

Øyunn Wathne Sæther

***A chaîne opératoire* analysis of the early Mesolithic site Mohalsen-I, Vega**

Master's thesis in Archaeology
Supervisor: Birgitte Skar
Trondheim, May 2017



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Department of Archaeology and Cultural History



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Front page cover picture illustrated by Øyunn Wathne Sæther

Abstract

The Early Mesolithic site Mohalsen-I on Vega, radiocarbon dated to about 10 700 – 10 500 cal. BP., is one of a few known Preboreal sites discovered along the coast of Helgeland in northern Norway. The site has been the subject of two excavations approximately 40 years apart; 1974 and 2012-2013. Both excavations were conducted due to erosion and sand drift resulting from heavy winds.

Stone Age sites have often been the subject of typological and morphological studies where very little emphasis has been placed on the technological aspects of the material, this is also true for sites along the western coast of Norway, and especially the northern region.

The purpose of this study is to investigate the technological aspects of an Early Mesolithic site by applying the *chaîne opératoire* approach to the material, thus attempting to reveal the utilisation of the site in terms of activities, how often it was visited and the duration for which it was occupied. In addition, on a “macro” analytical level it is also interesting to examine how the site can be understood in relation to its contemporary age, while on a “micro” analytical level it would be interesting to see if it is possible to understand the people that visited and occupied the site more than 10 000 years ago through the trace material that they left behind. An additional goal is to also examine how much difference exists between the analyses conducted on material from two very different excavation methods.

The analyses revealed that the site had been visited at least twice, however not in the exact same place, but perhaps by the same family group that visited it twice. Two activity zones could be seen on both parts of the site, however, there is uncertainty to whether the activity zones on the eastern part of the site were a result of the same visit or not. The analyses also revealed an extensive amount of different activities conducted in the zones, indicating that the site was a multipurpose residential site as opposed to a butchering site for example.

The excavations were for the most part divided between the two separate areas that revealed the different visits, thus making a comparison between the obtainable information from two distinct excavation methods easier than if the excavations had merged their inventories. The analyses revealed that excavations of Stone Age sites must be conducted in such a manner that there is very little doubt as to where the various artefacts were discovered, both horizontally as well as vertically.

Preface

When I first began to work with *chaîne opératoire* I had limited knowledge about what it entailed. Through the progress of understanding and defining the approach, I have come to recognise that the *chaîne opératoire* is a method that can provide much information about an archaeological site and its material expanding beyond pure description and typology, however, it should not be segregated from, nor used without the theory that refers to the cognitive aspect of the flint knapping process.

My knowledge and understanding surrounding the Mesolithic and its technologies can be attributed to my supervisor Birgitte Skar, who has always been available to answer my queries and to educate me on those points I needed to know and understand in order to be able to conduct a *chaîne opératoire* analysis. Her support, interest, and patience has been invaluable to me and my ability to complete this thesis.

Some appreciation must also be directed to my fellow master students at Kalvskinnet, especially those that started the same year as me, for all the support and fun times we've had. A thank you must also be given to Heidi Eltoft for reading through my thesis, in addition to being a close supportive friend. Skule Spjelkavik must also be mentioned as he conducted an analysis on the same material as me, and achieved knowledge which I have been able to take advantage of in this thesis.

My family also deserves to be mentioned for supporting me through the years, especially my aunts Astrid Sæteren, that supported me financially when the money ran out, and Karin Sæther for all the dinners, cakes and coffees that she has provided me with.

And lastly a big thanks to my dear Nathan that had to follow me through this, and has always been supportive, both mentally as well as practically by being my English spell checker. I'm not sure if this thesis would have been readable without your help.

Trondheim, May 2017

Øyunn Wathne Sæther

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1 Introduction

The Early Mesolithic site Mohalsen-I on the island Vega, is situated on the west coast of northern Norway. It is one of the earliest sites in the area, and dating back to the Preboreal time. During the following Mesolithic and Neolithic periods several parts of Vega were regularly visited and utilised in different ways as the isostatic rebound of land masses led to an increased amount of land accessibility.

According to Sørensen et al. (2013) in their NAR article *The First Eastern Migrations of People and Knowledge into Scandinavia: Evidence from Studies of Mesolithic Technology, 9th-8th Millennium BC*, the studies of early prehistory of Scandinavia and the Baltic has mainly been concerned with the typological aspects of formal tool types used to define archaeological cultures. This has resulted in the idea of prehistoric lifestyle being static and isolated (Sørensen et al., 2013, pp. 19-20). Technology is under-analysed and under-communicated in early Stone Age archaeology, especially the studies of the prehistoric technology in middle Norway, which has mainly been concerned with morphological aspects (Sørensen et al., 2013: 38). However, a new revival of the subject since the 1980s has led to a major discourse on technology and *chaîne opératoire*, and as a result an extensive number of doctorates on the subject have now begun to emerge (for example Damlien, 2016; Eigeland, 2015).

1.1 The scope of the study

I intend to study Mohalsen-I within the confines of the *chaîne opératoire* approach in order investigate to what extent the technological approach on a site can provide new information, and reveal the utilisation (function) of an Early Mesolithic settlement. Such a study has never been conducted on a site as far north as Vega. This leads to my main research question:

- *What can a chaîne opératoire analysis of the Early Mesolithic site Mohalsen-I reveal regarding the utilisation of the site on both a “macro” and “micro” analytical level?*

This research question is quite open, and it is therefore necessary to break it down into five further segments:

- ✓ *What kind of technology is applied to the material on Mohalsen-I?*
- ✓ *Is the technology different from other sites in Early Mesolithic Norway?*

- ✓ *If the settlement can be considered clean, in terms of no mixture of later occupation, and relatively short-lived, how can refitting highlight the activities on the site?*
- ✓ *Can the analysis reveal what type of site Mohalsen-I was (e.g. butchering site, hunting station, summer or winter camp, and so forth) (Binford, 1990; Bjerck, 1990)?*
- ✓ *How can the site be understood in relation to other sites in Norway, Scandinavia and northern Europe in the Early Mesolithic period?*

Mohalsen-I is situated in an area that is highly affected by erosion and sand drift due to heavy winds. It has been excavated twice over two periods approximately 40 years apart, both excavations were conducted due to the erosion. Despite the excavations being on the same site, a different number of layers were recognised during the two periods of excavation. An overview of the whole excavated area revealed two separate activity areas at an early stage of the analysis. It was thus necessary to understand the relation between the two excavation areas, and to understand what the layers themselves revealed. This resulted in the creation of several corroborative research questions:

- ✓ *Are the two initially visible activity areas on Mohalsen-I related to each other?*
- ✓ *Are the different layers and hearths found during the excavations a sign of several visits to Mohalsen-I?*
- ✓ *How have the different excavation methods influenced the possibility of an analysis of the site?*

1.2 Chronology, geography and a larger context

Northern Europe during the Late Glacial was covered by a uniform ice sheet that started retreating across the whole area between 18 500 and 17 000 cal. BP with only a minor re-advance during the Younger Dryas. In Norway, parts of the coast of Rogaland were deglaciated as early as 16 700 to 15 300 cal. BP, and the entire Norwegian coastline was deglaciated between 15 000 and 14 600 cal. BP (Wygál & Heidenreich, 2014, pp. 114-117). Several finds have indicated that parts of the Norwegian coast-line were not covered by The Late Glacial ice sheet at all (B. G. Andersen, 1979, pp. 80-81). There is also data that indicates that the southwestern most part of Norway was ice free at around 18 000 uncal. BP (Anundsen, 1996: 208). The rest of Norway was primarily deglaciated during the preboreal era, approximately

10 300 to 9000 uncal. BP, and during this period there were rapid environmental transformations which had an impact on the topography and biology. The melting of the ice sheet resulted in the elevation of both sea level and landmasses (Bjerck, 2008b: 66).

South of the southwestern coast of Norway was a vast area that is now covered by the North Sea. This is today referred to as Doggerland, a northern European plain that linked Denmark and Great Britain together. Doggerland was submerged ca 10 000 cal. BP (Wygala & Heidenreich, 2014: 117).

The fact that Pleistocene coastal areas became submerged due to the post-glacial rise in sea level causes problems when exploring the beginnings of marine foraging traditions (Bjerck, 1993; 1994: 48; 2008b; Bjerck & Zangrando, 2013).

From approximately 11,700 cal BP the archaeological record indicates a more consistent northward expansion from the northern European Plain and southern Scandinavia, due to the retreat of the ice sheet along the Norwegian coast. Approximately 800 settlements, belonging to this pulse of migration, are found throughout the Norwegian coast-line from around c. 11,500 – 11,300 cal BP (Breivik, 2016). The Norwegian coast had been ice free for more than 3000 years before the first pioneers started moving northwards along it (Bang-Andersen, 2012: 106), and the colonisation of the entire Norwegian coast happened fairly quickly after the arrival of the first pioneers (Bjerck, 1994, pp. 45-46; 2008b: 84). Artefacts and tools associated with these pioneer settlements show links to mobile hunter-gatherer groups with a southern origin (Bjerck, 1993; 1994: 37; 2008b; Boaz, 1999: 14; Fischer, 1996; Fuglestad, 2005, 2012; Waraas, 2001), and several studies regarding this have been conducted in Sweden and Norway (e.g. Cullberg, 1996: 188; Fischer, 1996: 165; Fuglestad, 1999: 197; 2000, 2007; Gustafson, 1999; Sørensen & Sternke, 2004: 85). It is believed that the Swedish west coast was the point of departure for the pioneers that moved into present day Norway from around 11500 cal BP, as there are sites in the Oslo-fjord area, dating to the Holocene-Pleistocene transition that links sites in Sweden and Norway (Bang-Andersen, 2012; Bjerck, 2014; Skar & Breivik, In Press with references). The rapid exploration and colonisation of the west coast also indicates the utilisation of seafaring vessels (Bjerck, 1993: 141; Bjerck & Zangrando, 2013: 80). There is, however, no empirical evidence regarding the means of travel in EM, and the lack of boats in archaeological context has led to a discussion regarding the type of boats utilised along the Norwegian coast, as well as the importance of them (Bang-Andersen, 2013; Bjerck, 1993, 2008b, 2013; Fischer, 1996; Glørstad, 2013).

Mohalsen-I – datings and geography

Climate/vegetation period	Period classification		Calibrated BC (cal. BC)		Duration		Calibrated BP (cal. BP)		Duration		¹⁴ C-years BP (uncalibrated)		Duration	
Preboreal	TM	TM1	9500	9000	500	1500	11 500	11 000	500	1500	10020	9590	430	1120
		TM2	9000	8500	500		11 000	10 500	500		9590	9270	320	
		TM3	8500	8000	500		10 500	10 000	500		9270	8900	370	
Boreal	MM	MM1	8000	7500	500	1500	10 000	9500	500	1500	8900	8400	500	1210
		MM2	7500	7000	500		9500	9000	500		8400	7970	430	
		MM3	7000	6500	500		9000	8500	500		7970	7690	280	
Atlantic	SM	SM1	6500	6000	500	2500	8500	8000	500	2500	7690	7110	580	2460
		SM2	6000	5500	500		8000	7500	500		7110	6560	550	
		SM3	5500	5000	500		7500	7000	500		6560	6090	470	
		SM4	5000	4500	500		7000	6500	500		6090	5680	410	
		SM5	4500	4000	500		6500	6000	500		5680	5230	450	

Table 1: Overview over the periods, as portrayed by Spjelkavik (2016), (after Bjerck (2008b))

The material from Mohalsen-I correlates to that of the Early Mesolithic Cronozone 10 020 - 8900 BP (11 500 – 10 000 cal. BP) (Bjerck, 2008b: 74), which includes the western Norwegian technocomplex called Fosna and the earliest part of the northern Norwegian technocomplex called Komsa. It is not a part of the initial period of exploration, but belongs to TM2; however, it is highly likely that Mohalsen-I represents the first occupation of Vega.

Vega is an island situated outside the Helgeland coast of the county of Nordland. It is presumed



that the sea level on the Helgeland part of the Norwegian coastline was approximately 80 meters higher during the Preboreal times than it is today, thus placing Mohalsen-I on the shoreline during the time of use.

Figure 1: Vegas position in the landscape. Map retrieved from Spjelkavik (2016: 1) (created from data retrieved from norgeskart.no)

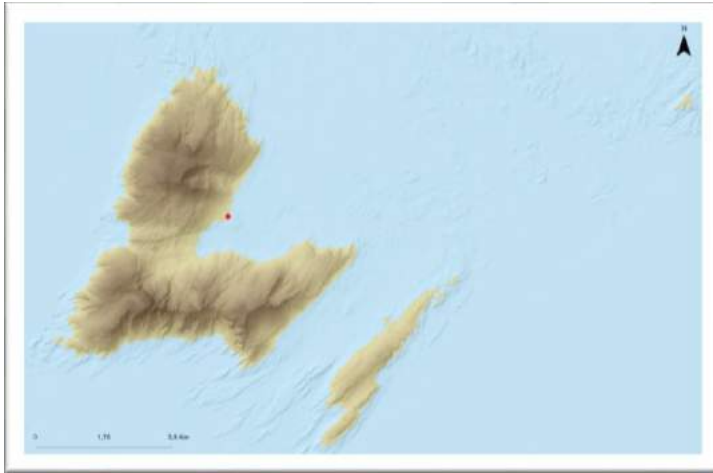


Figure 2: Vega in the Preboreal times, with the seal level at 80 m.a.s.l. Mohalsen-I is denoted by a red dot (map basis: Raymond Sauvage. Processed by Spjelkavik (2016: 28))

Skule O. Spjelkavik has calibrated the dates from Mohalsen-I in his master thesis from 2016. I will utilise Spjelkavik’s calibrations, and the dating method should remain similar to that utilised by Spjelkavik where possible. However, there will be dates in my thesis that are not calibrated, this is due to time constraints. The uncalibrated and calibrated dates will be specified where possible. Due to the lack of specification of uncal. or cal. within some of the references used, some dates will lack specification in within this thesis.

