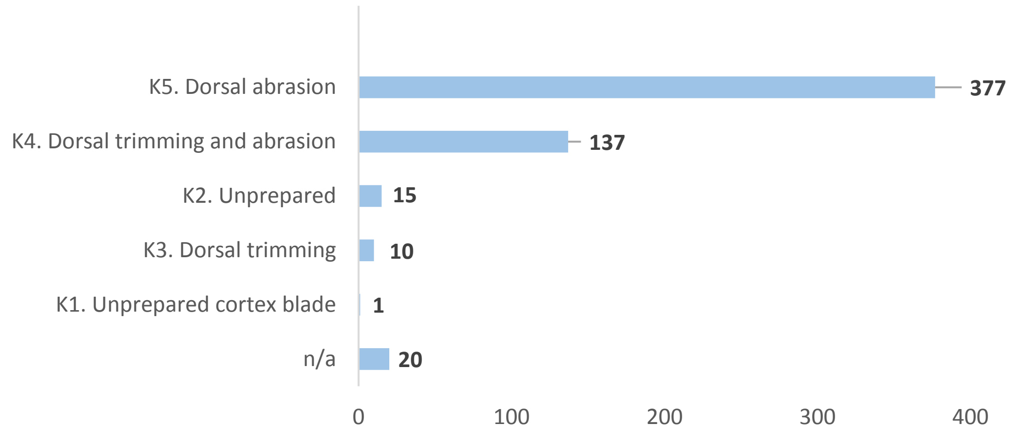


Figure 5.12: Blade preparation seen among investigated unmodified blades from Hovland 3 in Larvik, Vestfold (n=560).

Blade fragmentation

As was stated earlier, a prominent characteristic of the blade assemblage is the high level of fragmentation. A general tendency for perpendicular fragmentation of blade was easy to recognise. This tempted the presumption that traces of intentional snapping of blades would be frequent. However, the possibility of the assemblage being trampled was not excluded (e.g. Conard, et al. 1998; Flenniken and Haggerty 1979; Pryor 1988; Shea and Klenck 1993).

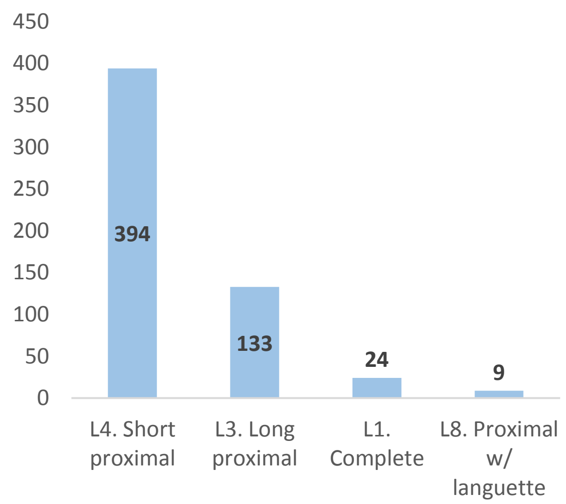


Figure 5.13: Blade fragmentation observed among investigated unmodified blades from Hovland 3 in Larvik, Vestfold. (n=560).

The relative amount of specimens classified as short proximal is significant (figure 5.13). While 133 specimens were classified as long proximal, only 24 was classified as being complete. Nine specimens featured a *languette*.

Effects of trampling are seen to be minimal. The blades generally exhibit clear transversal breakage (see figure 5.1 for examples).

Measurements

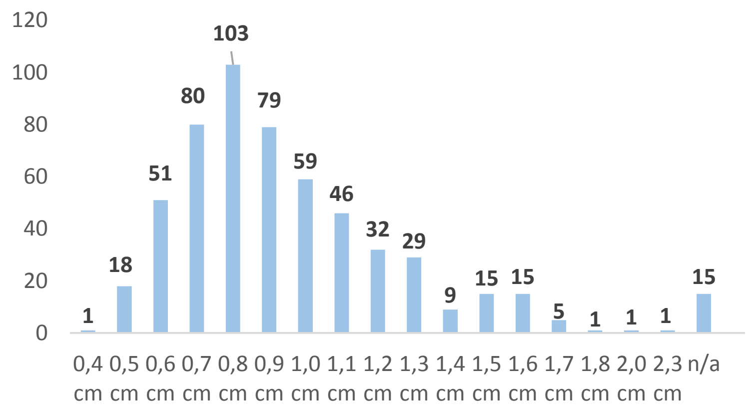


Figure 5.15: Blade width measurements of unmodified blades from Hovland 3 in Larvik, Vestfold. Average width = 0,93 cm.

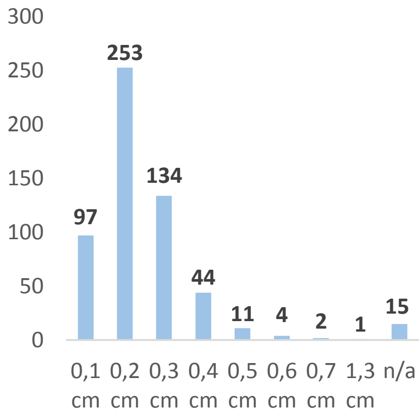


Figure 5.14: Thickness measurements among unmodified blades from Hovland 3 in Larvik, Vestfold. Average thickness = 0,23 cm.

The bulk of the blade material width measures between 0,6 and 1,1 cm (figure 5.15). The average width of blades is 0,93 cm. The majority of blades had a thickness between 0,1 and 0,3 cm (figure 5.14). The average thickness is 0,23 cm.

5.1.2 Modified blade debitage (n=226)

In the present analysis, modified blade debitage refers to debitage featuring retouch, possible edge damage from use, and remains of mastic. This section was made for the purpose of separating the artefacts with definite or possible traces of human modification that could not be typified as tools. In the following chapter the possible presence of certain tool types in this category will be discussed. An important aspect of the analysis of the modified blade assemblage is to trace any possible traits that may help to discern specific choices of material deemed suitable for modification, and how this material is distinguishable from the unmodified material. The total amount of material included in this section is 226.

Dorsal features

Seven out of eleven attributes of this category are represented among the modified blade material (figure 5.16). As with the unmodified blade debitage, the majority of modified blades feature two, three or multiple scars.

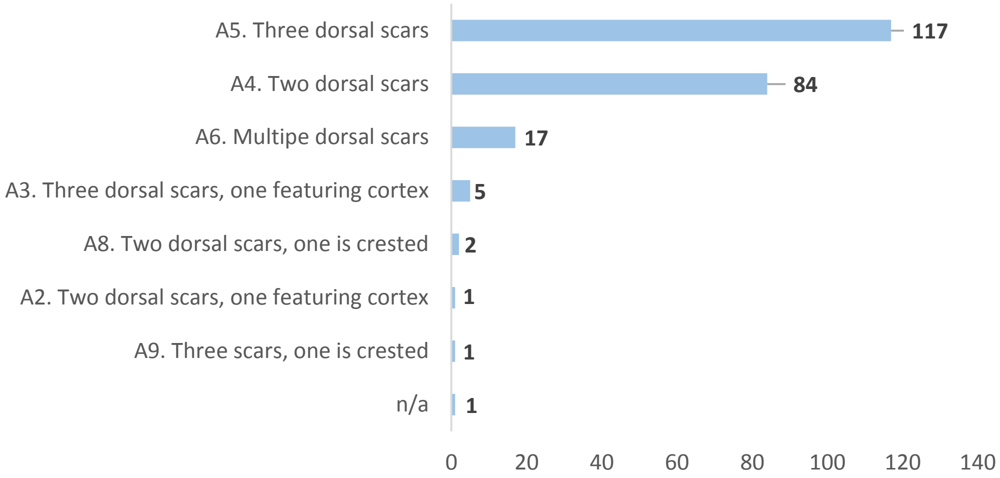


Figure 5.16: Dorsal features seen among modified blade debitage from Hovland 3 in Larvik, Vestfold. (n=226).

Regularity

Among the modified blades, very few blades was considered to be extremely regular or irregular (figure 5.17). The vast majority is seen as being regular.

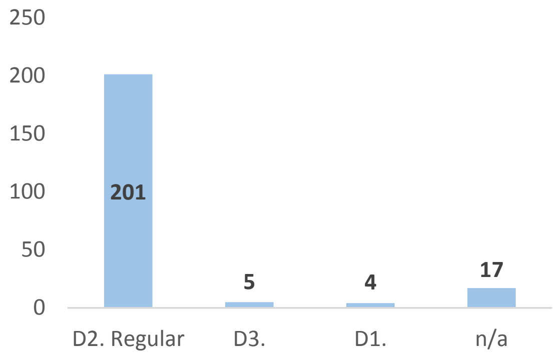


Figure 5.17: Regularity among modified blade debitage from Hovland 3 in Larvik, Vestfold. (n=226).

Ventral ripples

The variations of ventral surfaces among the modified blade debitage is similar to the variation seen among the unmodified blade debitagé. The majority features a smooth ventral surface (figure 5.18). The amount of blades with visible ventral ripples is comparably low, while the presence of blades with pronounced ripples is insignificant.

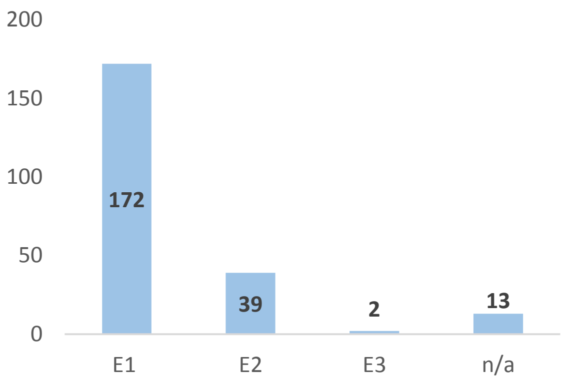


Figure 5.18: Ventral surfaces featured among modified blade debitage from Hovland 3 in Larvik, Vestfold (n=226).

Bulb morphology

The majority of modified blades featured a combination of a bulb and lip (figure 5.19). A number of specimens also featured either a lip formation or bulb. Only two specimens indicated neither.

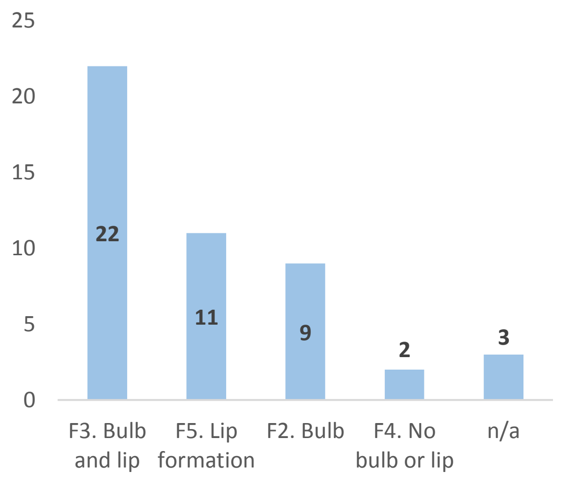


Figure 5.19: Bulb morphologies seen among modified blade debitagé from Hovland 3 in Larvik, Vestfold (n=47).

Bulbar scars

The relative frequency of bulbar scars among within this material group (figure 5.20) is similar to the unmodified blade debitage.

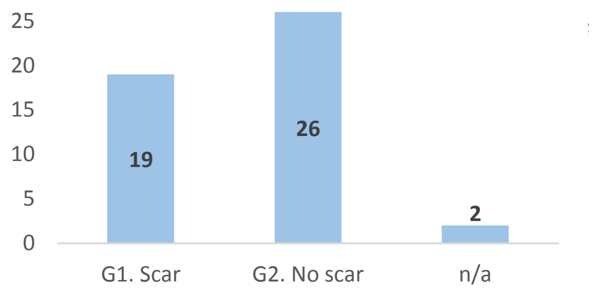


Figure 5.20: Bulbar scars featured on modified blade debitage from Hovland 3 in Larvik, Vestfold (n=47).

Conus formation

The majority of modified blades exhibited no conus formation (figure 5.21). Three blades featured ventral fissures along with a ring crack, while only one blade exhibited a detached bulb.

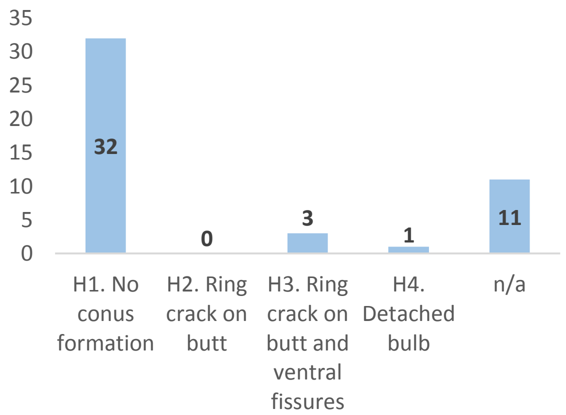


Figure 5.21: Conus formations seen among the modified blade debitage from Hovland 3 in Larvik, Vestfold (n=47).

Butt morphology

The majority of blades among the modified blade debitage feature small butts, but a significant number of blades also feature larger butts (figure 5.22). The relative amount of large butts is higher among the modified blades, compared to the unmodified blade debitage.

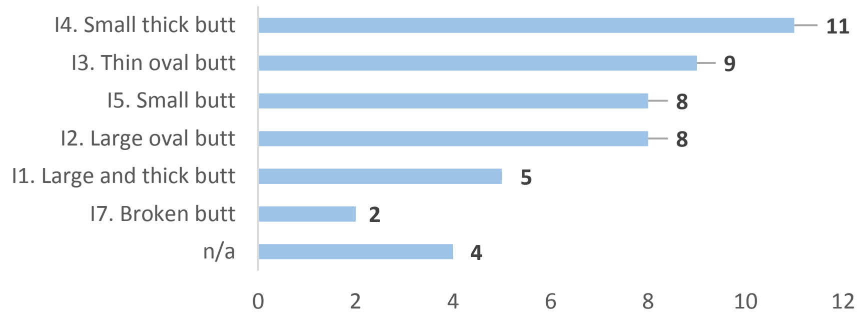


Figure 5.22: Butt morphologies seen among modified blade debitagé from Hovland 3 in Larvik, Vestfold. (n=47).