Spjelkavik’s calibrations were conducted using Oxcal v. 4.2.4.². He marked the datings calibrated by himself with an asterisk (*), and all dates were in the majority of cases conveniently given one standard deviation (68.2% probability, 1σ). If one standard deviation had more than one peak in the calibration curve, Spjelkavik marked the one with the highest probability with a “%” (Spjelkavik, 2016: 4). Based on the samples from the excavations conducted on Mohalsen-I, Spjelkavik has estimated an overall dating of the site as being from

Lokalitet	Provemateriale	¹⁴ C-alder	Kalibrert alder, cal. BP
Mohalsen-I (2012/13)	Trekull: vier (<i>salix</i>)	9396±66	10 710 – 10 553 cal. BP (68,2% sannsynlighet)*
Mohalsen-I (2012/13)	Trekull: vier (<i>salix</i>)	9481±68	10 793 – 10 648 cal. BP (42,8% sannsynlighet)*
Mohalsen-I (1974)	Trekull: vier (<i>salix</i>) og små mengder eik (<i>quercus</i>)	9350±270	10 868 – 10 246 cal. BP (58,7% sannsynlighet)*
Mohalsen-I (1974)	Trekull: eik (<i>quercus</i>)	8440±190	9599 – 9131 cal. BP (68,2 % sannsynlighet)*

Table 2: Calibrated dates from Mohalsen-I. Retrieved from Spjelkavik (2016: 31)

10 700-10 500 cal. BP (1σ) * of the site. This falls within EM2-EM3 (Spjelkavik, 2016: 31). Throughout this thesis I will use the following abbreviations for the following terms: EM (Early Mesolithic); MM (Middle Mesolithic); LM (Late Mesolithic); LP (Late Palaeolithic); MN (Middle Neolithic)

1.3 Structure of this thesis

This thesis revolves around a *chaîne opératoire* approach to a small EM site on Vega. Chapter 2 is therefore a presentation of the approach itself, including its research history, the present research status and the methodological and theoretical implications of the approach. Methodological limitations of the *chaîne opératoire* are also taken into consideration.

In chapter 3, I intend to take a closer look at the regional and local context of Vega and Mohalsen-I. This will be followed by a presentation of the previous excavations conducted at the site in question.

The focal point of my thesis is presented in chapter 4, this is the analysis of the material; the main point of interest revolves around the spatial organisation of the site. I will begin with an overview of the results from the morphological analysis, and also Spjelkavik's results from his raw material analysis (Spjelkavik, 2016). In addition, I will introduce other parameters of a raw material analysis. This will be followed by a presentation of the results from the technological analysis, the results from the refitting, and the related spatial analysis. I will then briefly gather the results from the preceding analyses and present them within the context of a *chaîne opératoire* approach. An examination of the combined results will be conducted in chapter 5.

In chapter 6, a discussion of all previous results will be conducted within the contextual framework presented in the previous chapters. Finally, in chapter 7, I will summarize the results and present my conclusion before suggesting some further directions for future research.

2 An introduction to the *chaîne opératoire* approach

2.1 Research history

The history surrounding the subject of refitting stone artefacts spans over 100 years. It was F. C. J. Spurrell who first refitted stone artefacts from an excavation in Kent in 1880, and others soon followed his example. The earliest “refitters” were not merely interested in answering technological questions, but had an interest in reconstructing human behavior, and viewed refitting as an opportunity to accomplish this (Arts & Czesla, 1990: 651).

Refitting was used as a means for studying human behavior early in the 1960s in both France and the U.S.A. The term *chaîne opératoire* was first introduced in French publications and works as a reaction towards the purely typological studies, a heritage from earlier research and common at the time (Eriksen, 2000a: 76; Sellet, 1993: 107). It was the ethnologist and archaeologist A. Leroi-Gourhan, a well-known critic of the classical typology, who came up with the concept and applied it to the groundbreaking excavation at the Paleolithic site of Pincevent during the 1960s (Eriksen, 2000a: 76; Pedersen, 2008: 93). Leroi-Gourhan was inspired by his teacher Marcel Mauss, a French anthropologist who focused on the techniques of the body (Mauss, 1973). Mauss’ philosophy was based on the notion that people everywhere are faced with “*physio-psycho-sociological assemblages of series of action*” that was embedded in the society (Mauss, 1973: 85), by which he meant that techniques are production and reproduction of learned bodily actions that seem natural (Dobres, 2000: 153).

Leroi-Gourhan developed a new approach to material culture that was more dynamic and differentiated than the older typological ones. According to Leroi-Gourhan it was necessary to view the artefacts in their correct behavioral context, because a tool was without any value to the interpretation if it was not related to any action or behavior (Eriksen, 2000a: 76). Leroi-Gourhan’s structuralist view on the production of a tool was that it should be viewed as a dialogue between the producer and the raw material (Eriksen, 2000a: 77). He turned the body into a tool itself, and the gesture was the combining principle between the means and the action, thereby making the tool incomplete without the gesture that puts it in to action (Tostevin, 2011: 354).

During the 1960s Gerhard Bosinski showed the different dispersions of a worked raw material by mapping refitted cores at the Rheindahlen site, and stressed through this the chronological implications of a site. Leroi-Gourhan and Michèle Julien continued this at the Pincevent

excavation, and used straight connection lines to show refits that could be directly connected to each other. Here, Julien pointed out the differing lengths of the lines, and Bosinski applied this to the Gönnersdorf site where he added arrows to the connection lines in order to depict the direction of the process (Cziesla, 1990: 11).

It was during the 1970s, with the new excavation techniques and the improvement of the quality of documentation that the refitting of objects came in to its own right (Arts & Cziesla, 1990: 651). Systematic refitting was utilised to answer technological and functional questions. Experimental controlled productions and usage of tools and worksites was conducted in order to enable the interpretation of the damage on projectiles and to interpret the usage of prehistoric sites (Cziesla, 1990: 11). Cziesla claims that during the 1980s this became a standard in the examination of sites that had been excavated (Arts & Cziesla, 1990: 651). While this might be the case in Germany and France, in Norway this has not been the case up until now.

Leroi-Gourhan might be the founder of the *chaîne opératoire* approach, but it is the ethnologist and anthropologist Pierre Lemonnier that has made *chaîne opératoire* what it is today (Eriksen, 2000a: 77).

2.1.1 *Chaîne opératoire* research in Scandinavia

During the 1980s and 1990s some research was conducted applying the *chaîne opératoire* approach to different sites in both Norway and Denmark.

The refitting of the Høgnipen site Rørmyr II was the first refitting to be conducted in Norway (Fuglestad, 2012: 3), and the study revealed a short-term hunting site with only a few people that arrived with a few cores; both prepared and partially prepared. The artefacts were refitted and placed into three main groups. The dispersal of heat affected flint revealed two hearths at the site, connected to three different activity areas. The results revealed that projectile points had been manufactured at the site, a hunt had taken place, and the game was brought back and butchered, the arrows had also been retooled (Skar & Coulson, 1986). In addition, Skar and Coulson could see distinct knapping differences between two knappers in the core preparation (1986: 97).

Foldsjøen 4A is interpreted as a pit stop in the zone between the coast and the mountain, where arrows were repaired, and the production of blades, which were removed from the site took place. The interpretation points towards the blades being semi-finished blanks produced in preparation for hunting in the mountains, and that two, possibly three cores were knapped at

the site. This site also revealed three different work areas, where area III had somewhat different characteristics to the other two areas, the artefacts found in this area were not produced here but brought to this location from the two other areas. These were the production areas (Skar, 1989).

The refitting of Bare Mosse II resulted in a high quantity of artefacts (48%) that were refitted back into seven main groups. The refitting disproved the earlier interpretation of some of the artefacts as belonging to a different visit to the site (Skar, 1987: 101). The site itself was interpreted as being a short time stay inside a dwelling with strict regulations regarding the production zones (Skar, 1987: 103). The refitting resulted in the discovery of several tools that were not previously recognised (Skar, 1987: 103).

In 1990 Kristine Johansen analysed the inventory of Uransbrekka in Sør-Trøndelag using the *chaîne opératoire* analysis. Her study revealed that several of the different reduction strategies utilised on the site were applied to all the different raw materials at the site. The knapping was mainly conducted using direct technique; the differences were however based on the choice of hammer. This showed that conscious choices were made, based on tradition and knowledge of different raw materials (K. Johansen, 1990: 179). The analysis also revealed that there were no separate activity zones at the site, and that the production and deposition was conducted in the same area (K. Johansen, 1990: 180).

Arne Johan Nærøy used distribution analysis and lithic analysis in his PhD from 1998 to investigate the utilisation of sites ranging from EM to MN. Through these analyses he achieved knowledge concerning the changes, differences and similarities on sites through 6000 years (Nærøy, 1998).

2.1.2 Present research status

Chaîne opératoire is now an increasingly utilised research framework in archaeology, and several new doctorates and research papers based on the theory and method are now emerging (Damlien, 2016; Eigeland, 2015). During this section I will present some different types of research where the framework has been applied in order to provide new information on a variety of assemblages and technologies in Norway, Denmark, and Germany, as well as providing information on similar technologies across regions.

Through the utilisation of *chaîne opératoire*, Julia K. Kotthaus has proven several of the interpretations made by Rust (1958) of the late glacial site Borneck-Ost in northern Germany

to be true. Kotthaus reaffirmed the interpretation of a tent at the site, as well as rendering information regarding individual knappers. She also proved that the site belonged to the Federmesser technocomplex (Kotthaus, 2013).

Mikkel Sørensen has utilised *chaîne opératoire*, combined with experimental knapping, to develop a nomenclature regarding different knapping attributes. He defines, with the help of the *chaîne opératoire* framework, seven operative schemes for blade production in the Maglemose culture (Sørensen, 2006b). Some of these operative schemes will be utilised in my technological analysis.

Mara Julia Weber concluded in her PhD, using the *chaîne opératoire* approach, that the Hamburgian represent a part of the Magdalenian Tradition (Weber, 2012).

Christina Lindgren utilised *chaîne opératoire* to study the relationship between technology and society. She studied the technological change that occurred 4500 BC in eastern central Sweden, and examined how technology was used as an instrument to instigate and maintain the formation of social groups in a changing society (Lindgren, 2004).

Refitting, alongside an analysis of technological attributes was also applied in order to highlight connections across the Scandinavian and Baltic regions during the late Preboreal and Boreal periods, based on the similarities in the pressure blade concept utilised in these regions (Sørensen et al., 2013: 46). This is particularly interesting, as it depicts the extent to which the *chaîne opératoire* framework can be utilised across today's borders if researchers collaborate.

Hege Damlien has used this method in her PhD to look at the maintenance and change of lithic tool-making in southern Norway during the colonisation period and the successive EM and MM periods. She has also utilised an analytical method called the MANA method, which is a method related to the physical refitting of an assemblage. The MANA method is based on the procurement and utilisation of raw materials on a site, and can be helpful in terms of acquiring an understanding of the site in relation to other sites (Damlien, 2016).

2.2 Theory

The theoretical aspect of the *chaîne opératoire* is based on the idea of physically taught knowledge regarding the production of tools. This knowledge is considered to be part of a set cultural context. It should therefore be possible to reach an understanding regarding the cultural

and cognitive processes within a society through the study of the technological production of tools.

The object of a *chaîne opératoire* study is the biography of the core; from it being discovered in the form of raw material in nature, to the discarded residue of it as waste. Eriksen (2000a: 80) refers to this as a process with at least six phases, if not more (see figure 3). The emphasis is placed on the production of tools, and the research focuses on the reconstruction of the production sequence. There are however, other elements behind and embedded in this production sequence. These are the movements, tools and instruments that the human being behind the production, uses to control the process towards a given outcome (Dobres, 2010; Martín-Torres, 2002: 33). This leads to the terms **knowledge** which is the theoretical and conscious aspect behind the process, and “**know-how**” which is the practical and intuitive aspect within the knapping process (Dobres, 2006; Pelegrin, 1990: 118).

The steps and stages in the process are more or less predictable because they are a reproduction of a set and taught craft within a cultural context. Although the technological choices take place within the constraints of the raw material and the main goal of the production, the flint knapper can still choose between several different methods to achieve the same result, and the choice of the action might stem from the society and culture that the technician belongs to (Martín-Torres, 2002: 34; Soressi & Geneste, 2011: 337). These different methods can be recognised in the technique utilised on the material (as can be seen later in my technological analysis). The theory involved behind the *chaîne opératoire* approach is described as a range of intentions embedded in the knapping process. These intentions are common for all people living within the same tradition and are embedded in the technological **knowledge** of the agent, and can therefore be described as an explicit, conscious and cognitive concept; defined as a *chaîne opératoire*. The *chaîne opératoire* analysis is thus a conceptual framework that can clarify the cognitive aspects, the reasons behind the choices made, and explain the underlying process at hand. It could also help with placing a site within a technological tradition both geographically and chronologically (Dobres, 2006; 2010: 51; Martín-Torres, 2002: 35; Pedersen, 2008: 93; Sørensen, 2006b: 23).

The “**know-how**” is the bodily and cognitive **experience** executed on a raw material by the skilled practitioner (Knutsson, 2003: 166; Pelegrin, 1990: 118). This means that although some flint knappers work within the same cultural tradition that lead to their choice of technology, they have different ways of executing the craft, with different bodily intuitive and unconscious

gestures that is embedded in the person (Dobres, 2006). It is therefore in the “**know how**” you can recognise the different practitioners based on the preferred method of knapping, in addition to the level of skill, as seen in Skar and Coulson’s analysis of Rørmyr II (1986).

A *chaîne opératoire* analysis contains three analytical levels which address the elements already described: 1) studies of the artefacts and the residue, 2) the actions behind the process and 3) the technical knowledge at hand, which is at a very abstract level and therefore hard to grasp, but which can however lead to the discussion of the cognitive aspects (Eriksen, 2000a with references to Lemonnier).

2.2.1 Terminology

Knapping method and knapping technique refer to two different parts of the technology. The method refers to a sequence of actions that are performed in relation to techniques, while the technique itself is the physical action, represented by the utilisation of a hammer and the bodily gesture during the moment of percussion (Inizan, Reduron-Ballinger, Roche, & Tixier, 1999: 30). The method implies a scheme where a production of set artefacts is the goal, and where the technical process is controlled by the underlying intentions (Eriksen, 2000a: 79; Inizan et al., 1999: 30; Sørensen, 2006b). The *operative scheme* (*scheme opératoire*) refers to the intentions of the flint knapper and contains the underlying thoughts and social implications that lead to the bodily gesture (Eriksen, 2000a: 79), while the *operative chaîne* (*chaîne opératoire*) refers to the whole process or chaîne of events; the lifecycle of an artefact, from raw material procurement do the discarding of it at a site. The *chaîne opératoire* analysis follows the artefacts life in reverse, and the foundation of the process contains six phases:

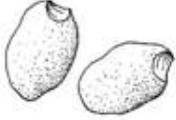









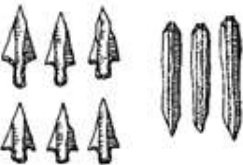

Phase	Action	Product	Debris
0 Procurement of raw materials	Decortication Selection		
1 Preparation	Shaping of nodule Selection		
2 Ground production	Production of blades Selection		
3 Modification	Production of tools Selection		
4 Usage	Tooling, utilisation, reuse, retooling Continuation of selection		
5 Discarding	Discarding, loosing or abandoning		

Figure 3: *The chaîne opératoire model*. Retrieved and translated from Eriksen (2000a: 81). Illustrations by J. Mührmann-Lund

Due to the fact that the different types of refits can provide information regarding the intra site movements, Cziesla has suggested a distinction between production sequences, broken artefacts and modifications, which are the three terms that all different types of refits can be attributed to (1990: 14-15):

- Refitting of the production sequence; With this he refers to “*the refitting of all products resulting from “basic production”, e.g. flakes and blades onto cores and onto each other*”.
- Refitting of breaks; This refers to “*the reconstruction of “basic products” and tools, mainly the refitting of broken pieces*”.

- Refitting of modifications; This is “*the refitting of all products resulting from the modification or working of an artefact as well as a resharpening*”.

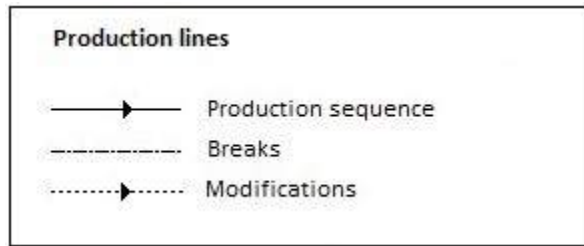


Figure 4: After Czesla 1990: 18

In terming the flint knapping process, both the method and technique are used. According to Sørensen (2006b: 23), the method is defined as the way the work is conducted in accordance to the *chaîne opératoire*, whilst technique is the way in which the physical force is transferred from the knapper to the stone. The technique is defined in five ways; these will be presented in chapter 4.4.2.

2.3 Method

2.3.1 Technological analysis

The technological analysis is often conducted on the blades. The reason for separating and analysing the blades lies in the fact that these artefacts were constructed in series with the purpose of being used as tools or made into tools (Sørensen, 2006b: 21). The blades that were taken out to be processed further are called ideal blades or blanks, and these were the main achievement in the blade production. The cultural significant operational scheme that took place on a site was conducted by the professional flint knappers, which makes only these persons blades correct for an analysis in regard to an affiliation with tradition as they would have been the only ones following the correct technical process for their culture or tradition, and that can reveal the technological profile of a site (Eriksen, 2000b, pp. 11-12; Sørensen, 2006b: 23). It is therefore important that when analysing a site, the archaeologist should be aware that the assemblage can contain traces of several different individuals, learning situations and knapping skills, and that not all of them represent the tradition per se (Sørensen, 2006a: 294).

2.3.2 Refitting

As a pure methodological tool the *chaîne opératoire* approach consists of a refitting of lithic artefacts, preferably back to an initial core, and an analysis of the debitage product which will

reveal the technological attributes (for example scar patterns and the usage of hard or soft technique). The refitting portrays the knapping sequence in reverse order of the original production, thus making the process itself, and not only the products, observable (Bar-Yosef & Van Peer, 2009: 106). To be able to refit the debitage, it is easier to apply the method to raw material that is of a heterogeneous type, so that it is possible to recognise different patterns that reveal which surfaces belong together. It is also quite useful for the analysis if the material at hand can yield enough refits to display a pattern, but fewer refits can also reveal something about the material, the site or the knapper. According to L. Johansen and D. Stapert it is possible to recognise individual knappers based on different levels of skills (2008: 16). This can be seen in Kotthaus' refitting of Borneck-Ost (2013) and Skar and Coulson's refitting of Høgnipen (1986).

The refitting of stone artefacts can provide information about the technology in use, and knowledge about the intra site movement. An important part of the *chaîne opératoire* method is therefore to analyse the distribution of the lithic assemblage in the original archaeological context, both stratigraphically and horizontally, and thereby trace the behavioural pattern and activity areas on the site. Information about this can also be drawn from the different types of refits (Cziesla, 1990: 14).

A site often includes several different activity zones, such as a primary production zone, a tool production zone and activity zones related to living on a site (such as food production and so forth). A spatial analysis can help identify these zones and a refit can reveal if any of the zones are interrelated to each other (Ballin, 2000: 115). Such a result can be seen from some of the refitting's already mentioned, such as Skar's refitting of the site Foldsjøen 4A in Sør-Trøndelag (1989), where three separate activity zones surrounding a central hearth were recognised due to refitting. Skar and Coulson's analysis of the preboreal site Høgnipen, where the tool's reduction sequences can be traced and the connection of three activity zones can be observed (1986: 101) is also an example of this. In addition, Skar's refitting of Bare Mosse II reveals activity zones that are connected. Here, two of the three manufacturing areas surrounding the hearth were linked, while the third could be the result of a second knapper (Skar, 1987).

The value of the information provided through refitting is constrained by the excavation method and the level of documentation conducted during the excavation, the more limited the documentation, the lower the information value of the artefacts (Ballin, 2000: 110)

2.3.3 Spatial analysis

The *chaîne opératoire* concept can also be applied to the site itself, as there are underlying processes during the creation, utilisation and abandonment of a site. Choice plays a key role in deciding where the best location to settle is; such as the choice of harbour or place of shelter, where to erect the tent (if tents are used) as well as the type of activities that are to be carried out at the site (Pedersen, 2008: 93).

The different refit units form patterns of lines that display the directions and distances of movement of the knapping process on the site (Cziesla, 1990: 17). An analysis of these patterns can reveal how the site has been organised, where the activity zones are and what kind of work has been conducted there, as well as uncover different phases of settlement and reveal latent and evident structures (Eriksen, 2000b: 14). The tools at hand can also reveal what the site has been used for: for example, a short stay for hunting, or longer stay with more than one purpose. It is important to observe the dynamics of the different functions of the tool to be able to understand the organisation of the site, and that the tool's function is relative to the context. A concentration of arrowheads at a specific location does not necessarily mean that a hunt has taken place at the location Grøn (2000: 159). It is also important for the analysis to be aware of the different visibilities that the different activities portray through the material. The altering of artefacts, from one tool to another during the stay, will have an impact on which tools are visible in the activity zones, and which tools are only to be found in the deposition zones (Grøn, 2000: 159).

In order for an analysis such as this to be conducted, it is vital that the excavation itself is executed in a way that renders little doubt over the location of the finds horizontally and stratigraphically (Cziesla, 1990: 17; Eriksen, 2000b: 14; Sørensen, 2006b: 24), preferably within quadrants that measure no more than $\frac{1}{4}$ m² (Grøn, 2000: 157). It is also important that the excavation is registered in a way that provides as much information as possible about the site itself (Sørensen, 2006b: 24). Ideally, the site should be relatively undisturbed and the artefacts should be found in their respected activity zones, though this is rarely the case. Later disturbances are always a risk, as well as the fact that the people that have lived there may have tossed waste products in places other than where the knapping was conducted. They might also have cleaned their work sites and deposited their waste material at another location. This creates the possibility for different types of waste deposition at a site (Grøn, 2000: 158) The majority of the sites where these observations have been conducted, is related to younger and

more sedentary societies than that of the one associated with Mohalsen-I. Waraas' as well as and Nærøy's analyses of several EM sites in the southern to western parts of Norway and Sweden shows that there is similar spatial organisation on these sites, with an area that has been cleaned, a hearth and a production area (Nærøy, 1998: 106; Waraas, 2001: 117). Waraas refers to this as a cultural element on the same scale as the similarities in the lithic inventory (Waraas, 2001: 117).

In the context of spatial analysis, one can identify that it is not only the technological, but also the natural impacts on the material that should be considered. For example can heat-effects on lithic debitage reveal a hearth even though this may not have been visible during the excavation, as seen in the refitting of Høgnipen (Skar & Coulson, 1986). All the various types of usage and production that have been conducted on site can be found as "tools", fragments and debitage. It is mainly the waste that remains, as blanks and tools have been curated either for later modification into tools or used during off site activities and hunting. However, the waste can reveal the hidden secrets of the site (Sørensen, 2006b: 23). The *chaîne opératoire* analysis can reveal a pattern of the utilisation of a site, both stratigraphically and horizontally, and can therefore show the chronological order of the events that have taken place within the area (e.g. Skar, 1987).

2.3.4 Methodological limitations

Chaîne opératoire does have its limitations, which are based in the methodology, as there are many variables during a refitting that can have implications on the success rate of the study. One of these is the size of the assemblages that are to be refitted, as it appears that success rate declines along with the increasing size of the assemblage (Goring-Morris, Marder, Davidzon, & Ibrahim, 1998: 155). Other implications involve raw material quality, as very homogenous raw material types with little diversity make it difficult to find refits. The time spent on the refitting does also have an impact on the success rate. A success rate of 20% refitted artefacts from the entire assemblage is considered to be good by many analysts (Laughlin & Kelly, 2010: 427).

3 Contextual backdrop of Mohalsen-I

3.1 Natural settings and biome in Norway in the Preboreal time

The environment of the Norwegian west coast in Preboreal time can be described as similar to the climate and biome of the Norwegian mountains today, with dwarf birch, heather and other mountain plants dominating the ice-free land. However, there were still changes in the climate, which in turn had an impact on the environment, and led to unstable conditions for the numerous types of flora (Johansson, 2000: 57). With both the fluctuation of the sea levels and the elevation of the land masses there must have been noticeable changes and instability along the shoreline for everything living under the conditions of the Preboreal era (Zvelebil, 2008: 19).

There is a correlation between the site distribution and density and the marine productivity in early Stone Age. Data shows that there might have been different approaches to the landscape in different parts of Norway relating to different resource situations (Breivik, 2014; Svendsen, 2007). A mixing of different water masses where the fjords met the archipelago and the establishment of the Norwegian Atlantic current created living conditions for new species, and thus the outer coast became the most productive zone in Preboreal time. In central Norway, a close relation between this kind of marine habitat and the EM living pattern can be demonstrated; the sites are on exposed islands, orientated towards these zones where marine productivity was high. The situation was somewhat different in the northernmost of Norway, where the Norwegian Atlantic current had less effect on the landscape, and the conditions were colder and more arctic. Here the living conditions were more correct for the sea mammals that were dependent on the sea ice, and the distribution of marine species would have been different from, and maybe more restricted, than further south. In this area, the sites are distributed more around fjord heads and sheltered sounds (Breivik, 2014, pp. 1484-1485).

Seals have probably been exploited for several reasons during the EM, and discoveries of concrete blubber deposits in Sweden and the Baltic area prove that seal blubber was utilised as fuel in hearths and lights (Pettersson & Wikell, 2014; Skar & Breivik, In Press: 11, with references). No such discoveries have been made in Norway, although lipid analyses have been conducted on Mohalsen-I, as well as on hearths that contained a substance with similarities to blubber concrete on Site 48 Nyhamna (Bjerck, 2008c: 559).

The premises presented above indicates that the main adaptation was marine in the EM (Bang-Andersen, 2012: 106; Bjerck, 1986, 1989, 1990, 1993, 1994, 1995, 2014; Breivik, 2014; Svendsen, 2007). This was, however, probably combined with alpine and inland hunting of reindeer (Bang-Andersen, 2012; Breivik & Callanan, 2016) as there are similarities in the organization of sites and lithic assemblages in the coastal and mountain sites. The inventory on mountain sites is however less varied than coastal sites, and show a larger degree of similarities in the assemblages (Breivik & Callanan, 2016: 588).