Butt preparation

The majority of modified blade debitage feature a plain butt (figure 5.23). Six butts feature more than two facets, while five exhibits only two facets.

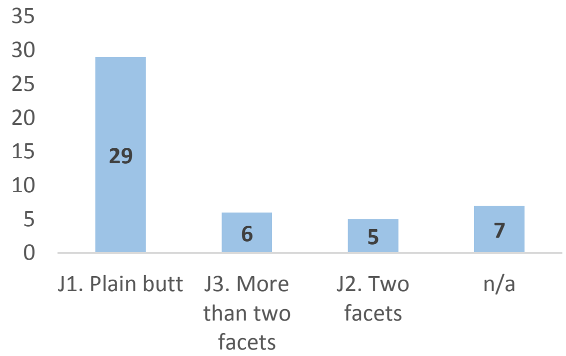


Figure 5.23: Butt preparation seen among modified blade debitagé from Hovland 3 in Larvik, Vestfold. (n=47).

Blade preparation

As was seen in the unmodified blade debitage, dorsal abrasion is in majority among the modified blade debitage, followed by twelve specimens featuring dorsal trimming combined with abrasion (figure 5.24). Dorsal trimming is seen on five blades, while there are only three unprepared blades.

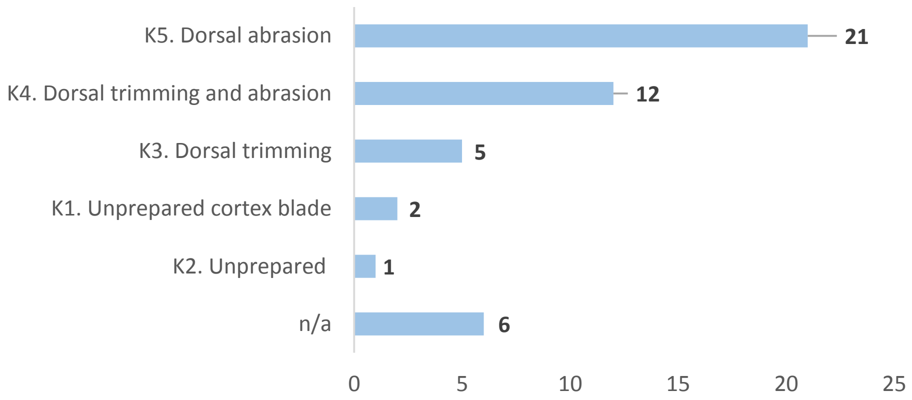


Figure 5.24: Blade preparation featured among modified blade debitagé from Hovland 3 in Larvik, Vestfold (n=47).

Blade fragmentation

Only 47 modified blades featured a proximal extremity (figure 5.25). The majority of blades have been classified as medial fragments. Indications of intentional snapping was frequently observed.

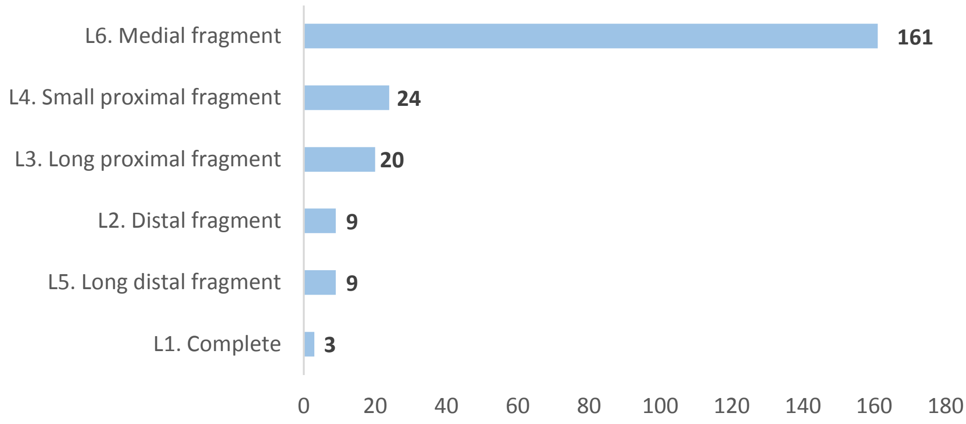


Figure 5.25: Blade fragmentation among modified blade debitagé from Hovland 3 in Larvik, Vestfold (n=226).

Measurements

Compared to the unmodified blade debitage, the majority of modified blades have a width between 0,7 and 1,1 cm (figure 5.27). The average width of the secondary worked debitage is 0,97 cm – only slightly more than the width of the unmodified debitage. The majority of modified blades have a thickness between 0,1 and 0,4 cm (figure 5.26). The average thickness is 0,24 cm.

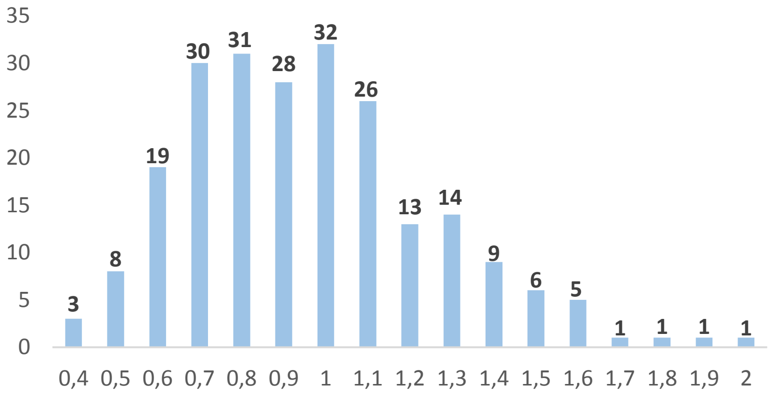


Figure 5.27: Blade width measurements of modified blade debitagé from Hovland 3 in Larvik, Vestfold. Average width = 0,97 cm (n=226).

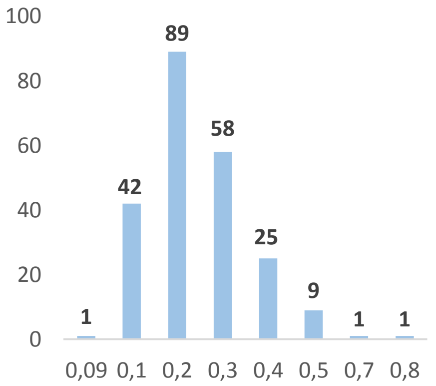


Figure 5.26: Blade thickness measurements of modified blade debitagé from Hovland 3 in Larvik, Vestfold. Average thickness = 0,24 cm (n=226).

5.2 Tools

Three types of lithic tools have been included in the technological analysis: microliths (n=17), scrapers (n=16) and borers (n=23). In Chapter 6 I will also discuss the possible presence of a blade tool referred to as 'rulers' in the assemblage (Sjöström and Nilsson 2009). The results from the analysis of blade tools will in the following sections be presented in text, rather than in figures as seen in the previous sections. This is due to the relatively small number of artefacts included in the analysis of tools. Only a select few attribute categories from the classification will be presented in figures.

Microliths

Seventeen microliths was technologically classified. As a result of considerable modification, only a few technological characteristics were visible among the specimens. The dorsal features on the microliths, seen in figure 5.28, show that blades with two or three dorsal scars are most common. One specimen feature four dorsal scars, while one specimen could not have its dorsal face classified due to retouch. The microliths have all been produced from regular blades, judging by the dorsal ridges and the lack of ventral ripples.

Figure 5.29: Two single barbed points from Hovland 3 in Larvik, Vestfold. Photo by Ellen C. Holte (KHM), edited by author.

Figure 5.29 shows two microliths typified as single barbed points ('*hullingspisser*') by the excavators (Solheim and Olsen 2013:205). The relative quality of the material is observed as being of a high standard, compared to the general blade population. The microliths from Hovland 3 have been modified with semi-abrupt retouch - diagonally or along the edge. The diagonally retouched microliths have been typified as scalene triangles ('*skjevtrekanter*') (Solheim and Olsen 2013:205). The average width of the microliths is 0,71 cm, with an even range of widths from 0,6 to 0,9 cm (figure 5.31). The

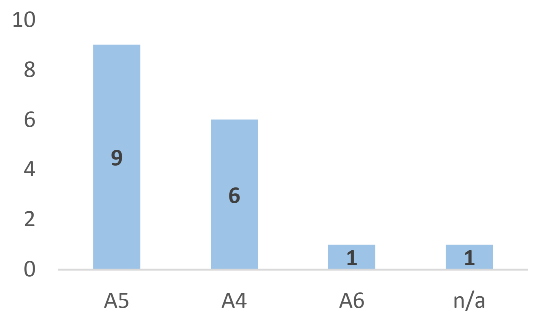


Figure 5.28: Dorsal features seen on microliths from Hovland 3 in Larvik, Vestfold (n=17).

majority of microliths have a thickness of 0,1 cm, while the average thickness is 0,16 cm (figure 5.30).

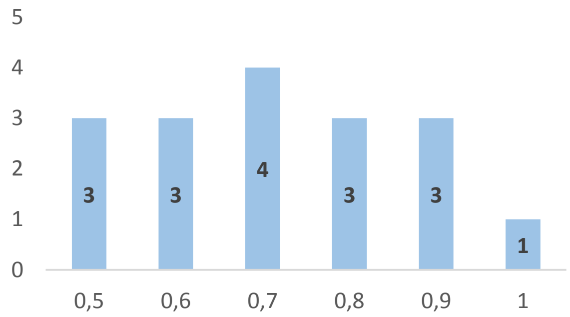


Figure 5.31: Width measurements of microliths from Hovland 3 in Larvik, Vestfold. Average = 0,71 cm (n=17).

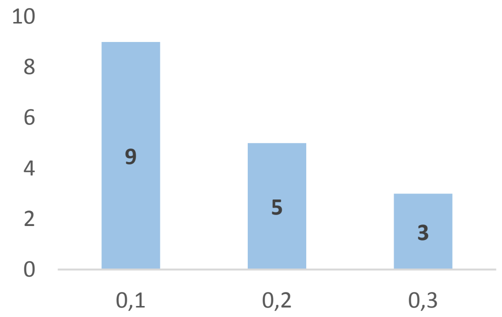


Figure 5.30: Thickness measurements of microliths from Hovland 3 in Larvik, Vestfold. Average = 0,16 cm (n=17).

Scrapers

Sixteen blade scrapers were incuded in the technological classification. The majority of scrapers exhibit dorsal features with three or more scars. Two scrapers feature a prismatic dorsal face with two scars and cortex (figure 5.32). One scraper feature bilateral cresting. All of the scrapers were classified as being regular, except two specimens that were classified as irregular and two specimens too fragmented to determine regularity. Twelve specimens featured a smooth ventral surface, while four exhibited ventral ripples. The four specimens with a proximal extremity featured a combination of bulb and lip. Two out of four specimens had a bulbar scar. Each specimen featured a different butt morphology. Dorsal abrasion was seen on all four. Twelve specimens were seen to be fragmented into either short or long pieces, with the proximal extremity missing. The four specimens with a proximal end were all long pieces. Width measurements (figure 5.34) averaged at 1,4 cm, while measurements of thickness (figure 5.35) averaged at 0,43 cm. The

Figure 5.33: Blade scraper ID2235. The scraper features abrupt retouch on the distal end, while featuring semi-abrupt on the edges. Photo by author.

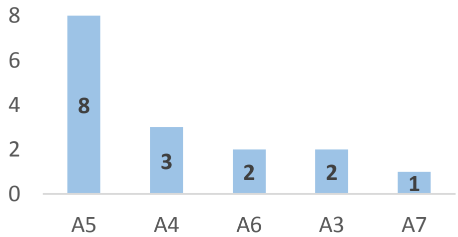


Figure 5.32: Dorsal faces featured by blade scrapers from Hovland 3 in Larvik, Vestfold. (n=16).

pieces have been modified with semi-abrupt retouch, with the occasional abrupt retouch (see figure 5.33 for an example).

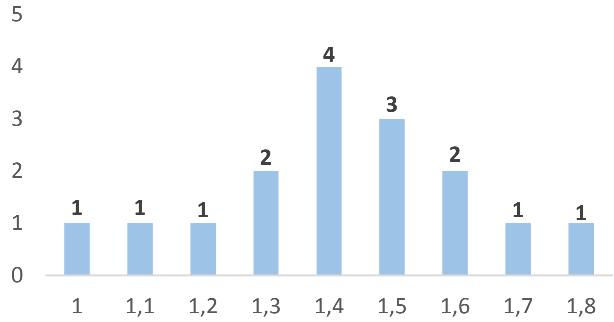


Figure 5.34: Width measurements of blade scrapers from Hovland 3 in Larvik, Vestfold. Average width = 1,4 cm (n=16).

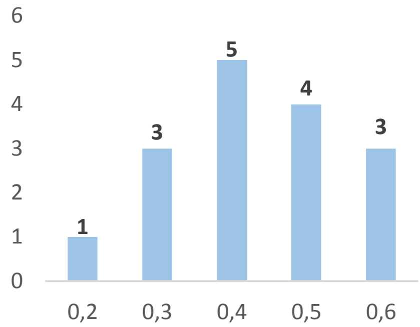


Figure 5.35: Thickness of blade scrapers from Hovland 3 in Larvik, Vestfold. Average thickness = 0,43 cm (n=16).