In northernmost Norway and Finland the situation was somewhat different as technological and raw material studies indicate that the coast was inhabited by the same maritime hunter-gatherers as further south, while a reindeer hunting population from the east settled in Finnmarksvidda and Finnish Lapland (Rankama, 2003).

3.2 Settlements, dwellings and material remains

Poor preservation conditions along the Norwegian coast have resulted in a lack of organic material that could have yielded information about any other technologies or utilisations than those conducted on lithics, hence only allowing studies on lithic material and dwellings to be performed in a Norwegian context. Finds of organic material from the Ertebølle culture from later in the early stone age in Denmark (S. H. Andersen, 2011), as well as from Tierra Del Fuego, an area with strong similarities to the Norwegian archipelago both today and during the stone age (Zangrando, Tivoli, Bjerck, & Piana, 2016, pp. 126-128), indicates that a very large number of tools and other inventory would have been manufactured from organic material, also during the preboreal in Norway. Future excavations of submerged EM sites in Norway might provide some knowledge in regards to prehistoric organic remains and material, such as the finding of a submerged pick axe made from bone, in Kirkehavn in southern Norway (Nymoene & Skar, 2011)

The dwellings are usually open air sites or, to a lesser extent, sites composed of tent rings made by stones. Cleared areas, and small, uniform entities, where the lithic distribution possibly represents floors, can reveal the possibility of temporary dwellings on a site (Bjerck & Zangrando, 2013: 83; Breivik, 2014: 1479). It is thought that the coast was settled by small social groups with high mobility and flexible relations to the areas they settled on land, as they probably carried everything they needed with them in their boats (Bjerck, 1993: 138; Bjerck & Zangrando, 2013: 84). The floors of the dwellings rarely exceed 10m², and are believed to be

structured according to the load capacity of a boat as well as the sizes of the groups (Fretheim, Piana, Bjerck, & Zangrando, 2016).

The excavation of Mohalsen-II in 2012 revealed a structure constructed of pebbles and with two hearths inside (Bjerck, Breivik, Fretheim, & Zangrando, 2012). The site is younger than Mohalsen-I, however, it does indicate that tent or hut like structures were used on Vega in the Mesolithic.

EM sites both along the coast and in the mountain, have revealed structures in the shape of tent rings, however, inconspicuous. The interpretation is that their placement is a result of human behaviour where the rings were moved around on the site with the repeated visits to the site, as well as the stones being rolled away during the deconstruction of the tents. The distribution pattern of the artefacts coincided with the distribution of the stones from possible tent rings, and strengthens the interpretation (Bang-Andersen, 2003; Bjerck, 2008a: 223).

According to Fuglestvedt (2005, 2012), the area chosen for a settlement could be based upon similarities to settlements on the northern European plains, with overview over the landscape (mountain sites) and seascape (coastal sites), and that this criteria was the reason why they chose the same area several times. Fretheim et al. (2016) have however showed that “space attractions”, where the remains of earlier settlements act as a sign of a desirable area to stay, could be one of the reasons for choosing the same area again. Bjerck’s (1989, 1990) analysis of favourable harbour conditions (see chapter 3.4, Figure 6) indicates how an area along the coast may have been chosen as a place to settle if there were no other “space attractions” on the site.

3.3 Mohalsen-I and Vega during the preboreal time

3.3.1 Flora

Nordland is situated in between central and northernmost Norway, both have been subject to ecological, environmental and technological studies, and due to less research in Nordland it is a bit difficult to say which of these conditions this area was subject to.

Tests from the hearths at Mohalsen-I revealed both willow and oak, however it is thought that the oak was driftwood gathered from the shoreline as this particular tree type was not known to growing in the area during the EM (Alterskjær, 1985). The presence of willow coincides with the results from the pollen analysis from Mohalsen-I, taken during the excavation in 2012,

which revealed that pine, willow and birch as well as cloudberry, heather and shrubs were present in the area during the utilisation of the site (Jensen, Sandvik, Storstad, & Virnovskaia, 2013).

3.3.2 The Nordland context



Figure 5 Map showing all sites and areas mentioned in chapter 3.3.2

The exploitation of Vega throughout the Mesolithic, as described by Bjerck (1989, 1990) must point towards the area as a desirable hunting ground with a high quantity of prey. The island was at that time not protected by the archipelago, which due to the isostatic uplift characterises the area today. It was instead exposed to the severe force of the Atlantic Ocean, with the nearest main land being as far as 20 kilometres away (Bjerck, 1989: 45). Yet, it was still densely populated during the period, which makes it credible to assume that the ecological situation on and around Vega was similar to that of the one in central Norway. However, as Mohalsen-I is the only site from the earliest time that has been found on Vega so far, it is fair to question

whether the island was as productive in the early Preboreal period as it might have been later on. This question might be directed at the entire Nordland coast as only a few other EM sites area found in Nordland so far, notably Kvefnsnhaugen in Leirfjord county, situated on the mainland further north of Vega. The site is situated approximately 82-83 m.a.s.l. and is ^{14}C dated to 9177 ± 77 (10 418 – 10 243 cal. BP (1 σ)*, calibrated by Spjelkavik 2016: 28) (Berglund, 2006, pp. 39, 41), and the sites Tuv and Evjen near Saltstraumen that both were situated on islands in the Preboreal times (Berglund, 2006). Another EM site was found further south of Vega, on Leka in Nord-Trøndelag in 2008 (Svendsen, 2009). There are however very few EM sites discovered in Nordland during the last 25 years. One might wonder if this is an indication of the natural conditions in the area being more like the northernmost parts, with less effect

from the Norwegian Atlantic current and with more fjord bound settlements that are not yet discovered due to limited recent construction activity, or if it is a sign of the Nordland's coast being uninhabitable this early after the ice age.

3.3.3 Mohalsen-I

Mohalsen-I is situated on a ridge that is quite distinct in comparison to the lower areas around it. Between rock outcrops there is a flatter area which people in the Mesolithic time found useful as a camping site on their way along the coast of Helgeland more than 10 000 years ago. During the Mesolithic times, this ridge was a wide headland in a shallow bay that lay in a north-westerly direction, partially protected from the waves by some small reefs to the southeast, but still very exposed to the sea (Lorentzen, 2013, 2014). Despite the site's location in shelter of the mountains behind it, there are heavy winds coming from the mountains south and west of the area today. This is the natural cause of the wind erosion on the site, and it must have been noticeable also during the EM (Bjerck, 2008c: 563).

The location of Mohalsen-I's, on a small ridge in a shallow bay with small reefs protecting it from the ocean, coincides with Bjerck's harbour analysis (Figure 6 C) conducted in the early 1980s (presented in the next chapter), it was however not situated in a protected bay but placed on the outer part (tip) of the ridge behind the protective skerries.

3.4 Research history of Vega and Mohalsen-I

The Stone Age of Vega was first acknowledged by the amateur archaeologist Edvard J. Havnø in 1923 along with the discovery of Ljøsåsen, a large settlement which was thought to date back to Neolithic times that contained as many as 30 hearths (Pettersen, 1982, pp. 13-14). This discovery led to a more extensive study of the area by several scholars, the first conducted by the archaeologist Theodor Petersen, who added several of the stone age artefacts from Vega to *Oldsagssamlingens tilvekst* in 1925.

During the 1950s the archaeologist Kristen Møllenus studied the discoveries from the Gulvåg site. The discovery of the lack of slate, in addition to the "old look" of the artefacts from this site, brought Møllenus to the conclusion that this was the oldest site on Vega and that it dated back to the Fosna culture in the EM times (Pettersen, 1982: 14).

The next person to show an interest for the Stone Age at Vega was Fredrik Gaustad in the early 1960s, who also thought Gulvåg was the oldest site. However, he was more hesitant to date it

back to the EM period as there was nothing at the site that indicated a relationship to the early Stone Age, in addition the distance above sea level did not allow for such a conclusion. He became aware of Mohalsen when he visited the place together with the local historian Haakon O. Wika in 1961 (Gaustad, 1977, pp. 394, 410).

Mohalsen-I was excavated in 1974 due to funding from Vega county (Alterskjær, 1974: 1; 1985: 37; Gaustad, 1977: 410; Pettersen, 1982: 17).. With the ¹⁴C-datings (9599-9131 cal. BP, and 10868-10246 cal. BP (Spjelkavik 2016:10)) from the site, as well as the “classical” EM artefacts such as tanged points and flake axes, the site was recognised as being one of the oldest sites discovered on Helgeland. Thus two areas stood out as important Stone Age areas on Vega, notably Ljøsåsen due to its size, and Moen due to its age (Pettersen, 1982: 18). Together these two areas were considered to span over most of the Stone Age at Vega, with Moen covering the oldest period and Ljøsåsen covering the youngest period (Pettersen, 1982: 13). The oldest part of Ljøsåsen was considered to belong to the end of the Mesolithic period based on the lack of slate present (Alterskjær, 1985: 41).

According to the unfinished and unpublished report from the 1974 excavation written by Kurt Alterskjær, and later publications by Gaustad and Pettersen, Mohalsen had already been labeled as a stone age site since 1923 after a previous visit by the amateur archaeologist Edvard J. Havnø. However, it was not until 1961 that artefacts were gathered and sent to the museum by Haakon O. Wika and Gaustad (Alterskjær, 1974: 1; Gaustad, 1977: 394; Pettersen, 1982: 17). Alterskjær writes in his preliminary report that despite the finds from the 1960s, nobody was made aware of the fact that the artefacts differed from the other and more well-known Stone Age sites at Vega until several years later, when in 1972 a group of students went to gather flint in the shifting sand area of Mohalsen together with Gaustad, and the flint arrowheads were found to be much older than anything else that were discovered previously in Helgeland (Alterskjær, 1974: 1; Gaustad, 1977: 410; Pettersen, 1982: 17). This, in addition to the location of the area at 82 m.a.s.l, indicated that the site could possibly be 9000 years old (Gaustad, 1977: 410). Both Alterskjær (1974: 1) and Gaustad (1977: 393) stressed that Mohalsen-I is situated higher in the terrain than the other sites. During the 1960s and 1970s this was quite unique, as the placement of the site in the terrain, as well as the artefacts discovered at the site, indicated

that this site was 3000 years older than what was previously thought to have existed in Norway. Due to this, Mohalsen-I became one of the oldest known Stone Age sites in Norway during this

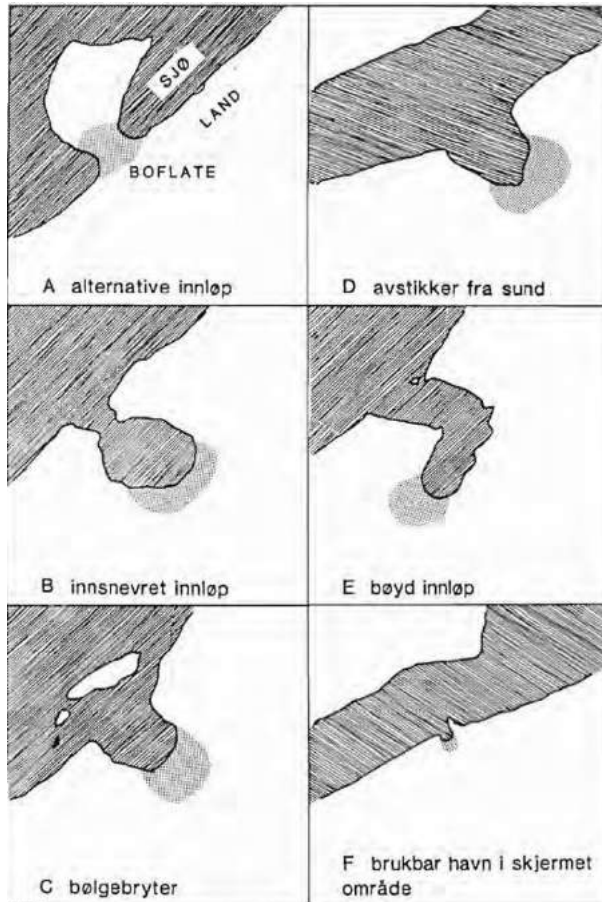


Figure 6: Favourable harbour conditions.

Illustration from Bjerck (1989: 93). A: alternative inlet; B: inlet with bottleneck; C: inlet with wave breaker; D: inlet in a sound; E: curved inlet; F: harbour in sheltered area (translation from Bjerck (1990: 7)

period (Gaustad, 1977, pp. 393-394, 410).

In the early 1980s the archaeologist Hein Bjerck conducted a research project on Vega. The goal of the project was to locate the sites from the Stone Age that were situated within the research areas (Bjerck, 1989: 25). Bjerck found that the area of Vega which was thought to constitute sites from the early Stone Age, covered approximately 50 km² of the 160 km² island (Bjerck, 1989: 45). Although his investigation focused on shorelines that date to the MM, there are still some useful interpretations relating to the areas chosen as sites for settlements during the Stone Age within his research. Bjercks shoreline analysis on the pages 92 - 99 provides, amongst other things, examples of topographical situations that provide favorable harbour conditions (1989: 93).

3.5 The excavations of Mohalsen-I

Due to sandy beach deposits and the wind, Mohalsen-I is affected by heavy sand drift. This is one of the reasons put forth for conducting both the excavation in 1974 and in 2012-2013. Alterskjær's main aim was to clarify whether apparent stable parts of the site could reveal cultural layers, while the 2012-2013 excavation was conducted as a rescue excavation. This is a short overview relating to how the excavations were carried out, and how this has affected the outcome of the data and interpretations of the site.

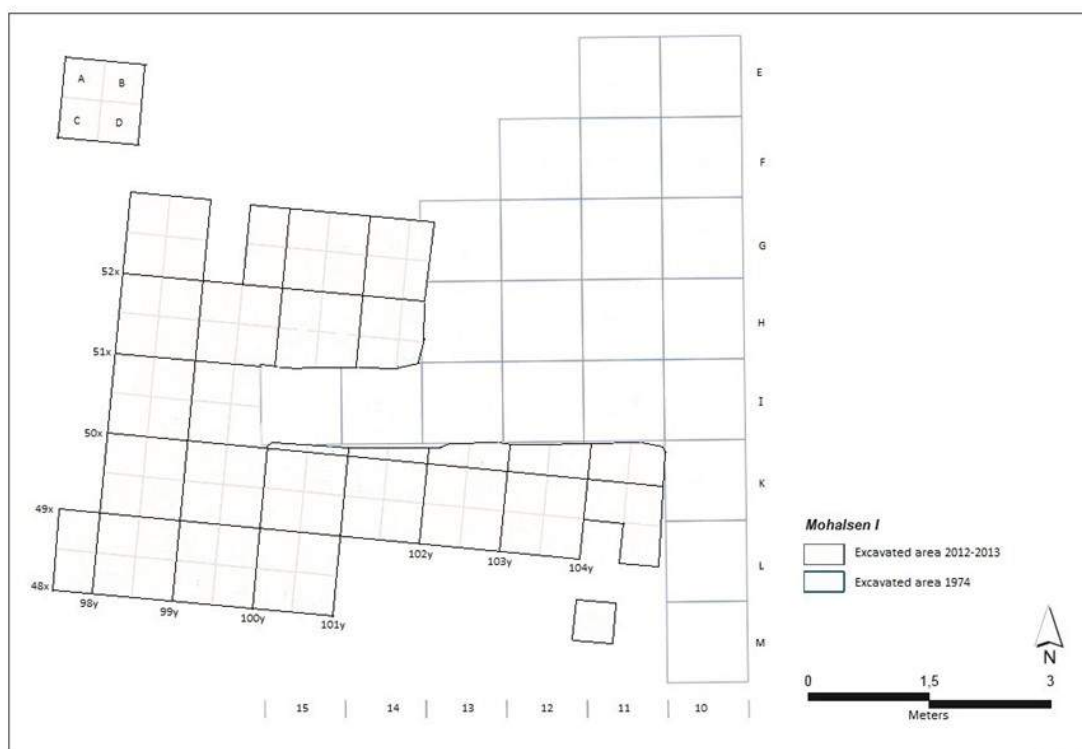


Figure 7: The excavation area from 1974 and 2012-2013

3.5.1 The 1974 excavation

Alterskjær explains in his preliminary report the three aims of the excavation conducted in 1974, notably to: clarify whether stable parts of the site contained cohesive cultural layers: to get an overview over the finds and the context: and to gather samples and artefacts that could reveal something about the age of the site as well as the scientific potential of the site. One of the problems on Mohalsen-I however, was that parts of the site were eroded and consisted of a lot of loose sand that shifted whenever there was wind in the area. This was one of the areas where people had been gathering artefacts prior to 1974, and Alterskjær decided to excavate close to this area (Alterskjær, 1974).

The excavation was conducted over a period of ten days and covered 20 – 25 m². According to Alterskjær, the initial survey did not reveal any stratigraphic divisions between layers, and during the excavation only two different layers were observed by the archaeologists, both in the soil itself and also in the archaeological material. Thus the area was excavated in two layers where the division was placed where the light sand met the brown and red sand (Alterskjær, 1974: 3). It was mostly in the transition layer and further down in the darker sand that most of the archaeological material was discovered (Alterskjær, 1974: 4).

The area chosen for the excavation was covered by peat, except for three of the squares, E10, F10 and two thirds of G10, which were heavily eroded due to the shifting sand. Where the shifting sand was covered by peat it seems to have been considered as part of Layer 1. There were few discoveries and no apparent concentrations in this layer. Where this sand was lacking in the first layer, there were more artefacts and more concentrated finds in Layer 1 (Alterskjær, 1974: 4)

Although there has clearly been other types of sand and soil visible in the first layer, these have not been considered as autonomous layers in themselves. Alterskjær mentions several of them in his preliminary report, without taking further notice of them. He also mentions a coal black transition layer between what he has interpreted as Layer 1 and Layer 2, and that most of the artefacts were found in this shift between Layer 1 and Layer 2, as well as some finds further down in Layer 2 (Alterskjær, 1974: 3-4).

Scattered spots of coal were noted in the transition between Layer 1 and Layer 2. In some of the squares there were concentrations of coal further down in the second layer, and in square G11 the amount of coal was so substantial compared to the other squares that Alterskjær

characterised it as a hearth. This hearth was excavated by a vertical exposure, but did not reveal anything in particular. Some artefacts were found in the hearth. In addition, in square I13 a coal concentration was noted, as well as some smaller concentrations within other squares. Alterskjær notes that the amount of discoveries was considerably larger in these areas than where no coal was detected (Alterskjær, 1974: 5-6). A ^{14}C sample from the hearth in G11 was dated to 9350 ± 270 BP, and a ^{14}C sample from one of the coal concentrations was dated 8440 ± 190 BP (Alterskjær, 1985: 39) (respectively 10 868-10246 cal. BP and 9599-9131 cal. BP (Spjelkavik, 2016: 31) - see Table 2). The oldest dating came from willow (*Salix*) and minimal amounts of oak (*Quercus*), and the youngest of the samples came only from oak. This represents a problem as oak did not exist in the area at the time Mohalsen-I was inhabited (Hafsten, 1987), though it is possible that the wood came from driftwood gathered from the shores (Alterskjær, 1985: 39 - 40).

The excavation was thoroughly conducted with a trowel, but the excavated soil was not sieved (Alterskjær, 1974: 4).

3.5.2 The 2012-2013 excavation

The second excavation at Mohalsen-I was conducted 38 years after the first excavation took place, and the development in the excavation techniques is apparent in these two excavations.

The excavations from 2012 and 2013 were conducted as rescue excavations due to the erosion. The goals were to map the erosion and see how it effects archaeological sites of this nature, and to save the remaining, highly important source material of the site from being collected by curious hikers tracking the path close by (Lorentzen, 2013: 3). In order to achieve an idea of the effects erosion could have on archaeological sites, two areas were opened for excavation on Mohalsen-I in 2012, one northern and one southern, where the southern was a direct extension of the 1974 excavation. The northern field was heavily eroded while the southern was less exposed to erosion. The results from this showed that the area that was less exposed to erosion had more flint artefacts than the area that was more exposed to erosion, which contained more quartz. The flint artefacts are easier to detect for non-archaeologists than artefacts of other materials, and the lack of flint in the eroded area is interpreted to be a result of hikers gathering recognizable artefacts on their trips within the area. This showed that the site was vulnerable not only to the effects of erosion itself, but also to people collecting stray finds in the area. As a result important research material was considered to be in danger of being lost (Lorentzen, 2013: 2).

The grid system from the 2012 excavation was initially supposed to be set up in accordance to the grid system from 1974, the idea was to expand this grid. A wrong measurement led to a shift in the new grid system, which made it deviate from the old one, and it is therefore placed at an angle on the 1974 grid. The measurement is most likely placed approximately 3 meters too far towards the southeast (Lorentzen, 2013: 6)

One of the main considerations in the 2012 excavation was to see how much erosion the site had been exposed to since 1974, and how much damage had occurred. The result was that the eastern part of the old excavation area had been heavily eroded, and the eastern profile from the 1974 excavation had shifted more than 80 cm during the period of 38 years. The western part of the site was considerably more intact (Lorentzen, 2013: 9).

The most intact part of the excavation site from 1974 was the *I shaft* located along the east-west axis. In 2012 the excavation was concentrated to the area along both sides and west of the *I shaft* to see if they were able to establish the limit of the concentration of discoveries, thus laying the foundation for an analysis of the activity at the site. At the southern side of the *I shaft* the area was opened all of the way to the 1974 *10 shaft* located along the north-south axis (Lorentzen, 2013: 9).

Two hearths were uncovered during the excavation in 2012. One hearth was discovered as two separate entities in 49x-100y and 51x100y, divided by the *I-shaft*. Lorentzen writes that it is impossible to determine whether these two separate entities are the same hearth (Lorentzen, 2013: 11-12). However, Alterskjær refers to an assemblage of coal between these two areas (Alterskjær, 1974), and one could conclude to a certain degree that they represent the southern and northern parts of the same hearth. Another hearth was discovered in the northern part of the area excavated in 2012-2013, situated in 51x-101y. The ¹⁴C samples taken from layers with finds were dated 9481 ± 68 BP and 9396 ± 66 BP (Lorentzen, 2014: 4) (respectively 10 793-10 648 cal. BP and 10 710-10 553 cal. BP (Spjelkavik, 2016: 31). See Table 2). The wood from the samples was identified as willow (*Salix*) (Jensen et al., 2013).

The excavation from 2012-2013 covered approximately 21 to 22 m². During the excavation 12 different layers were identified (including a pit and two hearths), and the excavation was conducted in accordance to the Single Context Recoding method in order to see whether it could yield any information regarding the contemporaneity of the deposits. The soil was sieved with 4mm and 5mm sieves (Lorentzen, 2013, 2014).

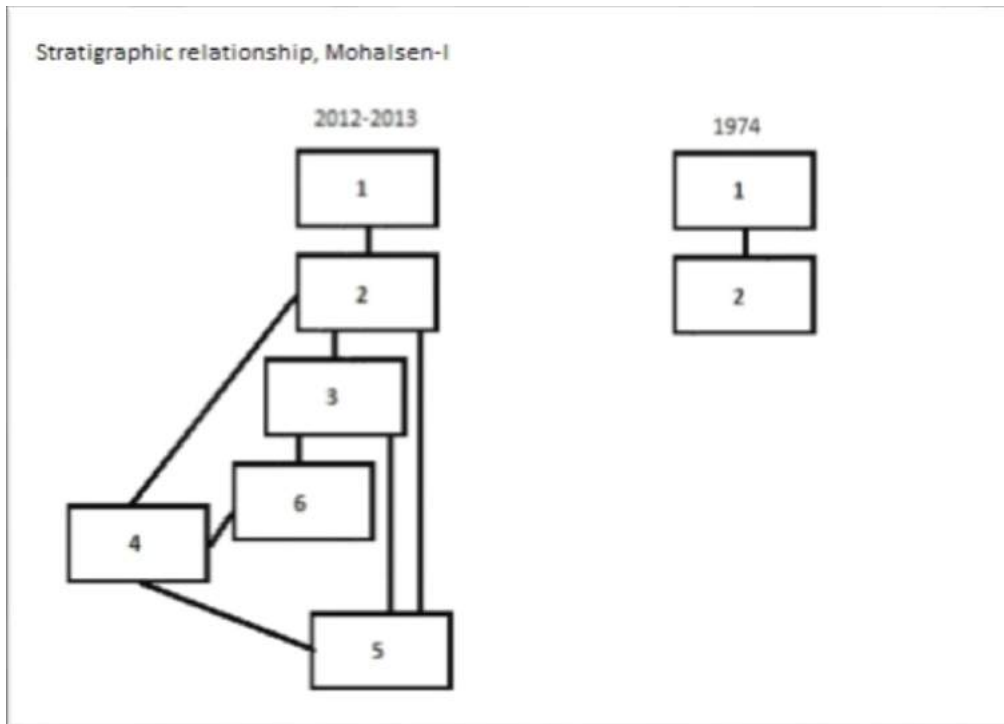


Figure 8: Stratigraphic relationship (after Lorentzen, 2013, 2014)

3.5.3 Difficulties regarding the excavations and the methods applied

The excavation methods have changed considerably during the time span between the two periods of excavation in Mohalsen-I. An increasing awareness of stratigraphy, raw material and distribution control have influenced how excavations have been conducted and increased the knowledge surrounding the relations between the objects and their context. This also effects the differences in the interpretations conducted at the site during the excavations, as they have a foundation in the definition of what is discovered. The interpretation of a site can have an impact on whether a layer is recognised or even identified (Hodder, 1999: 86), and one of the differences in the excavations on Mohalsen-I is the acknowledgment of layers in the stratigraphy. Where the archaeologists from the excavation in 1974 have differentiated between only two layers, the excavation from 2012-2013 recorded as many as ten layers (twelve including the two hearths and the pit), although not all of them contained artefacts.