Borers

Twenty-three artefacts typified as borers were included in the technological classification. The dorsal faces of the borers displayed a variety of features – six out of eleven attributes were represented. Eighteen specimens featured neither cortex nor cresting, four specimens featured cresting, while a single specimen featured cortex. The borers have been generally been modified with semi-abrupt retouch. A single borer was classified as being irregular, sixteen as regular, and three specimens as being extremely regular. Due to considerable retouch, two borers could not be classified according to blade regularity. Thirteen borers feature a smooth ventral surface. Eight specimens feature ripples, while only a single specimen featured pronounced ripples.

As a result of retouch modification, no specimens was classified as having their original distal extremity present. Nine specimens featured a proximal extremity, while thirteen was classified as being (long) medial fragments by featuring no proximal extremity. The proximal

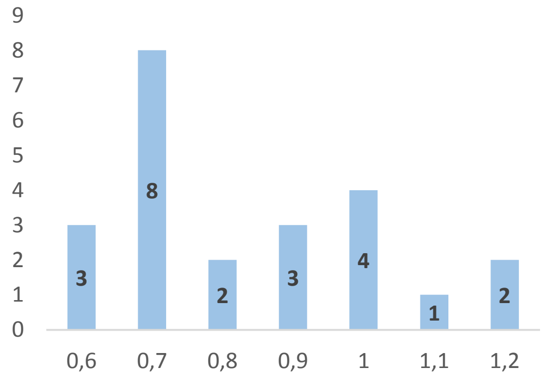


Figure 5.37: Width measurements of classified borers from Hovland 3 in Larvik, Vestfold. Average width = 0,83 cm (n=23).

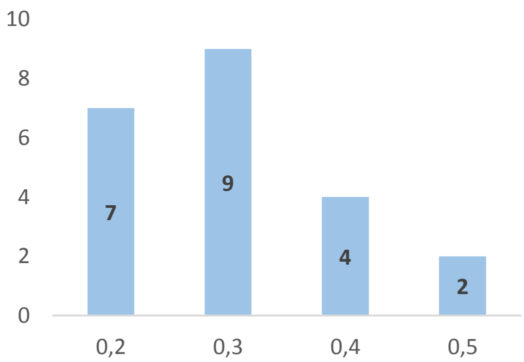


Figure 5.36: Thickness measurements of blade borers from Hovland 3 in Larvik, Vestfold. Average thickness = 0,3 cm (n=23).

specimens was seen to have generally small butts: four featured a small thick butt, two featured a small butt, two featured a thin oval butt, and only one featured a large oval butt. Four out of seven bulb morphology categories were present: four featured both bulb and lip, three featured only a lip, one featured a bulb, and one featured a pronounced bulb. None of the proximal specimens featured any conus formation. The average width of the borers is 0,83 cm (figure 5.37). The average thickness is 0,3 cm (figure 5.36).

5.3 Cores

A total of 44 complete cores were included in the technological classification. The general core assemblage had been exposed to thermal alteration, generally by heat. This had implications for the present classification. 28 of the included specimens had considerable thermal damage. A number of cores had been damaged to such an extent that they were excluded from the present classification. The classification of cores is accompanied with observations of platform flakes and core fragments.

Following the employed technological classification, two types of core morphology could be distinguished: subconical and conical. The average height measurement of the blade cores is 3,07 cm (figure 5.39). The average width measurement of the cores is 1,99 cm (figure 5.38).

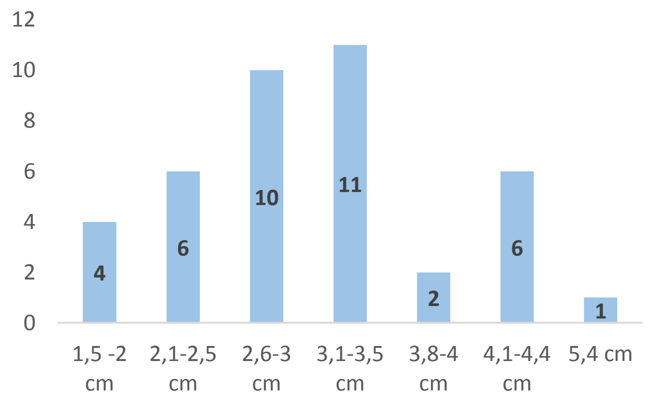


Figure 5.39: Height measurements of blade cores from Hovland 3 in Larvik, Vestfold:. Average length = 3,07 cm (n=39).

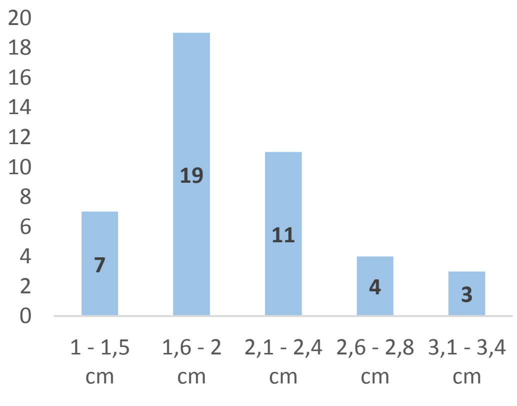


Figure 5.38: Width measurements of blade cores from Hovland 3 in Larvik, Vestfold. Average width = 1,99 cm (n=44).

Subconical cores

Seventeen cores were classified as being subconical with a single platform. The majority of cores had a morphology matching type O1a, while two cores was classified as type O1c. Four specimens had a smooth platform preparation, six had several large facets, while nine specimens had a systematically facetted platform. Six cores were classified as having ¾ frontal exploitation, and eleven had a single front exploitation. The variations of platform angles can be seen in figure 5.40. Six specimens had traces of cortex, with a surface coverage ranging between 10-20%.

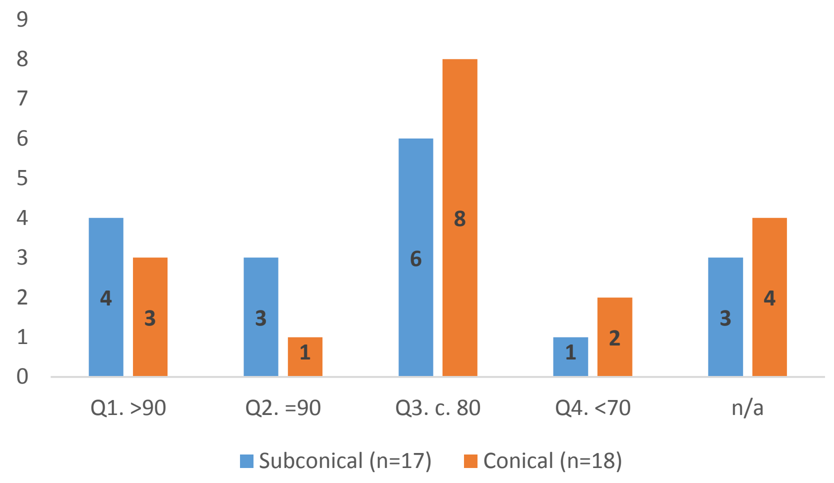


Figure 5.40: Platform angles of subconical (n=17) and conical cores (n=18) from Hovland 3 in Larvik, Vestfold. Several pieces could not be classified due to heat or frost damage.

Conical cores

20 cores was classified as conical with a single platform. 18 of these had a morphology matching type 2a, while two specimens was classified as type 2b. Seven of the conical cores had smooth platform preparation, ten had a systematically facetted platform, and one core could not have its platform classified due to burn damage. One specimen was classified as having circular exploitation, six had ¾ frontal exploitation, while eleven had a single front exploitation. The variations of platform angle can be seen in figure 40. Six specimens featured cortex, with a surface coverage ranging between 15-50%.

Platform rejuvenation flakes

Approximately 200 flakes had been typified as possibly being related to platform rejuvenation or preparation. A total of 49 artefacts were typified as definite platform flakes (Solheim and Olsen 2013:204, 209). 30 of these were typified as flakes from microblade core rejuvenation, while 14 as rejuvenation flakes from blade cores (Solheim and Olsen 2013:204). The flakes were observed to be distinctively hinged.

Core front rejuvenation

A total of seventeen artefacts were classified by the excavators as being core side fragments (Solheim and Olsen 2013:204). Fifteen specimens were registered as having been a part of microblade cores, while two were from cores that did not exhibit scars from blade production. Ten pieces had a conical shape.

My own observations of the artefacts suggested that the fragments could be classified as being core front rejuvenation flakes. The morphology of the artefacts is similar to the type S3 (side rejuvenation flake) of the present classification.

Summary

The results of the technological analysis has now been presented, following the applied schematic of the technological classification. Clear patterns are visible in each group of materials. The next step will be to interpret and relate the results. It is only by combining the results that it will be possible to distinguish the employed strategies of blade production (Sørensen 2006j). This will be the purpose of the following chapter.

Chapter 6 Interpreting the results

In the following chapter, the results featured within the four material groups of the analysis will be summarised and interpreted. Following the conceptual framework outlined in chapter 3, the material interpretation will enable me to discern patterns of prehistoric sociality within the temporally and spatially defined locality of Hovland 3.

6.1 Interpreting the unmodified blade debitage

The technological classification has provided clear indicators as to which methods and modes of force produced the unmodified blades.

The dorsal surfaces of the investigated blades have revealed that later stages of lithic production normally took place on site. The amount of cortex and the measurements of blades supports this. Only 54 specimens exhibited cortex (see figure 6.2). This suggests that knappers brought with them cores that had been procured, prepared and partially reduced elsewhere.

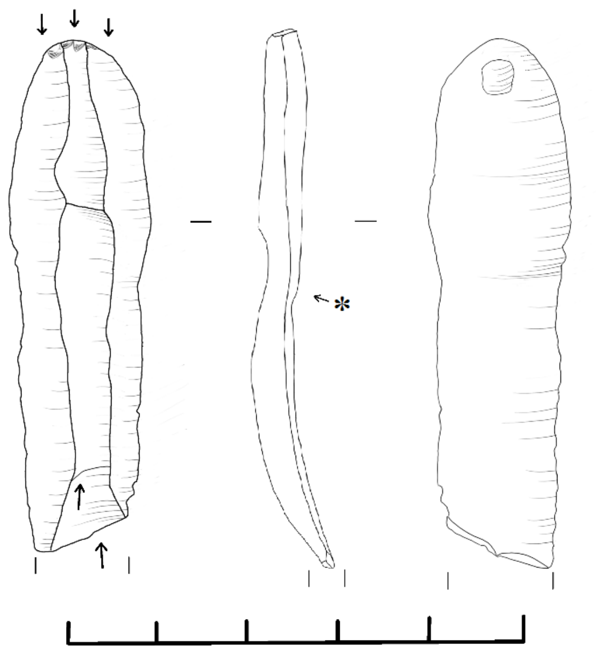


Figure 6.1: A regular blade (ID272) with a bulbar scar, a ventral 'belly' (indicated by the *) and platform abrasion. The removals at the distal end are believed to be traces of frontal core preparation (drawing by author).

Blade termination, curvature and regularity suggests that these prehistoric knappers was capable of producing regular and uniform blades throughout various stages of reduction. The blade termination among complete blade specimens have provided solid indicators of the morphology of cores. The tendency for distal extremities to narrow down is seen as an indicator of blade reduction from conical cores (Sørensen 2006j:26). Very few blades exhibited knapping errors. These observations indicate that blade production was performed by skilled knappers. However, the standardised production with a lack of knapping errors may also be attributable to the employed methods of production. The occurrence of opposing dorsal scars (see figure 6.1) – not typically associated with conical blade technology – is considered indicative of core rejuvenation rather than production from opposing platforms (see figure 6.9 for a core with traces of this type of preparation).

The curvature of blades indicates modes of production, as well as method. The presence of blades featuring ventral bellies is considered an indicator of the use of indirect percussion (Pelegrin 2006:42). The blades exhibiting this characteristic also featured other technological attributes further suggesting the use of indirect percussion. One such indicator is that the blades with ventral bellies are generally distally fragmented.

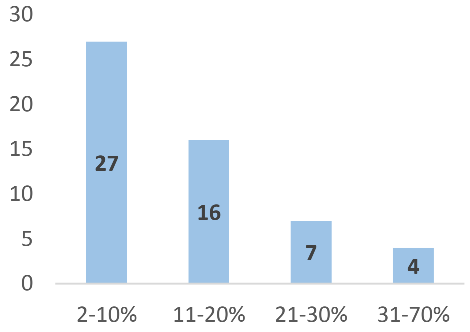


Figure 6.2: Remaining cortex on unmodified blades from Hovland 3 in Larvik, Vestfold (n=54).

There is a high level of fragmentation in the material. Based on the frequency of perpendicularly snapped fragments, this is seen as the result of two general causes: fragmentation during detachment or intentional snapping. See section 6.3 for a further assessment of snapped blades in relation to a type of burin that I have earlier referred to as ‘rulers’.

Bulb morphology, butt morphology, butt preparation, and blade preparation provided good indicators of which primary modes of force the knappers employed. A combination of a bulb and a lip formation is the most frequently observed bulb morphology. The most frequent type of butt morphology is small with the majority of blade butts featuring an unfacetted plain preparation. Few blades indicate impact traces on the butt. Dorsal abrasion and dorsal trimming with abrasion is seen as the most common form of blade preparation, produced by careful trimming of the platform edge by small feathering removals.

Very little could be inferred from the classification of bulbar scars. There were no real discrepancy between the number of blades featuring a scar and those that did not. If anything, an interchanging use of different modes, combined with the contingency of bulbar scar fracture, could have resulted in the lack of discrepancy. The absence of conus formations suggests that blade production with hard hammer modes was absent, although it cannot be entirely dismissed. However, blade production with soft hammer modes is considered likely, albeit for the purpose of preparation.

Summary

The general unmodified blade debitage indicate methods of production following strict geometrical patterns, in which regular blades are detached from single platform conical or sub-conical cores. The classification indicate that knappers employed methods which involved a frequent interchanging of different techniques during reduction. Soft hammer percussion and pressure is on the basis of the results argued to have been the primary modes of force employed during blade production. However, it would seem that knappers mainly resorted to pressure modes when detaching blades from smaller cores. The classification of unmodified blade artefacts from Hovland 3 strongly suggests that efficient and skilled artisans, strictly adhering to a distinct *schéma opératoire*, produced the blade debitage.

6.2 Interpreting the modified blade debitage

It is evident from the classification of this material group that the division between unmodified and modified debitage within the assemblage should only serve an analytical purpose. The analysis of the modified blade debitage suggest that specimens considered suitable for further modification and/or usage did not severely differ from the specimens found among the unmodified blades.

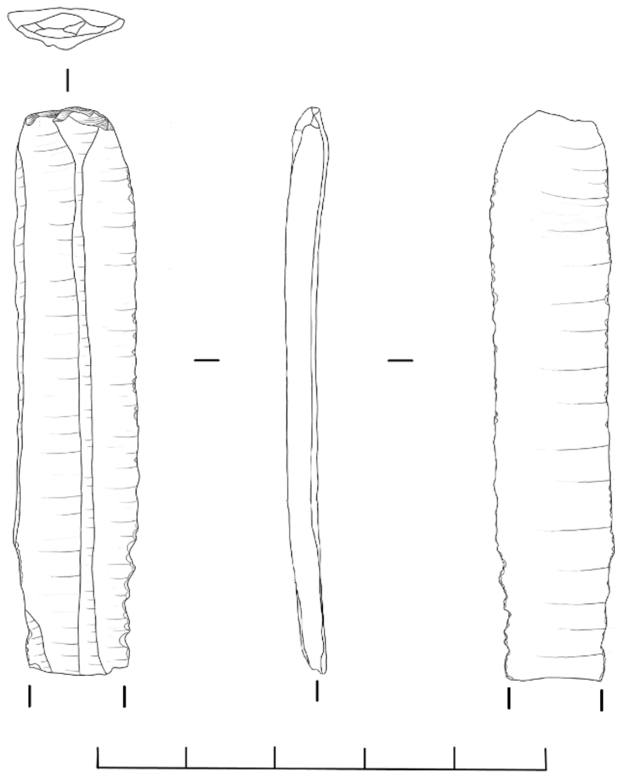


Figure 6.3: Blade ID115: An extremely regular blade with a straight profile, and some edge damage (drawing by author).

The dorsal features indicate that generally blades from advanced stages of reduction have been selected for modification. Prismatic blades with three dorsal scars have been favoured for secondary working or usage. The scarce occurrence of cortex further supports this argument. Only a small number of blades featured any trace of remaining cortex. Eleven samples had 2-10% cortex, while only two samples featured between 25-30% cortex.

The categories blade termination and blade curvature provided only a small amount of additional information, as few blades exhibited these features. The general blade population within this group is regular, and the majority feature no visible ripples on the ventral surface. The general tendency seen within the category bulb morphology is similar to the unmodified debitage, with the majority of blades featuring both a lip and bulb. The relative occurrence of bulbar scars and conus formations is also similar, with blades featuring no scar in a slight majority. The majority of blades featured no conus formation.

A slight difference between the modified and unmodified debitage is seen among blades featuring a butt, which are generally larger among the modified blades. Few blades feature facetted butts, while most blades featured plain, unfacetted butts. The relative amount of different blade preparations is similar to what is seen among the unmodified debitage, although the relative amount of blades with dorsal trimming combined with abrasion is higher. The characteristic fragmentation seen among the modified blades further suggests that intentional snapping of blades was an integrated part of lithic blade production at the site.

Only nine specimens exhibited indications of possible edge wear. The drawing in figure 6.3 illustrates one such specimen. An edge wear analysis should be able to ascertain the nature of the damage. Furthermore, should the damage have been caused by intentional use, it would contribute to the understanding of the technological organisation at Hovland 3.

Figure 6.4: Blade specimens featuring resin, from Hovland 3 in Larvik, Vestfold (Photo by Ellen C. Holte, KHM)

Retouch morphology is generally semi-abrupt, with parallel or sub-parallel removals. The retouch shaping of the blades varied, featuring diagonal, end and edge retouch. Larger specimens featuring end retouch may represent exhausted or broken end scrapers, although this was not possible to ascertain. Blades with diagonal or edge retouch are generally considered to have been produced as lithic implements used in relation to organic tool manufacture of composite tools. The four blades with possible mastic (see figure 6.4) further indicate such manufacture (Bergman 1993). The excavators of the site have suggested that these pieces have been part of a decomposed composite tool (Solheim and Olsen 2013:206).

Summary

The classification of modified blade debitage, compared with the results from the unmodified debitage, suggests that the prehistoric knappers at Hovland 3 produced blade debitage of high quality and uniformity. As such, almost any successfully detached blade was suitable for further modification and/or use. Blade detachment with the use of soft hammer percussion and pressure modes of force are indicated by the technological attributes of the modified blade debitage. The general similarity between the unmodified and modified debitage makes it evident that the blade debitage belongs to the same technological concept. It also signifies the qualities of the technological concept, as well as skilled craftsmanship.

6.3 Interpreting the blade tools

The analysis of blade tools has been able to further indicate preferences among the prehistoric knappers. It was possible to discern certain qualities among the artefacts that may have been important factors for the selection of blanks for tool manufacture. Three types of tools related to blade production were investigated: microliths, borers and scrapers. A tendency among all three tool categories is that a relatively high amount of these have been manufactured from debitage with a good, fine-grained quality (see Appendix B). However, as will be demonstrated, certain important variations between the tools were observed in size, composition, and technological attributes.

Microliths (n=17)

The results of the analysis indicates that microliths were an integrated part of later stages of blade production at Hovland 3. Both single-barbed points and scalene triangles were observed, although their typology is of lesser significance in the present study.

Only a few technological attributes of the classification could be discerned from the selected specimens. The dorsal faces show that the pieces have been shaped from blades and microblades detached from single platform blade cores. The microliths were seen to vary in both size and shape. However, the pieces were generally thin and straight, with a good cutting-edge.

The investigated microliths are all regarded as likely candidates for composite tool manufacture. In light of the current perspectives on the use of microliths, I will not convey assumptions as to what specific types of composite tools these would have been assigned (but also see Hartz, et al. 2010; Zhilin 2006 for possible tools). The fact that they have been left at the site indicates that they may have been considered unsuitable for use, that they have been used but later replaced by ‘fresh’ implements, or that their respective composite tool(s) have been discarded and subsequently eroded. Edge wear analyses on assemblages from the

European Mesolithic era has demonstrated that most microliths do not typically exhibit wear from use (e.g. Fischer, et al. 1984; Jaksland 2001; Knutsson and Knutsson 2013:174). The probable reason for this may be that the microliths found at an area of production have been considered undesirable for use by the knappers.

Borers (n=23)

A number of borers from Hovland 3 have been manufactured from blade debitage with 'atypical' qualities. This entails blades that have either a crested or irregular dorsal surface, or blades with a relatively larger thickness compared to the investigated blade debitage. The technological attributes suggest that blanks for borers may have been produced at almost any stage of blade reduction, except the later stages of microblade production.

Scrapers (n=16)

The investigated blade scrapers are all typified as being end scrapers. Blade debitage selected for scraper manufacture are generally of a robust composition, indicated by the general width and thickness of the pieces. A shared tendency for both borers and scrapers is that several of these appears to have been procured from pieces which can also be considered debitage from core preparation (such as crested blades).

Fragmented blades – burin tools?

In the excavation report, no mention of possible burins was made. However, during the investigation of both unmodified and modified blade debitage, a considerable amount of artefacts among the blade assemblage was noted for their conspicuous appearance. These artefacts were not presented within either section on blade debitage, due to their possible relation to a very specific type of tools. The artefacts were characterised by being rectangular medial fragments from blades that have been transversely snapped, with indicators of flexion breakage (see section 4.1). Edge damage on the corners and edges was also commonly observed (see figure 6.2 for two examples). The blade fragments are generally from macroblades, although a number of microblades share the similar characteristics (see figure 6.5). I have previously accounted for the possibility of intentional snapping (section 5.1, 6.1 and 6.2), and following the assessment made there, it is tempting to relate the edge characteristics to human intentionality.

The characteristics exhibited by the artefacts in question can be related to a certain type of tools, referred to as ‘rulers’ (Sjöström and Dehman 2010; Sjöström and Nilsson 2009), a name given due to the rectangular shape of the tools. Rulers are described as being a “sophisticated type of burin, whereby edge polishing was a controlled method of making the burin ‘edge’ (Sjöström and Nilsson 2009:793)”. Producing rulers is considered an efficient and economic method of burin production, as a single blade may provide a number of rulers. A prehistoric production of rulers at Hovland 3 may help explain the large amount of what seems to be intentionally snapped medial sections at the locality. However, in order to ascertain that an artefact is a ruler, micro wear analysis is necessary. The likelihood that the fragmentation and observed patterns of edge damage may be due to post-depositional factors should not be understated either (e.g. Conard, et al. 1998; Flenniken and Haggerty 1979; McPherron, et al. 2014; Pryor 1988). On the other hand, the characteristic fragmentation seen in the assemblage is highly suggestive of intentional breakage (e.g. Bergman, et al. 1987; Lamdin-Whymark 2011), and it is possible to relate this type of fragmentation to a specific means of debitage modification – namely ruler production. Edge wear from intentional use on similar blades have been indicated in assemblages from other Middle Mesolithic localities that were excavated during the E18 Bommestad-Sky project (Solheim 2013:273). In addition, edge wear analyses on assemblages from other sites in the region has confirmed that fragmented blades have indeed been used for the modification of organic material (see Knutsson and Knutsson 2013). Hence, it is suggested that the fragmented blades at Hovland 3 have indeed been intentionally broken and subsequently used as tools.

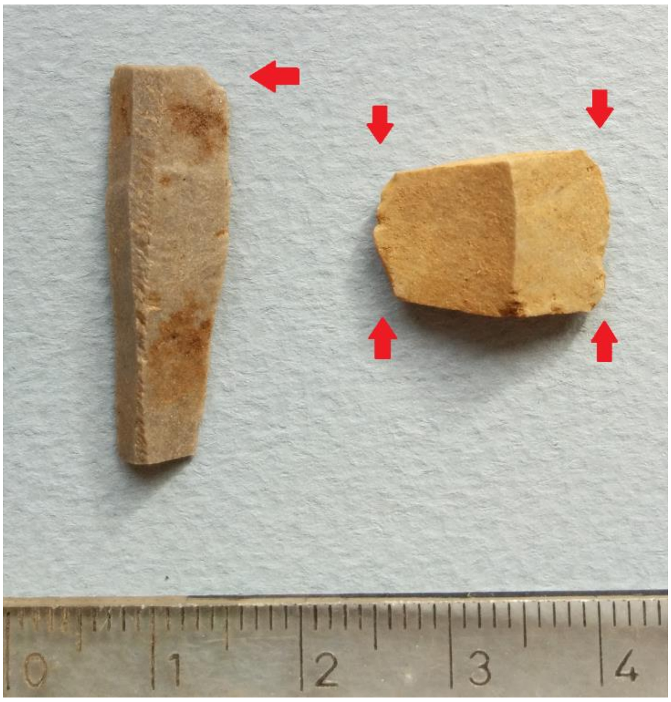


Figure 6.5: Two blade artefacts classified as possibly being 'rulers'. Both artefacts are medial fragments, with edge wear on the corners that are believed to indicate use wear or polishing rather than post depositional erosion. Photo by author.

Summary

The blade tool assemblage at the locality indicate certain differences between the types of tools produced. Scrapers and borers have been procured from 'atypical' blade debitage, i.e. blanks which does not provide favourable cutting-edge, but rather a suitable mass and sturdy composition. It would seem that these two types of tools were produced from almost any stage of blade reduction. The intentionally snapped fragments that have been suggested to be a burin-type tool is procured from generic (macro)blade debitage. Microliths are seen to have been primarily manufactured from microblades with a regular dorsal surface, a thin profile with a decent cutting-edge, and a straight curvature.

As such, it is evident that various tools were manufactured from all stages of lithic blade reduction, and that specific stages of production were expected to yield blanks for specific types of blade tools.

6.4 Interpreting cores and associated debitage

The cores were all classified as single platform cores. The majority of the specimens, both conical and subconical, had either a ¾ or single frontal exploitation. Systematically facetted platforms, platforms with large facets, and plain platforms were commonly seen among the cores. The general method of platform preparation is considered to be faceting of the platform. This, however, seems to have been determined by the core size and morphology. Larger cores are seen to feature fewer and larger facets (i.e. figure 6.9), while smaller cores (i.e. figure 6.6 and 6.8) with distinctly oval cross-sections feature plain platforms.

The thermal damage which was frequently observed among the cores prompted me to assess if it could have been caused by intentional heat treatment. The damage caused by exposure to heat is considered excessive enough to dismiss the use of heat treatment for raw material preparation. This is supported by the lack of blade debitage exhibiting heat alterations.

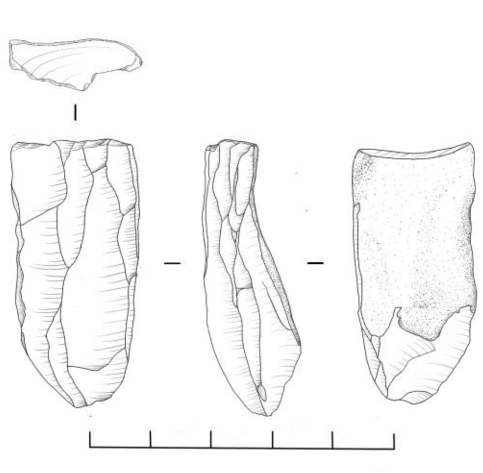


Figure 6.6 Subconical core ID6 with 3/4 frontal exploitation. Plain platform. Eroded cortex on backside. Negative opposing scars indicates shaping (drawing by author).