The handling of the excavated soil in the most recent excavations was also different from that of the earlier. In 1974 archaeological sites were mainly excavated by trowel, and sieving was not common practice. This was also the case at Mohalsen-I in 1974. In an article from 1985 in *AmS – Skrifter*, Sveinung Bang-Andersen analyses the loss of lithic artefacts at sites that have not been subject to sieving. After sieving the soil from three different locations that had initially had been excavated the “traditional” way with trowels, Bang-Andersen concluded that on average about 50 percent of the artefacts were lost, and the majority of this were artefacts of size between 6 to 10 mm which meant a total loss of 85 percent (Bang-Andersen, 1985: 18-22). On the other hand, in the size ranges between 21 - 30 mm the percent loss was between 33 to 42, decreasing in percent when increasing in size. Larger artefacts were also overlooked, the longest being one of 59 mm and the largest measuring 11,5 cm in total (Bang-Andersen, 1985: 13). In the tool category the percentage loss was 37 in average, and the tool most likely to be overlooked was projectile points (Bang-Andersen, 1985: 18). The lack of raw materials other than flint from the 1974 excavation can be partly explained by the lack of sieving, however, it



Figure 9: Photography of the excavation field from 1974, taken from the north. The hearth in G11 can be seen in the middle of the photo. The possible tent ring is can be identified by the stones towards the southwestern corner of the site. The photo is retrieved from Alterskjær (1985: 39)

is more likely that the main reason for the lack of other raw materials lies in the fact that the comprehensiveness of raw-material types was not recognised during the 1974 excavation.

The 2012 excavation was affected by water coming from the mire just north and west of the area, it was at the time necessary to set up a water pump in order to remove the water from the site. Heavy rain also had an impact on the excavation (Lorentzen, 2013: 7). The water pump was placed in a pump-hole outside the main excavation area along the *10-Shaft* from 1974 as this was the lowest part of the site. During the excavation in 2012 a possible tent ring, positioned in a manner that would have supported the tent against the heavy wind coming from northwest, was identified at the site excavated in 1974. Several large stones were uncovered south of the possible tent ring during 2012, and Lorentzen writes that it would be interesting do uncover the entire tent ring, however; the area of interest was also the area where the water pump needed to be placed, thus haltering any further investigation (Lorentzen, 2013: 12). The stones are positioned in I11 and -12, and H12 and -13, however some of them was initially moved during the excavation to weigh down the tarpaulin that was used to cover the site.



Figure 10: Overview over the hearths and the possible tent ring. (black line drawn by signed) (retrieved from Lorentzen 2014, Vedlegg 8b)

4 Analysis

4.1 Introduction

The purpose of this analysis is to gain a greater understanding of the lithic inventory of Mohalsen-I, both technologically, morphologically and spatially. Additionally, it will be an attempt to deliver a more thorough understanding of what kind of site Mohalsen-I is through an analysis conducted on all the material in general, and particularly on the projectile points. These combined analyses form the foundation for the *chaîne opératoire* analysis, and help uncover the different integrated sub systems that can be discovered at a site (Eriksen, 2000a: 80; Soressi & Geneste, 2011: 337).

Through the morphological analysis it is possible to determine where the material belongs within the confines of a chronological framework. To conduct the other subsequent analyses, it is important to know what the lithic inventory consists of. This will provide an overview over the different categories of the lithics, which may provide an indication as to what type of site Mohalsen-I was, what the main function within the lithic production was, and help provide a correct interpretation of the different activity zones at the site.

The method of refitting makes it possible to determine the movements of artefacts at the site, both horizontally and vertically. According to Cziesla, it also allows the opportunity to estimate the time spent at the site based on the length of the connection lines in a reduction or modification sequence (Ballin, 2000: 109; Cziesla, 1990: 31). This is however, most likely dependent on the persons inhabiting the site, and should be viewed in relation to other measurable parameters on a site, such as the amount of debris discovered. If viewed together with the results from a spatial analysis, refitting can also state whether the layers at the site are contemporaneous or the result of several visits, it can also provide information relating to the intentions within a knapping sequence or modification of an artefact.

A spatial analysis can give an understanding of the utilisation of the site, and where the different activity zones are. It can also uncover possible structures that may not have been visible during excavation. A technological analysis is a method of determining the type of technology and techniques applied during the production of tools and artefacts on a site.

4.2 Morphological analysis and some changes in inventory

As noted, the material at Mohalsen-I correlates to that of the EM Cronozone 9500 - 8000 cal. BC (11 500 – 10 000 cal. BP) (Bjerck, 2008b: 74), defined by its typological artefacts such as single edged and oblique projectile points (both types are tanged points with retouch on one whole side), tanged points with an unmodified point end (Waraas, 2001, pp. 40-41), scrapers, burins, unifacial cores and rejuvenation debris from flake axes, as well as the raw material being dominated by flint (Bjerck, 1983: 53).

There were in total 53 projectile points discovered on Mohalsen-I. According to the catalogue, 29 are single edged and 12 are tanged, 2 projectile points are classified as oblique, 7 points are classified as fragments or preparations, and 3 are unspecified. The higher number of single edged tanged arrowheads in comparison to tanged projectile points are more common in southern Norway than on the West coast where the tanged are in the majority (Bjerck, 1983; Indrelid, 1975: 8f). The tool inventory is in line with the radiocarbon-dating to EM2-EM3.

In blade production, unifacial blade cores and uneven and coarse blades are common during EM (Bjerck, 1983: 25). Fuglestvedt argues against this concept of “coarseness” in the EM material, due to the high level of skill needed to execute the technique required to produce the blades (Fuglestvedt, 1999: 194). However, although the blades found at Mohalsen-I vary in regularity, many of those left as whole correspond to Bjerck’s blade description as well as Sørensen’s blade description of blades from Maglemose 0 (Sørensen, 2006b)

Earlier morphological analyses on the material

The inventory from Mohalsen-I has already been classified with a basis in a revised edition of Helskog et al’s terminology from 1976, and I will continue to use these terms, albeit the English translations of them.

The material from the excavation conducted in 2012-2013 has been morphologically analysed and cataloged by Astrid Lorentzen, while the material from 1974 has been morphologically analysed and cataloged by Synne Husby Rostad in 2011. Martin Callanan also worked with and analysed the material excavated in 1974 in his master thesis *On the Edge* from 2007. Callanan’s analysis of only one part of the material from Mohalsen-I is important to the understanding of the lithic assemblage, as there will be differences in the inventory that can be traced not only to the excavation method, but also to the different morphological analyses conducted on the material.

Callanan's analysis focused on identifying informal tool elements on EM sites, thus acknowledging several new tool categories, and finding more tools within certain categories in the 1974-material. Possibly more than what might have been acknowledged in the 2012-2013-material.

Spjelkavik analysed the material from both the 1974 excavation and the 2012-2013 excavation in his master thesis *Mohalsen-I, Vega* from 2016. His primary focus was on the raw material; however, in addition he also examined the cores, and the size and cortex of blades. Spjelkavik recognised 36 cores (as opposed to the 44 cores recognised during cataloguing; see Appendix G) at Mohalsen-I, of which 23 were classified as unifacial, six as bipolar, five as irregular, one discos shaped and one bifacial. As he points out, the material is dominated by unifacial cores, which is normal for the period, however; unlike what is normal further south, Mohalsen-I contains a fair amount of bipolar cores and also one discos shaped core (Spjelkavik, 2016: 19). These types of cores are considered as more typical for northern Norway (Bjerck, 2008b).

Present study

Based on my analysis of the material, three of the four artefacts from the 1974 excavation cataloged as microburins are here interpreted to be flakes with intentional and unintentional retouch, and one of them is interpreted as the tange fragment of a projectile point. An oblique microlith from 2012/13 has been changed to a simple lancet. Several other artefacts have received the status of projectile points, fragments from projectile points, or projectile points in preparation. Other reclassifications have also been done to the inventory of both excavations, (see Appendix A for more information). Most of the changes have been conducted under the supervision of Birgitte Skar. However, since this has not been the main aim of this study, several informal tools might have been overlooked. One artefact from the 1974 assemblage (19464:92) does however need to be noted, as it changed in this present analysis from knife (Callanan, 2007) to projectile point.

Based on Waraas' master thesis, the main part of the intact projectile points can be classified as single edged tanged points (2001, pp. 40-41). T19464:133 and T25950:441 and :319 have similarities with drill-bits, which are small projectile points with coarse and steep retouch on both sides (Waraas, 2001: 45). The two oblique points mentioned earlier are T25950:480 and T26109:327.

Knut Helskog, Svein Indrelid, and Egil Mikkelsen’s classification system of knapped lithic artefacts distinguishes between primary artefacts and secondary flaking retouched artefacts (1972: 12). The first category represents the production of cores, blades, bladelets and flakes (Helskog et al., 1972: 13). The classification system has set metric standards for each type of artefact. However, several blades from Mohalsen-I do not meet these metric dimensions, and would be considered bladelets if measured in accordance to the standards (the same problem can be seen in Mikkel Sørensen’s analysis in his article from 2006). A structured production process does not follow a set metric dimension scheme, and a blade outcome does not necessarily follow the standards they are forced into today. As a result, technical and social distinctions can be lost (Hodder, 1999: 89). Therefore, I have chosen to reclassify several of the bladelets (after metric standards) from the 2012-2013 excavation as blades, as they clearly represent a concept where the production of blades has been the main purpose.



Figure 11: Examples of bladelets that follow a blade production concept

From the 1974 material, however, several of the bladelets and micro blades do not follow a set blade concept, and many of them are flakes or chippings. Thus, I have left these out of the analysis. However, it is worth noting that in regards to this decision, several of the micro blades are left out as chippings based on their lack of butt. According to Bjerck (1983: 29) not all blades have a butt, as the bipolar technique results in micro blades without butts. Therefore, the “chippings” may be a result of the “bipolar” technique.

Some notes need to be addressed in regards to the analysis of the cores; one of the artefacts cataloged as a core by Rostad and analysed as a core by Spjelkavik actually is a flake axe. In addition to this, the technique applied to the cores at Mohalsen-I that are analysed as bipolar is not the same technique as the bipolar technique known from the LM, but rather a result of an

attempt to attain more blanks from an exhausted core by using the opposite lateral side as core platform.

4.3 Raw material analysis – Spjelkavik 2016

Spjelkavik analysed the raw material at Mohalsen-I in order to understand the utilisation of the landscape in the EM. He distinguished between 23 different raw material qualities, divided across six different main categories (see Table 4); flint, quartz (quartz crystal is a type of quartz), quartzite, chert, greywacke and rock. The division of the different raw material qualities was conducted visually, and is therefore a tentative and subjective analysis. His analysis was based on different parameters: colour, quality and gloss, where the colour parameter was divided in 7 different nuances of grey within the qualities fine and coarse. Spjelkavik did initially view the quality categories as relatively accurate (Spjelkavik, 2016: 92), however, the post depositional processes some of the artefacts on Mohalsen-I have been subjected to made it difficult to divide the inventory based on these criteria (Spjelkavik, 2016:

Mohalsen-I		
Flint	5694	81,1 %
Kvartskrystall	676	9,6 %
Kvartsitt	313	4,5 %
Kvarts	273	3,9 %
Chert	47	0,7 %
Bergart	22	0,3 %
Totalt	7025	100 %

104).

Flint is the main raw material category, with 81.1%, while the rest of the raw materials together constitute 18.9% (Table 3). The utilisation of raw materials other than flint on Mohalsen-I is high compared to Site 48 Nyhamna, which was Spjelkavik’s reference material (Spjelkavik, 2016: 67).

Table 3: Raw material categories on Mohalsen-I. From (Spjelkavik, 2016: 30)

As seen from Table 4, there are 9 different flint types on Mohalsen-I. The quartz is represented with five types, while quartzite and chert are represented by three each.

Spjelkavik’s analysis shows that artefacts are left at various at various stages of production, Phase 0, 2 and 5 according to the *chaîne opératoire* analysis of Mohalsen-I. Vega is the suggested provenience of the flint, pegmatite quartz, quartzite and unspecified rock, while the quartz crystal was potentially found nearby on mainland and the chert was probably found in Alta (Spjelkavik, 2016: 106). This is notable in that the chert from Alta, which is a distance of 700 kilometres from Vega, indicating either high mobility with long reaching journeys or contact with other groups. There is no trace of primary reduction of this raw material on the site (Spjelkavik, 2016, pp. 99-100)

Through measuring the blade sizes and comparing them to the core sizes, it is possible to conclude something regarding the exploitation of the different raw materials. If one raw material holds both long blades and small cores, it is evident that the initial nodule was quite large, intensively exploited to achieve as many artefacts as possible from it. The discovery of only blades and no cores from a raw material could indicate that the core was completely exhausted at the site, or that it has been brought to another site (Spjelkavik, 2016: 67).

The cores at Mohalsen-I were in general smaller than the cores from Site 48 Nyhamna (2016: 80). Spjelkavik emphasises that the data shows a tendency. The interpretation is therefore that the cores at Mohalsen-I could be exploited to a higher degree than the cores on Site 48 Nyhamna (2016: 81).

Based on the measurements, Spjelkavik concludes that cores of grey and coarser flint of different qualities and a core of white quartz were the largest when discarded, while the glossy, finer types of flint were exploited more heavily (Spjelkavik, 2016: 82). This is especially visible in the black senon flint, which represented the smallest core on the site, even though it was represented by a large number of blades. This indicates that the initial core or nodule was quite large (Spjelkavik, 2016, pp. 82, 84). This feature is evident in several of the cores of finer quality, as it was these that were knapped to exhaustion and ended up resembling bipolar cores (Spjelkavik, 2016: 102).