The back sides of the cores were able to provide clear indicators of method. A few pieces was able to indicate the size of the original nodule, as well. Cores featuring a back with cortex (figure 6.6, 6.9) is evident of a frontal reduction in which blades are consistently detached from a single front. The cores with an exploited back exhibit scars that does not correspond with a circular exploitation. Instead, these belong to an earlier sequence of reduction in which the knapper consistently detached blades from this side. This also resulted in an oblong cross section. The blade cores with a corticated backside could indicate that knappers did not categorically select cores that were able to produce *both* macroblades and microblades. Core ID7 (figure 6.9) is considered representative of an early stage of blade production from a small nodule of moraine flint, classified as a preform. The cores with negative scars on the back have been considerably larger nodules at some point, and have been skilfully reduced to exhaustion. An example of such a core is core ID4 (figure 6.8), which feature traces of an earlier stage of reduction, and has a similar morphology as the cores with corticated backs (figure 6.6, 6.9). Core ID23 is the smallest complete core in the assemblage (figure 6.4). The raw material quality of this particular core was noted to be of high quality. It has clearly been subject to a circular exploitation, although the morphology suggests that the same method has been applied to core ID4.

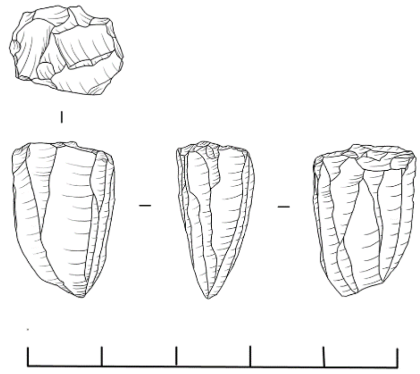


Figure 6.8 Conical core ID23 with a facetted platform. The core has been classified as having a circular exploitation (drawing by author).

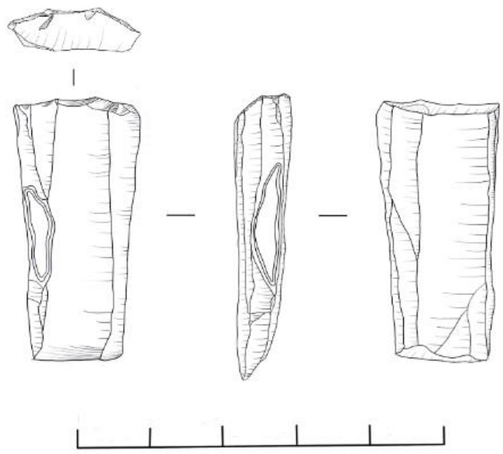


Figure 6.7: Core ID4: Subconical core with a 3/4 frontal exploitation. At first glance, it may seem as if it has a circular exploitation. The size of the scars and angle on the backside suggests otherwise. The morphology has been produced by a method of reduction in which knappers have consistently detached blades from a single front, and has at some point changed the front. The core also has a plain platform. It has indications of either frost or heat damage (drawing by author).

Despite the absence of devices intended for the immobilisation of cores, the strong indicators of pressure blade production suggests that such devices were in use at the locality. The morphology of cores, and the possible signs of crushing on the distal end of several cores, suggests immobilisation by the use of grooved and forked devices. Taking into account the measurements of the investigated blade debitage, a prehistoric pressure blade production of a similar fashion to Pelegrin's mode 2 and/or 3 is therefore possible (Pelegrin 2012:469-475, 491) (see Chapter 4, figure 4.1).

Three conical specimens (two without cortex, one with >25% cortex) and one subconical specimen (with 10% cortex) are considered preforms, shaped after the same *schéma opératoire* as the exhausted cores. Figure 6.9 features a drawing of a core with clear evidence of meticulous shaping, in order to achieve a conical shape. This particular specimen is a prime example of how a knapper has shaped a core according to a specific ideal core morphology.

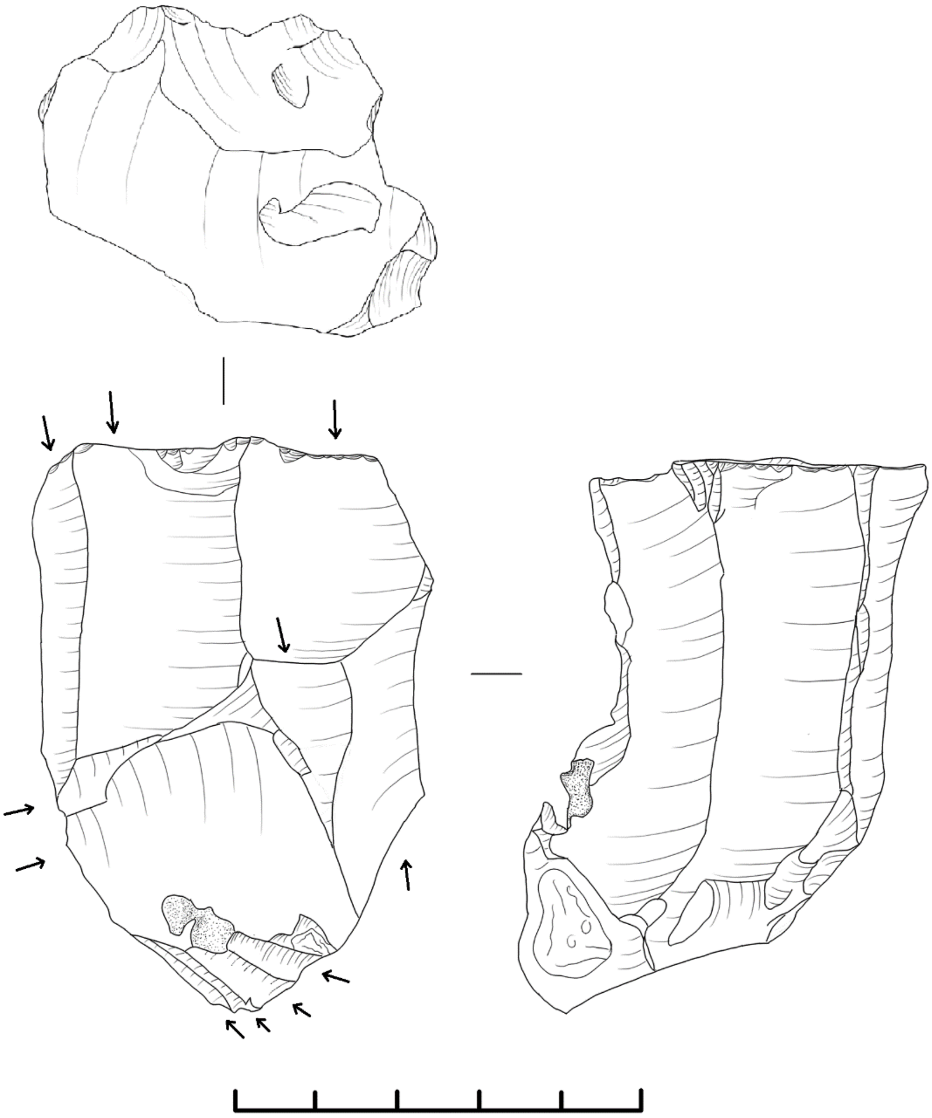


Figure 6.9: Conically shaped core ID7 with a 3/4 frontal exploitation. The platform exhibits large facets. The core has been struck from at least four different directions, for the purpose of shaping. The flaking at the bottom of the core could also be resulted from basal support of the core at the moment of the blow. The backside is covered with eroded cortex. The presence of cortex on the front indicate that the size of the core does not differ significantly from the original nodule size. It is argued that the specimen is a preform, made from moraine flint (drawing by author).

Core fragments and platform rejuvenation flakes

The technological attributes observed on platform preparation/rejuvenation flakes, as well as the core fragments identified as core front rejuvenation pieces, suggests that these artefacts belong to the same technological concept as the cores. As such, they are also related to the general blade assemblage at the locality.

Summary

Although variations are seen in core morphology and technological attributes, it is evident from the technological analysis that the cores have been produced by knappers following a distinct technological tradition. The extensive thermal damage seen on the majority of cores made it difficult to assess the general raw material quality. The few cores able to indicate raw material quality are of variable quality, although exhausted cores are of good quality flint (see Appendix B). The technological attributes of the cores, particularly exhausted ones, are highly indicative of blade production by the use of pressure modes.

6.5 Summarising and synthesising interpretations

The next step is now to synthesise these interpretations, relating the separated material groups with each other. As such, the *schéma opératoire* of Hovland 3 will be outlined.

The unmodified and modified debitage indicate both methods and modes of production. The unmodified debitage provided significantly more proximal ends than the modified category. However, the available proximal segments in the modified debitage exhibited technological characteristics corresponding with the general population of unmodified blades. Technological attributes capable of indicating modes of force were seldom found among the blade tools. The few tools with a remaining proximal end indicated the use of similar modes of production as was seen among the debitage. Indicators of methods were arguably more available, with several tools exhibiting a crested dorsal surface.

The results of the technological analysis strongly suggests that cores and the associated debitage is closely related to both blade debitage and blade tools.

The concept of blade production at Hovland 3

On the basis of the technological analysis, I argue that the lithic assemblage related to blade production at Hovland 3 belongs to a single distinct technological phase. This is evident from indicators of methods, modes and techniques of production. The technological classification was able to indicate that all sequences of production, from the stage of raw material preparation to the exhaustion of cores, took place on site. However, the later stages of production prior to the exhaustion of cores appears to have occurred more frequently. Comparing the size of the core preforms and blade debitage indicate that raw material selection was not necessarily determined by nodule size. The prehistoric knappers appear to have been capable of procuring cores following their *schéma opératoire* undeterred by the various sizes and shapes of available nodules.

The technological concept is oriented towards the production of blade debitage from single platform (sub)conical cores. The process of production granted access to debitage which would easily be modified into a variety of artefacts, such as scrapers, borers, burins, and implements (i.e. microliths). The different tools stems from various stages of reduction. Scrapers and borers are generally modified from atypical, albeit robust, blade debitage such as crested blades. In addition, the size of the scrapers relative to the blade debitage, tools and cores indicate that they were manufactured from earlier stages of lithic reduction. The choice of atypical blade debitage for scraper and borer manufacture may seem motivated by an economic rationale for a maximised raw material exploitation. However, the explanation that the size and composition of the debitage benefits the durability and the intended use of the tools is considered just as likely. The intentional breakage seen in the blade assemblage is regarded as a production of blade tools used for the manufacture of items from wood, bone, antler, etc. Their use as inserts in composite tools is considered the main purpose of producing microliths.

The general method of blade production is as follows: the core is shaped by striking flakes in any direction necessary to produce a (sub)conical shape (i.e. figure 6.9). This is followed by a cresting of the core front. Blade production ensues, in which blades are detached after careful trimming or abrasion (or both) of the platform-front edge. Throughout the knapping process, knappers meticulously rejuvenated the platform and the conical shape of the core. The sub-method of platform preparation was performed by detaching multiple deliberately hinged flakes. Detaching regular blades with an even/distal curvature and an even thickness (figure 6.4) would negate the need for core front rejuvenation. The morphology of the blade debitage is thus not only perceived as the 'ideal' type of blades for a particular tradition of tool manufacture, but also ideal in that it optimises the output of blades.

Despite the absence of equipment associated with soft hammer and pressure modes of production on site, the technological attributes of both blade debitage and cores indicate blade production emphasising the two modes. Although a number of blade debitage specimens suggests the use of pressure modes for detaching macroblades (e.g. figure 6.3), this mode of production are seen to have been generally used for detaching microblades. The macroblades generally exhibit indicators of soft hammer modes of production, with an emphasis on the use of indirect percussion. As such, it is possible that the technology follow two concepts of blade production: one which produces macroblades by indirect percussion, and the other producing microblades by pressure techniques (see Sørensen 2006j; Sørensen 2012a). However, the results of the analysis, indicating that both soft hammer and pressure modes of force have been used interchangeably during production, suggests that a single technological concept was followed. It is thus argued that the people who engaged in activities related to blade manufacture at Hovland 3 belonged to the same technological phase of the Middle Mesolithic. Furthermore, the general technological traits of the material confirms a close relationship with contemporary technologies of blade production in coastal and interior Norway (see part 2.2).

Chapter 7 Discussion and concluding remarks

At the onset of this thesis, I stated a question asking if it was possible to discern the social factors contributing to the consolidation and maintenance of blade technology from a specific Middle Mesolithic locality in the Oslofjord region of south-eastern Norway. The locality that was chosen as a case study was Hovland 3 in Larvik municipality, Vestfold county.

Initially, the aim of my study was to assess the relationship between the blade technology at Hovland 3 and the 'conical pressure blade concept' that has been granted such devoted attention in recent years. The project was thus intended to be a continuation of the same research agenda which had prompted the new perspectives on the development of technological traditions during the Early- and Middle Mesolithic in Northern Europe. As the project developed, it became clear that I would have to adjust the aim of the study. The relationship between the concept of blade making at the locality and technological concept diffused from the post-Swiderian complex was recognised within the early stages of the analysis. Therefore, the focus of the thesis shifted towards how this distinct tradition of blade technology was maintained throughout the temporal segment of the Middle Mesolithic represented by Hovland 3. The analysis provided clear tendencies which was interpreted in Chapter 6.

I will now discuss and explore the possibility of reconstructing the human sociality which maintained and reproduced the technological organisation of blade production at Hovland 3. Furthermore, the relationship between this sociality and the large scale cultural interactions and developments in Scandinavia during the Middle Mesolithic will be discussed.

7.1 The efficacy of pressure blade technology

Two factors have been considered central for the spread of the conical blade technology to south-eastern Norway, which are raw material efficiency and the production of a variety of tool blanks (Damlien 2014:10). This argument follow the idea that the production strategy involved in the technological concept is considered particularly suitable for highly mobile foragers with frequent residential moves, a lifestyle which would necessitate the availability of a variety of tools in the absence of readily available raw material. The conical blade technology is thus regarded as a generalised rather than a specialised blade production strategy, capable of resolving this necessity (Hertell and Tallavaara 2011:98, 108). In the assessment of the technological organisation of conical core technologies in north-eastern Europe, it has therefore been argued that this specific technological concept was employed as an adaptive measure for highly mobile, terrestrially oriented groups of people. A lower level of mobility on other hand, is related to a decreased reliance on conical core technology. This is based on observations indicating that small assemblages, associated with high mobility, feature a high proportion of conical cores. Large assemblages on the other hand have a higher proportion of irregular cores (Hertell and Tallavaara 2011:106-107). Within the context of the Mesolithic in NE Europe, a decrease in settlement mobility is associated with an increased reliance on aquatic resources and maritime means of transportation (Hertell and Tallavaara 2011:107-108). Should the similar technological concept at Hovland 3 represent a highly mobile prehistoric society, it would suggest that the indicators of a continuous use of the locality is the result of frequent but short occupations. However, if we take the environmental context into consideration, certain discrepancies become visible.

Hovland 3 was situated in a coastal environment, and would therefore have been integrated in a society oriented towards a coastal adaptation (Damlien 2013b:29). In addition, the core variability at the locality indicate a high proportion of conically shaped specimens. This contends the suggested correlation between large assemblages and small proportions of conical cores. It is thus problematic to induce the model of economy and mobility associated with conical blade technology envisaged in NE Europe to a SE Norwegian context. Nevertheless, these discrepancies could be explained by the 'amalgamation' of the post-Swiderian blade tradition with already established traditions of lithic tool making in the coastal regions of Norway, suggested by Sørensen et. al. (2013:45). In part 6.5, I argued that the investigated blade material can be considered closely related to the adapted conical pressure blade concept in coastal and interior Norway. The technological concept at Hovland 3 can therefore be considered a continuation of this amalgamation, representing a successful reproduction of a technology similar, albeit not identical, to the traditions of the 'post-Swiderian' complexes.

7.2 The social implications of raw material

In the assessment of why pressure blade knapping was adopted in the Danish late Maglemose era (approximately 7000 BCE), Sørensen (Sørensen 2006j, 2012a) argues that the conical pressure blade technology did not fulfil any specific economic or functional needs within the Maglemosian society, which already could not be met (also see part 2.2). This is primarily due to the availability of flint in Denmark. Flint sources in SE Norway, however, are far more contingent (see Berg-Hansen 1999; Eigeland 2014:46).

This raw material contingency would have had an impact on how the prehistoric communities and their knappers re-negotiated and reproduced their traditions of lithic technology. In addition, the uncertainty of raw material quality would also have to be settled. Even if there is easy access to raw material, the challenge of raw material quality is still an issue for a lithic crafter. In order to mitigate raw material waste while adhering to a specific tradition of lithic production, a high level of know-how is thus necessary. This creates a dialogue between the availability and quality of raw material, and the technological tradition (Hodder 1990:155). As such, in situations where raw material access is good, one might expect a larger proportion of individuals participating in the production. On the contrary, if the availability is constricted, participation in production would have to be restricted to fewer, more skilled, individuals (Apel 2001:28; Falkenström 2006:349). This calls for pertinent considerations, which I will expand upon later. First, I will turn to another aspect of the conical blade technology. In the previous chapter, the relationship between the production of blades and other technologies of tool manufacture was advocated on the basis of the technological analysis. The next section will discuss this relationship and the implications it may have had on the prehistoric community in the Oslofjord region.

7.3 The relationship between technologies

The results of the technological analysis was able to indicate patterns in the organisation of technology at Hovland 3, which may help extend the perspective of why the conical blade technology was maintained to reach beyond raw material efficiency. The *schéma opératoire* adhered by the prehistoric knappers at the locality suggests that an economic maximisation of lithic raw material was not necessarily the leading stimulus for producing blades by indirect percussion or pressure. Instead, upholding a specific tradition of lithic manufacture may have been favoured in order to facilitate and maintain other technologies, as well as interactions within and between social groups.

Experimental researchers (see Eren, et al. 2008) have attempted to shed light on what would motivate prehistoric people to rely on blade production, rather than flake production. Their results suggest that from a practical point of view, blade technology does not provide more tools per nodule of raw material than flaking technologies. While blades do provide more cutting edge than flakes, the production of blades is more wasteful. Rather than crediting blade production as an efficient and economic technology, they highlight the adaptive efficiency of microblade production in relation to organic tool technologies. Also, a possibility is conceived that blade technologies represents a uniform material expression capable of maintaining larger social networks, acting as a 'cognitive glue' (Eren, et al. 2008:959; see also Gamble 2007; Goebel, et al. 2000).

Although only a few tools made from organic material have been found in a south-eastern Norwegian archaeological context from the Middle Mesolithic (but see Persson 2014 for recent findings of bone artefacts in the region), the importance of such technologies must have been significant. As noted earlier, the production of blades at Hovland 3 was interpreted as a vital provider of necessary items for the manufacture and maintenance of organic tools. This is not to say that the pressure blade technology at the locality is proof that manufacture of items from wood, antler or bone occurred at the locality. Nevertheless, the technological tradition of pressure blade making at Hovland 3 would have been strongly intertwined with traditions of organic tool manufacture, as the relationship between pressure blade technologies and technologies of organic tools is well-established and commonly referred to (e.g. Bergsvik and David 2015; Bjerck 1986; Desrosiers 2012a; Elston and Brantingham 2002; Sørensen, et al. 2013). Excavated sites in areas with favourable conditions for preservation has provided clear evidence of this (e.g. Hartz, et al. 2010; Sørensen 2012a:238; Zhilin 2006). Despite the lack of preserved organic tool material at Hovland 3, it is imperative that this relationship is recognised. A recent *chaîne opératoire* study of bone artefacts from western Norway (Bergsvik and David 2015) has shown that the crafting of bone tools in the coastally adapted region during the Middle Mesolithic was closely related to the production of lithic artefacts. Furthermore, the identified tradition of bone tool manufacture is argued to have been the result of a regional development within a coastally oriented society heavily influenced by eastern traditions from the post-Swiderian complex (Bergsvik and David 2015:212-215). This resonates well with suggested amalgamation of post-Swiderian and western Scandinavian traditions of craftsmanship seen the concept of lithic blade manufacture at Hovland 3 (see section 7.1). It is conceivable that developments in bone technologies happened concurrently with developments in lithic technologies.

Earlier in this section, I briefly mentioned the possibility that the conical blade technology may have included a particular model of intra-social organisation of individuals. Particularly vertical transmissions of knowledge and skill is believed to have had major implications for maintaining the traditions of lithic blade making. It is therefore relevant to assess if it is possible to infer the social organisation which ensured that knowledge and skill was transmitted between generations.

7.4 Organising the reproduction of tradition

A common reiteration in research discussing the diffusion of pressure blade technologies during the Middle Mesolithic, such as the one found at Hovland 3, is that it would have been easily transmitted between people who already possessed knowledge and know-how of lithic production (e.g. Damlien 2014:9; Pelegrin 2012; Sørensen 2012a:254; Sørensen, et al. 2013:23). Compared to preceding Early Mesolithic traditions of blade technology which relied heavily on know-how for the production of blades, the recipe of production in Middle Mesolithic pressure blade technologies are regarded as being more reliant on knowledge. This implies that the production of blades by pressure techniques is mainly dependant on declarative transmission, i.e. orally or by demonstration, in order to be successfully reproduced by other individuals (Sørensen 2012a:254). However, that techniques of pressure blade production was easily transmitted horizontally between competent knappers does not grant a satisfactory explanation for how the established concept of blade technology was transmitted vertically between generations.

In a situation where suitable raw material availability is a pertinent issue, and the reliance on tool technologies that are only enabled through a successful lithic blade production, it is tempting to picture a social organisation which would ensure access to adequate material. This follows the argument that as technologies increase in difficulty and complexity, the need for society to intervene by regulating and rationalising apprenticeship grows, in order to produce technically competent practitioners (Pigeot 1990:138). I therefore argue that an important factor for maintaining of the concept of lithic blade production at Hovland 3 would have been a strong regulation of production, involving a strategic division of labour determined by knowledge and know-how. Following this Marxist perspective, the vertical transmission of the conical blade technology would have included the reiteration of a particular model of human sociality. The performance of production activities may then be perceived as a political matter, as it is subjected to the coercion of society and material (e.g. Conneller 2010:188; Mauss 1979).

If this perspective is developed further, it could be worthwhile to consider the scope of production activities, both in number of participants and its spatial/temporal organisation. In the aforementioned study of Middle Mesolithic bone industries in Western Norway, Knut Andreas Bergsvik and Éva David argue that the methods of bone tool manufacture was common knowledge within local groups of people, and was maintained vertically by parent-child relationships in which the tutor guided the learner towards sufficient know-how by direct intervention (2015:210). The manner of which the knowledge and know-how related to blade production at Hovland 3 was vertically transmitted is considered highly relevant for the topic of this study, and will therefore be explored further.

The technological organisation of pressure blade technology at Hovland 3 may have involved a mode of teaching which relies upon a high degree of coordination and collaboration between tutor and learner, referred to as 'scaffolding' (e.g. Greenfield, et al. 2000; Stout 2002; Stout 2005; Tehrani and Riede 2008). As such, the capabilities of a learner would be enhanced gradually through time in coordination with skilled practitioners, acquired by the cumulative mastery of increasingly demanding tasks. This would require little linguistic instruction, but rather depend on a mixture of demonstration, collaboration, and the occasional intervention by a skilled tutor. The concept of 'scaffolding' resonates well with the kind of information associated with craftsmanship: know-how, i.e. routinized motoric gestures (see Chapter 3, section 3.1) (Tehrani and Riede 2008:8-9).

Tehrani and Riede exemplifies this mode of teaching by referring to the transmission of textile knowledge in Iranian and Central Asian pastoralist tribes, in which adolescents progress through several years of apprenticeship in order to master the tradition of rug making. The knowledge is transferred by allowing the apprentice to participate in specific stages of production at a time. If a mistake is made by the learner, the teacher intervenes and corrects the error. The highly regulated participation is repeated and expanded gradually as the skill of the apprentice increases. Thus, the imitation of the production process is guided and constrained by skilled practitioners, ensuring that a tradition is passed on between generations with a remarkable level of continuity (Tehrani and Riede 2008:9).

In the previous chapter, the argument was presented that blade production at Hovland 3 was performed by skilled knappers. This assessment follows the idea that few indicators of insufficient know-how (i.e. knapping mistakes) signify a production performed by skilled artisans. A hierarchy of debitage management is principally followed: Satisfactory blanks, conforming to the ideal of a technological concept, will normally be retouched, utilised or carried away. Second choice blanks are those that may belong to the same stages of production but for various reasons have been judged to be of less value, and are therefore more likely to be left on site (Pelegrin 1990:120-121). Assessing the quality of 'second choice' blanks and other debitage becomes the interpretative path to take in order to infer the level of skill displayed by the prehistoric knappers. It is conceivable that in certain contexts, the traces of apprenticeship may be shrouded by the technological organisation.

The proposed model of pedagogy is considered by the present author to have been capable of shrouding inadequacies in skill. Furthermore, inadequacies in skill may also be shrouded by the prehistoric knappers' conceptions of value. In the interpretation of the blade material, it was argued that blanks from almost all stages of production were modified into tools. The blade scrapers and borers exemplified this, as they were seen to have been manufactured from atypical blanks. This indicate a pragmatic approach to lithic tool manufacture, one which may have accommodated the inadequacies of inexperienced knappers. Furthermore, one may entertain the possibility that tool manufacture by intentional breakage would have provided a viable option for further modification of blanks, regardless of their estimated compliance to an 'ideal' blade standard.

Inferring the mode of teaching that has been suggested creates a more nuanced impression of how people involved in the production of lithic blades reproduced and maintained their tradition of craftsmanship. It is also conceivable that a mode of teaching as this would not only ensure transmission of knowledge between generations, but also provide a flexible division of labour.

If we return to the dialogue between raw material and technological tradition, it is clear that the idea of few individuals participating in production activities in face of challenging raw material availability appears to become oversimplistic. Instead, the participation in activities related to crafting may well have involved a larger portion of the social group. The contingency of raw material, the division of labour, and the production of technically competent individuals would be solved by institutionally organising the technology in a similar fashion to the 'scaffolding' mode of teaching. Another alternative is thus introduced, in which raw material constraints may be solved by a technological organisation encouraging participation and learning, yet at the same time can be characterised as highly conservative of its traditions.

The highly conservative transmission of knowledge could also be explained by the relationship between the pressure blade technology and other technologies. If we imagine the presence of a bone tool technology at Hovland 3 similar to that in western Norway, it would imply that maintaining the tradition of conical blade production would contribute to the reiteration of other technological traditions, and vice versa. A mutual dependency would be in effect (cf. Hodder 2012).

The social organisation of technology that has been proposed is likely to have shared many of the same structural elements as a sociological situation characterised by the anthropologist Fredrik Barth as an open informational ideology which generates broad transactions in knowledge, encouraging a strong propensity to learn, as well as being geographically mobile and expansive (1987:79-80; 1990:650-651; 2002:6) (see also Prescott 2012:121). These characteristics, in correspondence with the model of pedagogy presented above, provides an interesting perspective on the forces behind the Middle Mesolithic trajectory of technological and social development. The MM across the Oslofjord region, sharing a similar material culture, may well have been characterised by a sociological situation similar to the one proposed above. Further technological studies of MM assemblages from the region should be able to confirm or discredit this.