Råstoff	Kvalitet	Farge	Glans	Kode	Tallkode
Kvarts	Fin	Klar	Blank	KFKB	1
		Røykkvarts	Blank	KFRB	2
		Hvit	Blank	KFHB	3
	Middels	Hvit	Blank	KMHB	4
	Grov	Hvit	Blank	KGHB	5
Kvartsitt	Middels	Blå-grå m/hvite bånd	Matt	KIMBM	6
		Hvit	Matt	KIMHM1	7
	KIMHM2			8	
	Grov	Mørk grå m/hvite prikker	Matt	KIGMM	9
Flint	Fin	Svart	Blank	FFSB	10
		Grå	Blank	FFGB1	11
				FFGB2	12
			Matt	FFGM1	13
		FFGM2		14	
		FFGM3		15	
		Brun	Blank	FFBB	16
	Middels	Grå	Blank	FMGB	17
			Matt	FMGM	18
	Uspesifisert	Brent, kun cortex ol.	-	FU	19
Chert	Fin	Svart	Matt	CFSM	20
		Lys Grå	Matt	CFLGM	21
		Grågrønn	Matt	CFGGM	22
Gråvakke	Grov	Grå	Matt	GRÅ	23
Bergart	Uspesifisert			BA	24

Table 4: Classification key, raw material on Mohalsen-I. Retrieved from Spjelkavik (2016: Appendix A)

4.3.1 MANA analysis

An interesting parameter within the *chaîne opératoire* analysis is the procurement and discarding of raw materials, which represents the first and the last phase of the production chain. Spjelkavik (2016) as noted previously has analysed the procurement of the raw materials found on Mohalsen-I, and he also performed an analysis of the discarded raw materials that were represented by cores at the site. However, there are raw materials on Mohalsen-I that are only represented by a few flakes or possibly some blades or projectile points. The initial core production of these raw materials must have taken place somewhere else, and a pre-worked

core, or perhaps a few blanks have been brought to Mohalsen-I. The core might have been worked on at Mohalsen-I, and some flakes may have been knapped off the core and discarded on site. The core has then been brought from Mohalsen-I to be worked on further at another site.

A recently revived method of analysis has been applied to the assemblages on different Norwegian Stone Age sites (Damlien, 2016: 103). This method is called MANA analysis (Minimum Analytical Nodule analysis), and the premise of the method is that by separating the raw material in a Stone Age assemblage into units, it should be possible to analyse the inventory and see, through refitting, which artefacts came from the same nodule. The units are referred to as minimum analytical nodules (MAN) (Damlien, 2016: 103; Inizan et al., 1999: 26). Thus, the method can reveal which raw materials were brought to the site, which raw materials were worked on at the site, which were discarded at the site and which were brought away from the site. This provides further information on the artefacts brought to and from the site, and also the production taking place at the site (Damlien, 2016: 103).

My analysis is not an in-depth analysis on the raw material from Mohalsen-I as this has already been conducted by Spjelkavik (2016). However, there are some raw material types from the site that are only represented by a few flakes (like the refit W4, see chapter 4.5.2, Figure 20) or a blade or a projectile point. There is not much micro debris, if any, from these raw materials, and no cores have been found. The chert and quartz crystal falls within such an analysis, and an interesting aspect regarding the chert is that we possibly know where the procurement of this raw material occurred. This indicates that Mohalsen-I could be a part of a larger network of sites along the coast of Helgeland, and in case of the quartz crystal between the coast and the inland, that it should be possible to uncover based on the presence of cores, nodules and artefacts.

4.3.2 Knapping different types of raw material

A study on whether the raw material quality has an effect on the knappers level of skill has been conducted by Metin I. Eren, Stephen J. Lycett, Christopher I. Roos and Garth C. Sampson (2011). The experiment was conducted on two different types of chert, where the knapper went from a high quality chert to a less tractable type. The reason for conducting such an experiment was the assumption that raw material properties could have an effect on the outcome of

artefacts made from it, and the researchers wanted to see if this a priori knowledge was true (Eren et al., 2011: 2731).

The result of this test revealed that the switch to less tractable raw materials only rarely had an impact on the skill level of the knapper, however; the raw material did have an impact on the knappers ability to economise with the material, as it was necessary to take of more flakes from a lower quality core than a high quality one (Eren et al., 2011).

This experiment was, as stated, conducted on two types of chert. These two raw materials are similar and of better quality than the coarse quartz and quartzite found on Mohalsen-I, and the result can therefore not be transferred to two highly different raw materials, however, the results are of interest when two different types of flint from Mohalsen-I are compared.

The consideration of different raw materials and the utilisation of them on a site is of high interest as they can indicate how raw materials were perceived. At Mohalsen-I both local, regional and imported materials were discovered (Spjelkavik, 2016).

A refitting conducted by Joachim Schäfer on a site in Germany demonstrated that different raw materials found at the site had been exposed to different kinds of reduction strategies (Schäfer, 1990), the same result was achieved by Kristine Johansen in her analysis of Uransbrekka (1990).

4.4 Technological analysis

Introduction: The technological analysis will to a certain degree follow the steps of the *chaîne opératoire*. One of the main aims of this thesis is to obtain an image of how the site has been used. The initial impression provided by the overview of the distribution map (from Lorentzen 2014: Vedlegg 7a) is that there is a visible gap with almost no artefacts between the western and eastern part of the site. The main division lies where the *13-Shaft* from the 1974 excavation runs, where approximately 80 of the 6666 artefacts were found if finds from both excavations are taken into consideration. I have therefore decided to separate these two areas into East and West. This means that lithics found in 1974 belong to the area excavated in 2012-2013, if it was discovered at the western part of the site.

Based on the number of blades and the discovery of core rejuvenation flakes with negatives from blade production at the site, it is quite clear that blades have been one of the main focuses during production at Mohalsen-I. This is despite the fact that there were blade cores discovered

at the site. The technological analysis will therefore mainly be focused on the technical production of blades.

The cortex on blades and flakes is an indication of whether the initial decortication of the nodules has taken place at the site. The cortex covered blades and cortex on cores have already been analysed by Spjelkavik (2016), and his data will be further utilised in this analysis.

The size of the blades, and the size and shape of the cores, provides us with an indication of the initial size of the nodule. They can also reveal whether the knapping technique in use was altered during the knapping sequence. The blades and cores have already been measured by Spjelkavik (2016), and I will continue to use his data within this analysis.

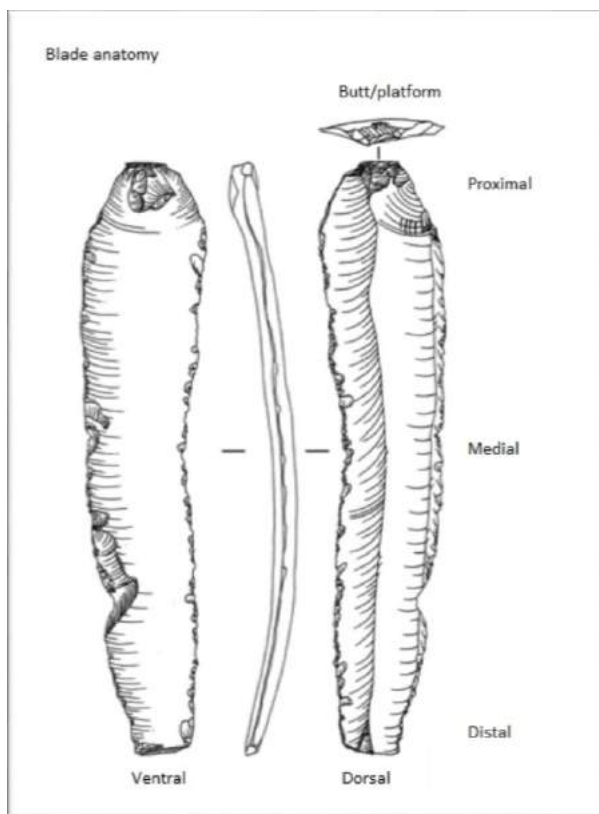


Figure 12: Blade anatomy.
Illustration retrieved from
https://www.researchgate.net/publication/264002663_The_Emergence_of_Pressure_Blade_Making 15.03.17

The shape of the blades, as well as the knapping errors, can yield information about how skilled the knapper was. However, knapping errors can also be the result of poor quality or flaws in the raw material.

The proximal end of an artefact bears witness to technique, and thus technological affinity. Several different knapping attributes are, alone or combined, indicators of the choice of hammer and technique. The preparation technique applied to the proximal part, does also provide an indication of the technology used. It may also display individual choices and preferences.

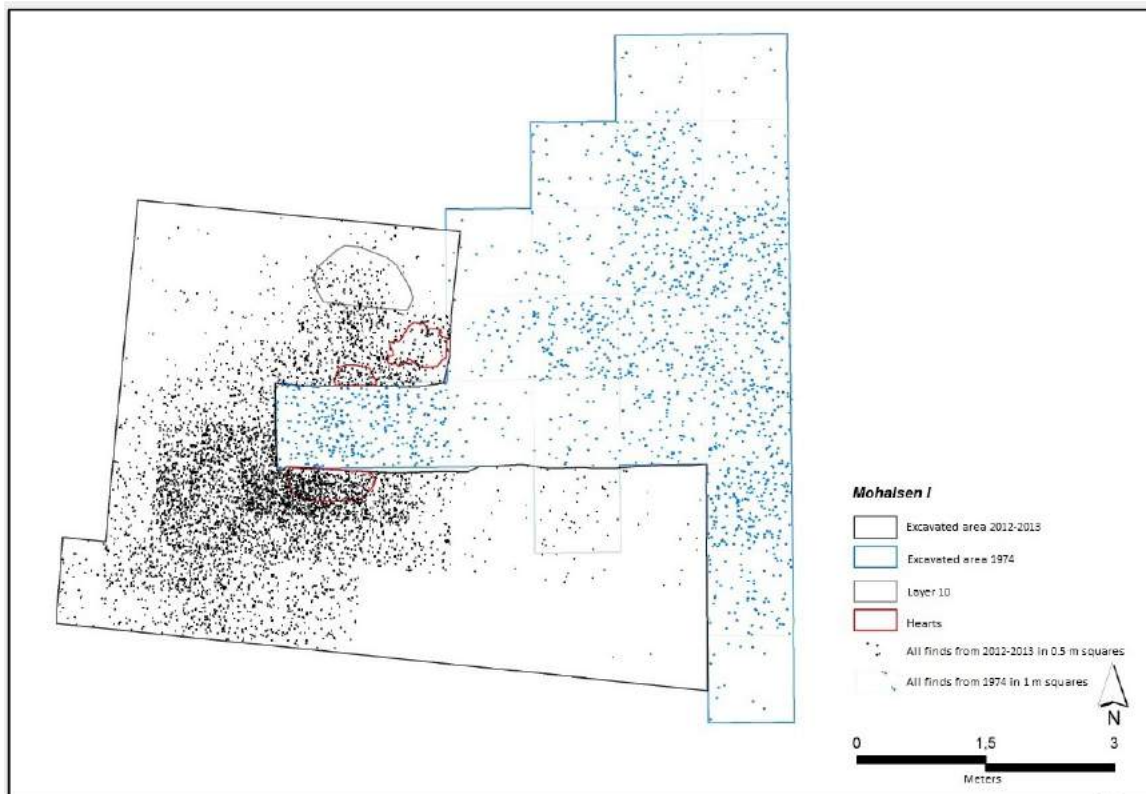


Figure 13: Dispersal of all finds from Mohalsen I. Image taken from Rapport Sikringsgraving - Mohalsen, Vega 2013. Unpublished report. (Lorentzen, 2014: Vedlegg 7a)

4.4.1 Condition of the lithic material

The physical condition

The artefacts found at Mohalsen-I have been deposited both over and underground for thousands of years, resulting in post depositional processes affecting the material. According to the reports from the excavations in 2012-2013 and the preliminary report from 1974, iron precipitation has been a factor on the site (Alterskjær, 1974; Lorentzen, 2013, 2014). This is evident when looking at the artefacts. The result of this has also been a challenge during the refitting, as the artefacts effected by the iron have been discoloured and does not resemble the artefacts and cores from which they might belong to. This can be observed in the refit W7 (see chapter 4.5.2, Figure 23), where the two refitted macro flakes display different colourations. Some artefacts have also been affected by sunlight or water running through the site, resulting in a change of appearance.

Cortex:

I have chosen to analyse the amount of cortex based on whether it appears that the initial intent of the knapping was to reduce cortex, or whether the cortex was of little or no relevance when the flakes were removed from the core. Therefore, the cortex covered flakes have been divided into three segments based on the amount of cortex, in addition to the intent of the knapping. The reason for conducting the analysis this way is to examine at the intent behind the action, as opposed to only the measurable parameters. This, in addition to the cortex on the blades, can depict how early the knapper began to focus on shaping the core towards the intended production. The cortex has only been measured on flint flakes as this is the main raw material on the site and can provide the information needed.

To measure the cortex on flakes, I have utilised the same method as Spjelkavik used measuring the cortex on blades. The method is based on Andrefsky (1998); (2005) (Spjelkavik, 2016: 67), and is only used when there is an uncertainty to whether the amount of cortex is under or above 50%. To measure the cortex, a transparent, dotted paper is placed on a picture frame (Andrefsky, 2005: 107), on which small blocks are attached to elevate the frame of the table so that there is room underneath for artefacts (this was done by Spjelkavik in 2016, and I continued to utilise the same frame).

Approximately 30% of the 2085 flakes on the western part of Mohalsen-I had cortex of some degree. Only approximately 6% were flakes where removing cortex was not the sole intent of the knapping. All of these flakes had less than 20% cortex, the main part had only an edge or a point with cortex.

There were, according to Spjelkavik (2016), 23 cortex covered blades on the western part of Mohalsen-I (26 if the *13-Shaft* is taken into consideration). Of these, nine had cortex grade 2 (50-100% coverage) (Spjelkavik, 2016: Appendix E). This shows the size of the cores, and at which stage the cores were shaped towards blade production.