So far in this discussion, the focus has been on illuminating the 'internal' social organisation implied by the blade material from Hovland 3. Both the inter-site organisation of particular social groups as well as interactions between social groups would also have had a significant impact on the preservation of the particular tradition of blade making at Hovland 3. The interpretation of the technological analysis questions the validity of separating between an internal and external organisation of this particular blade making tradition – especially when considering that the analysis has been centred on the identification of a normative *schéma opératoire* (see Dobres 2000c:179-180).

During the cataloguing of the various lithic assemblages from the localities excavated during the E18 Bommestad-Sky project, the excavators noted that different steps of lithic production appeared to have been emphasised at different localities (Solheim 2013:258-259). The technological analysis of blade material from Hovland 3 indicate that generally later stages of blade production took place at the site. The interpretation of the technological analysis also suggests that lithic objects related to blade production have been imported from other areas. In light of the interpreted technological analysis, and the observations made by the excavators, the frequency of later stages of production and imported objects is believed to imply a technological organisation structuring labour across and between different areas. As such, different stages of production were emphasised in various contexts. The neighbouring Middle Mesolithic sites in the area in which Hovland 3 was excavated hints toward similar patterns. An example is the nearby locality Hovland 2, which featured what has been interpreted as a raw material deposit (Koxvold 2013). It is considered plausible that the technological organisation also influenced the inter-spatial patterning of the community of people that visited Hovland 3. In the following section, I will explore how such an organisation may have contributed to maintaining the distinct tradition of blade technology seen at Hovland 3.

7.5 The temporality of craftsmanship

Further research on the observed patterns of an interspatial organisation of technology is considered to have great potential for a deeper understanding of the structural elements and processes of the Middle Mesolithic society that existed in south-eastern Norway. A line of research employing the idea of *taskscape*, outlined by Tim Ingold (1993), should be able to harness this potential. The basic principle of the theoretical concept is that landscapes must be understood as 'congealed taskscapes'. As such, a landscape is seen as being actively created by people (Ingold 1993:158). This enables a dynamic perspective of Mesolithic peoples, more so than seeing them as simply responding to conditions set by the environment. The latter perspective has traditionally been integral to Mesolithic archaeology, thereby producing interpretations which tends to emphasise a limited array of logistical or economic functions (Conneller 2010:185).

Recent research on Mesolithic hunter-gatherer site use at the Star Carr site complex in the Vale of Pickering, England, exemplifies the potential of the taskscape. Earlier interpretations of the relationship between the numerous sites of this complex suggested that they were integrated in a seasonal use pattern which remained unchanged for hundreds of years. The sites themselves were subjected to functionalistic readings based on microlith typology, resulting in simplistic interpretations of site types. These interpretations have also been challenged by ethnographic research on seasonal mobility patterns, which suggests that mobility patterns are far too unstable to be discerned in archaeological material (Conneller 2010:185). With the focus on taskscapes, in conjunction with the *chaîne opératoire,* it has been possible to interpret the Star Carr site complex in a different light.

Within a taskscape perspective, the sites are regarded as nodes in networks of movement across the landscape (Conneller 2010:186). Both worked and unworked objects were transported between different sites. At particular sites, cores, blades and tools were prepared before being carried away to another site. An example is how a number of unworked nodules were brought to a specific site where they were prepared by careful removal of cortex, before being carried off the site, ready to be used at a later time. A similar situation is seen on another site, in which people had brought a prepared core and subsequently worked it to produce blades for microlith manufacture, eventually leaving the site with the microliths. These examples illustrate how a landscape is produced through networks of connections between people, places and things (Conneller 2010:187). Additionally, they imply that tasks cannot be considered as isolated events, but instead as interlocked within a whole range of tasks, producing meaningful landscapes, facilitating relations between people and creating the temporalities of social life (Conneller 2010:187-188).

The idea of taskscape is not without its issues, however. Reconstructing taskscapes of the Mesolithic may easily engender a vision of idyllic collectives of people without inequalities, living as one with nature. Applying this concept in Mesolithic archaeology through studies of lithic craftsmanship, considered to have been an everyday activity, projects visions of ahistorical communities, void of politicised spaces and activities (Conneller 2010:188). In section 7.5, I proposed that the organisation of technology at Hovland 3 involved a socially regulated vertical transmission of craftsmanship tradition. Thereby, the particular tradition of blade making observed at the locality would have been embedded in temporal social systems. It has been argued that technological changes within prehistoric hunter-gatherer societies should not be considered a result of these being passive recipients of external influences. Instead, changes must be understood as a result of communities actively participating in interactions, capable of negotiating knowledge to make it meaningful within local contexts (Skandfer 2012:134-135). I believe that it is possible to apply this argument to a discussion of why a specific traditions of craftsmanship was temporally maintained within a specific area. Circumventing the vision of hunter-gatherer communities as ahistorical and apolitical units of people, instead perceiving them as constantly transmitting and re-negotiating their traditions of craftsmanship, enables the recognition of the effects social life would have had on the development of prehistoric hunter-gatherer societies. Traditions of prehistoric craftsmanship are thus historically created and maintained by networks of politicised connections between people, things and places.

Following the principles of the taskscape, the *chaîne opératoire*, and the critique against ahistorical perceptions of hunter-gatherer sociality, it should be possible to visualise the temporalities of craftsmanship traditions. As such, one may be able to discern both broad and small-scale continuities and transformations in Middle Mesolithic societies, and how these interplayed (Conneller 2010:189). In this regard, the recent large-scale excavations in south-eastern Norway offers a great potential for expanding the knowledge of this period, both regionally and interregional. Synergising the employed methodology of this study with the theoretical concepts that have been proposed is believed to be a promising venue of future research. It should therefore be possible to create a more dynamic and heterogeneous picture of the spatial and temporal organisation of Middle Mesolithic craftsmanship in south-eastern Norway. This may in turn challenge our understanding of the development of social life during the Mesolithic in both Scandinavia and Europe.

7.6 Concluding remarks

The focus of this thesis has been on the effects human sociality had on the maintenance and reproduction of a distinct tradition of blade manufacture from the Middle Mesolithic in south-eastern Norway. Previous research on lithic assemblages in the region, with a scope of research limited to regional typologies, have not been capable of extending the understanding of this period beyond regional tool variations and chronologies. However, in recent years this situation has changed.

International research, characterised by interregional perspectives and an auspicious methodological approach, has stimulated the most recent studies of the Middle Mesolithic in south-eastern Norway. This has prompted new research perspectives capable of highlighting the qualities of human interactions and transmission of cultural traits, i.e. traditions of knowledge and know-how, which contributed to the evident change in the culture-historical trajectory of the northern European Mesolithic which occurred between the Early- and Middle Mesolithic periods.

These new perspectives have provided a platform for further exploration of the social implications of lithic blade manufacture during the Middle Mesolithic. To treat this issue, a technological analysis was conducted in order to discern the organisation of blade technology at the locality Hovland 3 in Larvik, Vestfold county. The analysis was performed by applying the method of technological classification, following the principles of the *chaîne opératoire*. The investigated blade technology provided clear indicators of belonging to a distinct temporal tradition of material manufacture. Furthermore, the use of blade technology at Hovland 3 is considered to have been embedded within a tradition of lithic craftsmanship present throughout Scandinavia, which has been adapted and reproduced vertically through generations.

In the last chapter, I discussed and explored the possibilities of expanding the understanding on how the development and maintenance of blade manufacture was influenced by social life during the Middle Mesolithic. While the present study has been able to indicate certain local patterns of temporal human sociality in the MM, it has also strongly accentuated the need for future studies. Extensive technological investigations of other sites from this period is therefore necessary. The employed methodological approach of this study is but one of several promising venues for future research. Refitting studies of MM blade assemblages would contribute by elucidating idiosyncrasies of blade production within the conical pressure blade concept. Micro-wear analyses would provide further insights into the *chaîne opératoire* of blade manufacture, especially the purpose of intentionally breaking blades. Should these analyses comply with the suggested burin function of the fragmented blades at Hovland 3, it would enhance the understanding of the relationship between different material technologies.

In conjunction with the research concepts that have been discussed, these technological studies will be able to shed light on how traditions of craftsmanship shaped, and were shaped by, human sociality. Future research on the Middle Mesolithic should therefore be able to discern historically significant processes in local, regional, and interregional contexts.

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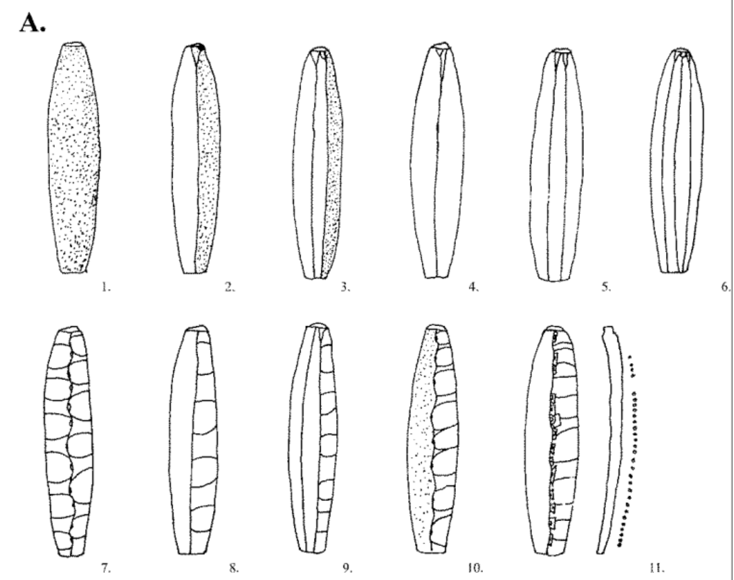
APPENDIX A

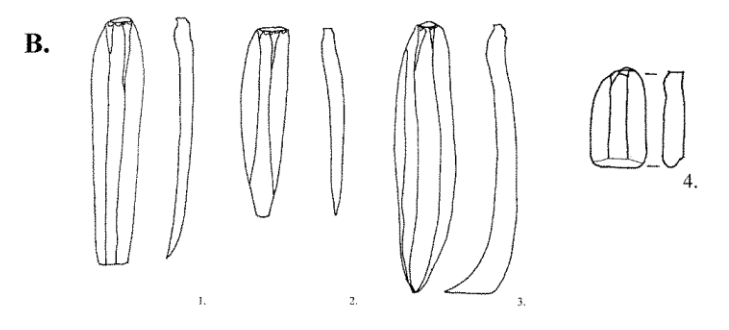
The original classification schema used at the NBTN workshops is presented here.

Dynamical technological blade classification (A. - E.)

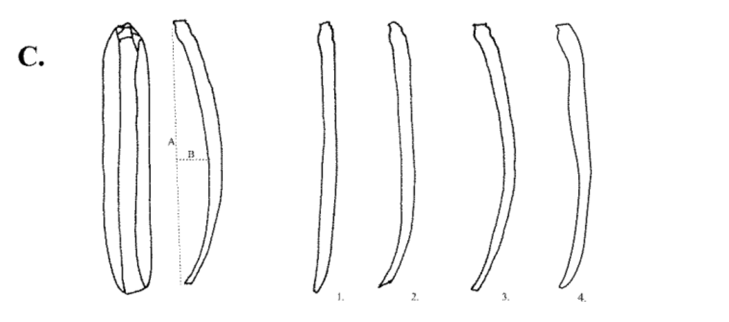
A. Dorsal blade faces
1.Dorsal cortex
2.Two dorsal faces, one cortex
3.Three dorsal faces, one cortex
4.Two dorsal faced blade
5.Three dorsal faced (prismatic) blade
6.Multi dorsal faced blade
7.Bilaterally crested blade
8.Two dorsal faced blade,
one face with scars of previous crest
9.Three dorsal faced blade,
one face with scars of previous crest
10.Two faced blade, one side cortex,
one sided cresting
11.Two faced blade,
one sided cresting and trimming



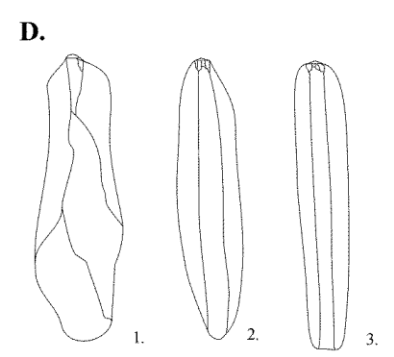
B. Blade termination
1.Ideal
2.Feathered
3.Plunging
4.Hinged



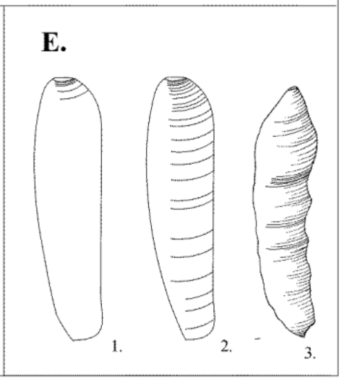
C. Blade curvature
1.Straight
2.Distal curvature
3.Even curvature
4.Curvature and tendency to ventral "belly"



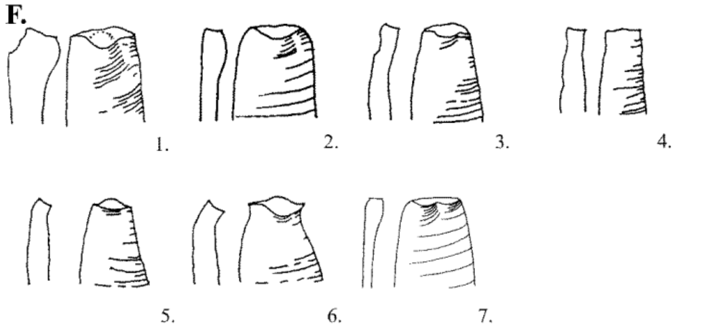
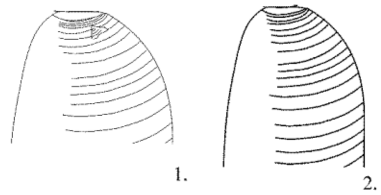
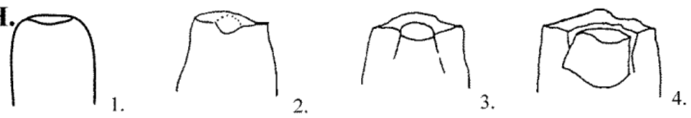
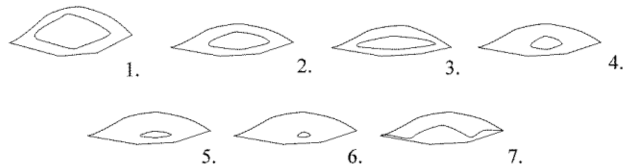
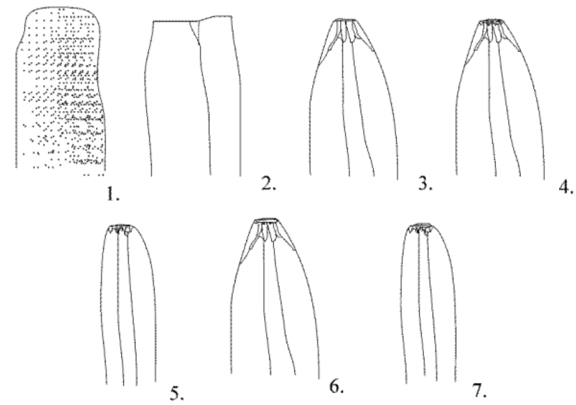
D.Regularity
1.Irregular blade
2.Regular blade
3.Extremely regular blade



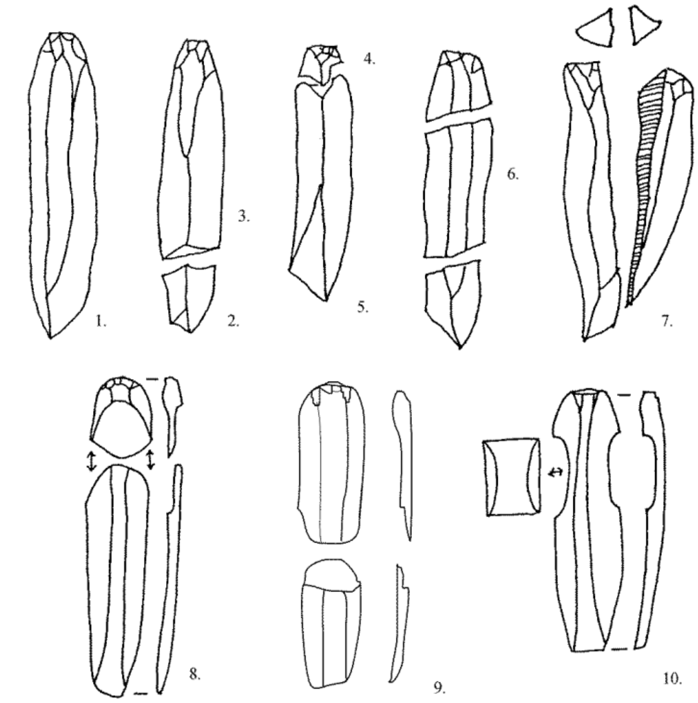
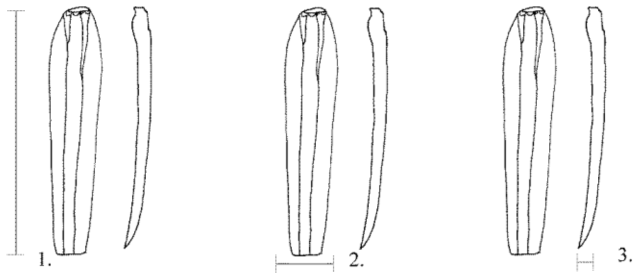
E.Ventral Ripples
1.Smooth ventral face
2.Visible ventral ripples
3.Pronounced ventral ripples



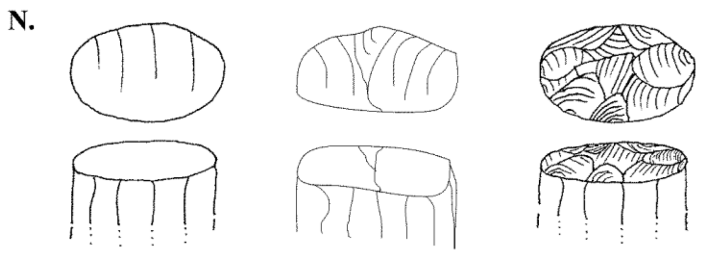
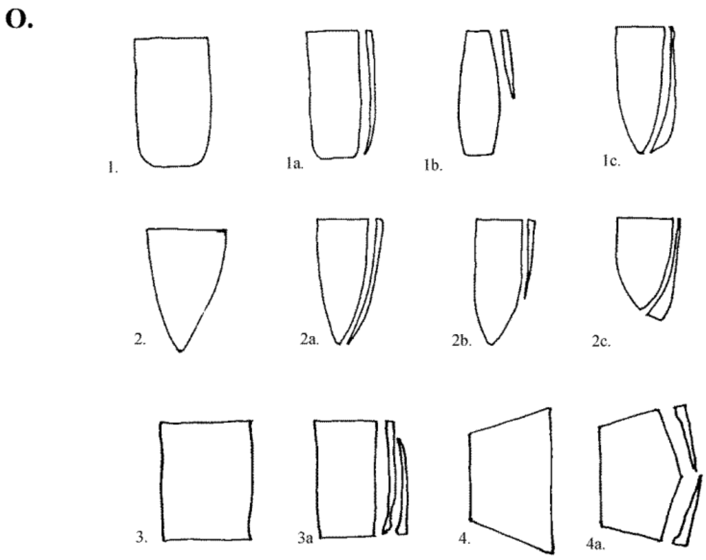
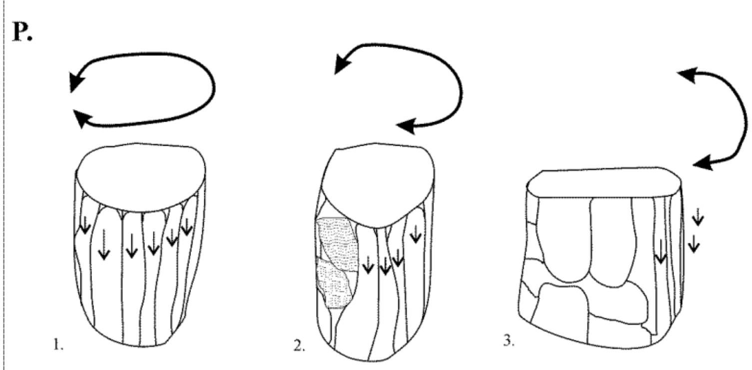
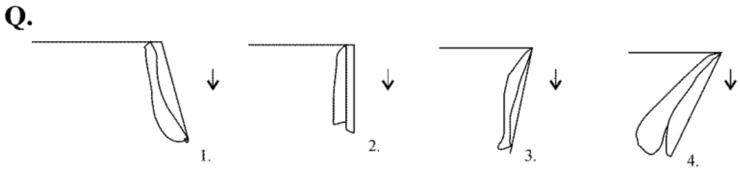
Dynamical technological blade classification (F. - K.)

F. Bulb morphology 1.Pronounced bulb 2.Bulb 3.Bulb and lip formation 4.No bulb or lip 5.Lip formation 6.Pronouced lip formation 7.Double bulb	**F.** 
G.Bulbar scar 1.Scar 2.No scar	**G.** 
H. Conus formation 1.No conusformation 2.Ring crack on butt 3.Ring crack on butt and ventral fissures 4.Detached bulb	**H.** 
I.Butt morphology 1.Large and thick butt (more than 50% of blade width and thickness) 2.Large oval butt 3.Thin oval butt (> 50% of blade width, < 50% of blade thickness) 4.Small thick butt 5.Small butt 6.Punctiform butt (less than 1 mm) 7.Broken butt	**I.** 
J. Butt preparation 1.Plain butt 2.Two facets 3.More than two facets	**J.** 
K. Blade preparation 1.Unprepared cortex blade 2.Unprepared 3.Dorsal trimming, 4.Dorsal trimming and abrasion 5.Dorsal abrasion 6.Dorsal trimming, abrasion and grinding 7.Dorsal abrasion and grinding	**K.** 

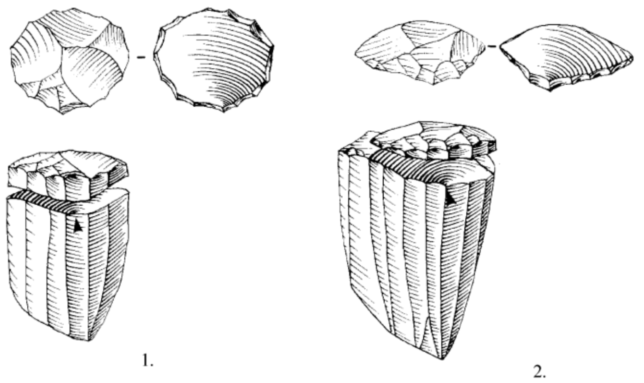
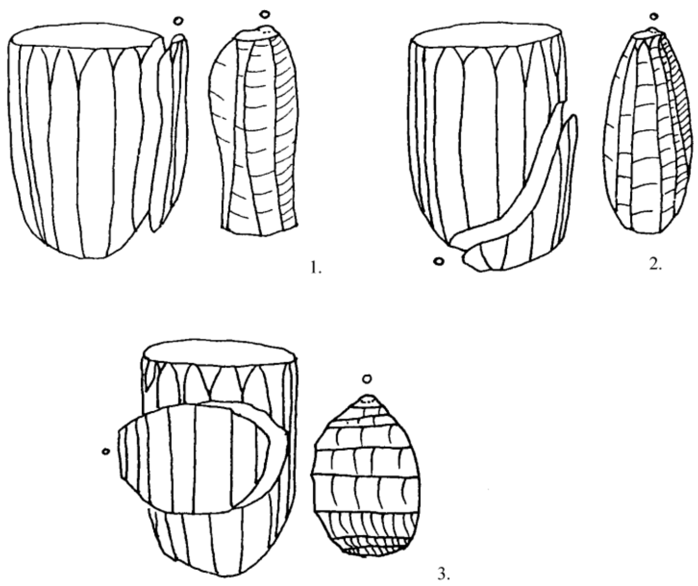
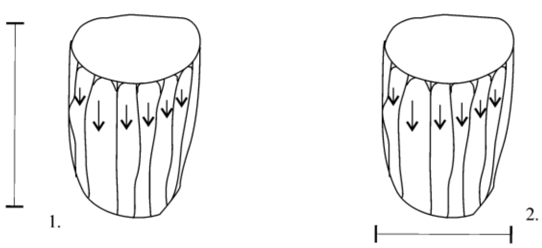
Dynamical technological blade classification (L. -M.)

L. Blade fragmentation 1.Complete 2.Distal fragment 3.Long proximal fragment 4.Small proximal fragment 5.Long distal fragment 6.Medial fragment 7.Split cone fracture 8.Proximal fracture languette 9.Distal fracture languette 10.Fracture nacelle	**L.** 
M. Measurements 1.Maximum blade length (complete blades) 2.Maximum blade width 3.Maximum thickness	**M.** 
Notes	

Dynamical technological blade core classification (N.-Q.)

N. Platform rejuvenation 1.Smooth platform 2.Large faceted platform 3.Systematically multi faceted platform	
O. Dynamical blade core morphology 1 (a-c).Single platform, subconical blade core 2 (a-c).Single platform, conical blade core 3 (a).Dual platform, cylindrical blade core 4 (a).Dual platform, prismatic blade core	
P. Core front exploitation 1.Circular exploitation 2. ¾ circular exploitation 3. Single fronted exploitation	
Q. Blade core platform-front angle 1. > 90 2. = 90 3. c. 80 4. < 70	

Dynamical Technological blade core classification (R-T.)

R. Blade core platform rejuvenation 1.Platform rejuvenation (core tablet) 2.Platform preparation flake	**R.** 
S. Blade core rejuvenation 1.Front rejuvenation flake 2.Distal blade core rejuvenation flake 3.Side rejuvenation flake	**S.** 
T. Blade core measurements 1.Maximum blade core height 2.Maximum blade core width	T. 
Notes	

APPENDIX B

Raw material variations observed in the investigated assemblage:

Code	**Descriptio**	**Quality**	**Unmodified**	**Modified**	**Borers**	**Scrapers**	**Microliths**	**Cores**
MG	Grey	Opaque	151	40	4	6	3	5
MMG	Dark grey		76	33	2			2
MLG	Greybrown		27	12	1			
MGM	Dark grey	Opaque, fine grained	73	26	4		2	5
MGML	Light grey		47	9		2	3	1
LGB	Light brown		6				1	
MT	Mottled grey/brown		15	4				
GHF	Grey/white flint		9	10			2	
HF	White flint		1	4	1			1
BB	Brown bryozo		1	1		1		
GB	Grey bryozo		7	17	3	1	1	1
MBF	Dark opaque flint		1					
MGB	Dark grey/brown flint	Transluscent	2					
MSP	Dark senon flint with dots		31	8	2	4	1	
MSP2	Dark senon flint with large inclusions		6	3				
MSP3	Dark senon flint with lighter sections		2	1				
FGP	Mottled grey/brown with lighter sections		12	3				
FGB	Brown flint		2					
GF	Grey flint		45	44	4	2	4	2
WG	White/grey flint		9		1			
n/a	n/a	n/a	37	10	1			27