At the eastern part, almost 46% of the 260 flakes in Layer 1, and approximately 28% of the 385 flakes in Layer 2 had cortex of some degree.

Both layers had 7 to 8 cortex covered blades. Only Layer 1 had one blade with cortex grade 2 (50-100% coverage) (Spjelkavik, 2016: Appendix E).

Knapping errors

When examining the number of knapping errors at Mohalsen-I, there are 28 hinged blades (complete and distal fragments) on Mohalsen-I West, which comprises 13.46% of all the western blades, and 24 in east, which comprises 13.79 % of all the eastern blades. I did not analyse knapping errors as negative scars on blades and flakes, and the result is therefore incomplete. However, the result can provide an insight into the skill-level of the knappers at Mohalsen-I, if the raw material quality and size is taken into consideration, as this can have an effect on the chosen technique and reduction strategies. Hinged blades can be a result of constraints in the raw material, or a sign of a novice in the reduction technique (personal communication with Morten Kutschera).

Blades and bladelets:

Blades and bladelets have been analysed in accordance to Mikkel Sørensen's nomenclature developed in his article "*Teknologiske traditioner i Maglemosekulturen*" from 2006, and, to a lesser extent, Berit Valentin Eriksen's article "*Chaîne opératoire*" from 2000.

Mikkel Sørensen defines blades as: *a serial production of cleavings with the purpose to be tools, or preparations for tools* (Sørensen, 2006b: 21, my translation), and are thus continuing Helskog, Indrelid and Mikkelsen's interpretation of primary artefacts and secondary flaking retouched artefacts. According to Sørensen the *ideal blades* within this concept are the physical intention behind the production (Sørensen, 2006b: 23).

In the technological analysis of the blades and bladelets, the primary focus has been to the proximal part of the artefact. The proximal end yields information about the technique at hand. This is where the knappers *knowhow* comes to light, and the *knowledge* and technique becomes visible and can shed light on the tradition, culture and intentions of the individual.

Of the 208 blades analysed from the 2012-2013 material, 151 have a proximal part. As many as 107 of the blades are considered complete, of which 17 have hinges or are close to being hinged.

Of the 174 blades analysed from the 1974 material, 120 have a proximal part. Of these 98 are considered to be complete, 20 of them with a hinge or close to being hinged.

The medial parts of the blades found at both sides of Mohalsen-I are what can be described as ideal blades, thus indicating that the blades selected for further modification into tools in many instances were the best blades constructed at the site.

Fragment	2012	2013	Sum 12/13	%	1974	%
Complete	42	48	90	43.26	78	44.82
Lack of distal	26	18	45	21.63	22	12.64
Medial	17	12	29	13.94	11	6.32
Lack of proximal	16	1	16	7.69	39	22.41
Complete with hinge	8	10	17	8.17	20	11.49
Distal with hinge	6	5	11	5.28	4	2.29
Sum	115	94	208	100	174	100

Table 5: Condition of blades, both assemblages by number and percentage

Attributes such as bulbs, bulbar scars and lips, as well as the butt size and shape are all indicators of what kind of technique and which size and type of hammer was applied during the knapping sequence. The frequency of the given attributes combined helps provide an indication to the type of reduction strategy that was applied during the knapping process.

4.4.2 Knapping techniques defined

The following knapping techniques are defined by Berit V. Eriksen (2000a: 42) and Mikkel Sørensen (2006b: 36).

- **Direct hard technique:** conducted with a hard stone. Creates irregular blades with a large variation in thickness, large bulbs and large butts with possible bulb scars and marked cone fractures that can continue down on ventral side. Split cone fracture can occur.
- **Direct medium hard technique:** conducted with a softer stone. Creates slimmer blades, smaller bulbs and butts. Tendency towards lip and pointed or shattered butts. Heavy ripples and bulb scars often appear. *Esquillement du bulbe*, which is a sign of soft hammer where a shell shaped cleaving with a certain depth, starting directly at the ventral edge of the butt (Weber, 2012: 39), often occurs.
- **Direct soft technique:** conducted with an elastic/soft hammer, like antler, bone or wood. Creates more even, slimmer and longer blades. Mostly with bulbs and lips, however, they are also discovered without bulbs and with larger butts. The butts are often pointed or shattered. Ventral sides are often heavily rippled. *Esquillement du bulbe* often occurs.

- **Indirectly soft technique:** conducted with an elastic/soft middle piece. Creates slimmer and more even blades, with more even sides. Rarely rippled ventral sides. Pointed, small and broad, or small and narrow butts. Creates a small bulb and frequent lip formations.
- **Double bulbs** are a sign of a hammer that is too large.

Preparation and abrasion is a way of controlling the outcome of the hammer blow. Type of preparation is related to technique and culture; however, it can also be an expression of personal choices.

Regularity in the blade production, as well as the shape of the original nodule is indicated by the shape of the blades. High frequency of normal outcome shows high regularity in the production. Early outcome and overtly curved are indications of hinge fractures and irregular shaped nodules.

4.4.3 Knapping attributes to proximal part

When dividing the material, the number of blades in each assemblage changes somewhat in comparison to the amount found in each excavation. The western assemblage contains 169 blades with a proximal end, while the eastern assemblage contains 104 blades with a proximal end. Only the blades from I14 and I15 have changed assemblages. This means that there is a slight error in difference when one examines other blades that could have belonged to either east or west. However, I have conducted a quick overview over the blades in the *13-Shaft* and from 102y to 104y, and the few blades analysed from these squares do not change the initial data.

West: There are several different knapping attributes occurring on the material from the western part of the site. These combined resulted in 25 variations, as listed in Appendix B. Single bulbs are the most common characteristic, followed by single bulb in combination with a lip.

Altogether, bulbs were, either alone or in combination with other attributes, seen on 145 of the 169 proximal ends analysed from the western part. Of these there were 38 *esquillement du bulbe*, and 11 double. Only two of the bulbs could be considered as large. 59 of the blades have a lip, either alone or in combination with other knapping attributes.

The most common butt shape is the point/shattered, followed by large butts, and small and broad butts. The large butts are very rarely seen together with other knapping attributes that is typical for hard technique.

There does not seem to be any distinctions between the production techniques of flint, finer quartzite and quartz crystal.

East: In the eastern material, the knapping attribute combinations provides 28 variations to the proximal end. Single bulb and *esquillement du bulbe* are the most common characteristics, followed by single bulb with a lip. Two of the bulbs can be considered as large in this assemblage as well.

Altogether, bulbs were noted on 92 of the 104 proximal ends analysed on the eastern part of the site. *Esquillement du bulbe* represent 24 of these, while 7 were double. 37 of the blades have a lip, alone or in combination with other knapping attributes. The eastern part has a higher representation of ripples to the ventral side of the blade than the western.

The most common butt shape is the point/shattered followed by wide and narrow and stricken off. Only two of the large butts are seen together with other knapping attributes that is typical of the hard technique.

Blade shape

The majority of the blades on both parts of Mohalsen-I have a regular shape. There are a few more overtly curved blades than blades with an early outcome. The same pattern in blade shape can be viewed on both parts of the site.

Preparation

The most common type of core preparation at the western part of Mohalsen-I is small dorsal trimming and/or abrasion followed by no preparation.

The most common type of core preparation at the eastern part of Mohalsen-I is normal trimming followed by small dorsal trimming and/or abrasion.

Note

There are no immediate differences in the knapping techniques on the different sides of the hearth in I-15.

4.4.4 Summary of knapping attributes

Decortication of flint nodules has taken place on Mohalsen-I, as seen from the number of cortex covered flakes. In addition to this, the initial production of blades takes place quite early on a core, as seen from the cortex on blades.

The technological analysis reveals that the blades have been produced by direct soft or direct medium hard knapping technique on both the western and the eastern part of the site.

There are differences in butt condition, cone formation and type of trimming from east to west.

It is not possible, for me, to distinguish between different knappers on the western part of Mohalsen-I. However, this may be due to my lack of experience in analysing and interpreting the material. A subsequent analysis by a more experienced person might lead to other conclusions.

The technique applied to coarser raw materials is not easily detectable on the material from Mohalsen-I, however, there is reason to assume that the testing performed on the coarse quartzite and quartz is conducted with direct hard technique due to the constraints in the raw material.

4.5 Refitting at Mohalsen-I

4.5.1 The process of the refitting of Mohalsen-I

In order to better understand the knowledge behind the knapping technique in use, I have personally attended a knapping course held by Morten Kutschera. This provided an idea of what years of training can provide when it comes to understanding the material and technique. It also increased my awareness in regard to understanding the differences between the trained knapper and the amateur, and the difficulty that exists in regard to mastering the craft, especially when it comes knowing where to strike the stone next in order to achieve the desired result from the material. This course helped me to reach a greater understanding regarding the skills and techniques required to achieve different sets of tools, and thus to a certain extent I will be able to analyse the material from Mohalsen-I.

Kutschera's two day course consisted of twelve participants and within a relatively short period of time we were able to create a considerable number of artefacts.

The first step of the analysis of the Mohalsen-I site was conducted on the material from the initial excavation in 1974. The original grid system from the excavation was reconstructed (albeit in reduced scale) on a table surface, and the lithic artefacts were distributed according to quadrants. An exception was made with material that is considered to be micro debitage. This was excluded due to the size of the debitage, however its presence in the material is still essential to the knowledge regarding the usage of the site, as residue of this size is more likely to be left where the knapping occurred, and can thus reveal the different activity zones. The blades were separated and the knapping technology was analysed in accordance to Mikkel Sørensens nomenclature on the blade technology in Denmark (2006b).

The following refitting of the 1974-material yielded minimal refits, and none of the artefacts could be mapped to a core, though the material itself revealed some clue as to the usage of the site.

The second phase of the work was focused on the material from the 2012 and 2013 excavations. Similarly, the blades from the excavation were separated and analysed to shed some light on the technology in use. The material was distributed across the surface of the table together with the debitage from 1974, and the micro debitage was again excluded.

The refits have been mapped according to which grid the different parts belong to, and the symbols used to represent the different artefacts and refitting types is based on Cziesla's standardised set from 1990 (: 16). I have also opted to apply Cziesla's mapping method (Cziesla, 1990) in order to analyse and determine the different types of refits discovered at Mohalsen-I.

There are 67 refits from Mohalsen-I. Of these 67 refits, 24 are breaks, 41 are production sequences, 1 is a modification and 1 is a pop-out (placed in "other" category). One refit from the 1974 assemblage was already made before I initiated my analysis on the material. This refit is not taken into consideration within the analysis as the information surrounding it is irretrievable. Testing of material is a part of the production sequence category.

The total number of artefacts discovered after the final excavation in 2013 was approximately 7025. There are 6666 artefacts all together in the assemblages that I have analysed once the artefacts from the northern area excavated in 2012, and the stray finds from both excavations, are deducted from the total. All together 148 finds have been refitted with one or several other finds. This comprises only 2.22% of the total artefacts in the analysed assemblages. If viewed in relation to the assemblage they belong to, only 64 of them are found in 2012-2013. This

constitutes 1.3% of the 4918 artefacts discovered there, in comparison to the 84 finds refitted from the 1974 assemblage which constitutes 4.8% of the artefacts discovered there.

There are noticeably more refitted artefacts from the 1974 excavation than from the 2012/13 excavation if one compares the percentages. This might be due to the fact that there were altogether fewer artefacts gathered during the initial excavation than during the two latest excavations. This may sound unreasonable, however the reason for the difference in number of refits despite the size of the assemblage may relate to the fact that it is easier to find refits in a small sum of artefacts than in a larger sum. In addition, the fact that there were 24 raw materials at Mohalsen-I, and several of these were quite homogenous, has probably had an impact on the number of refits obtained. The time allocated to finding the refits might have also had an impact, as more time was spent on the initial part of the work on the material from 1974, than the subsequent part, which focused on the 2012-2013 material.

Not all the refits will be analysed in close detail, however the refits analysed from both the East and West will be numbered from 1 and up. To provide an easier distinction between the refits, their Western or Eastern affiliation will be denoted with a W or an E. These refits are chosen as they can provide information regarding technology and technique, layers, movements on the site, as well as utilisation of raw material, in addition they could possibly provide information regarding the people occupying the site. They may also depict how refits can re-categorise and lead to new information surrounding a specific artefact.

Note:

There are no refits between the material from 2012-2013 and 1974. There are also no refits between Layer 1 and Layer 2 from 1974.

Layer 4 from 2012-2013 and Layer 2 from 1974 are described in a similar manner in the reports from the two excavations. The same goes for Layer 5 from 2012-2013 and Layer 2 from 1974.

4.5.2 Refits, West

T-nr	ID	Classification	Layer	Notes
25950	413	Macro flake, quartzite	Layer 5	
25950	743	Macro flake, quartzite	Layer 8	
25950	141	Medio flake, quartz crystal	Layer 6	
25950	343	Medio flake, quartz crystal	Layer 5	
25950	416	Macro flake, quartz crystal	Layer 5	Tool
25950	595	Medio flake, flint	Layer 5	Proximal on blade
25950	143	Retouched macro blade	Layer 6	Tool
25950	23	Core, quartz	Layer 1	
25950	161	Fragment, quartz	Layer 5	
25950	275	Fragment, quartz	Layer 5	
25950	330	Medio flake, flint	Layer 5	
26109	40	Macro flake, flint	Layer 6	
25950	111	Medio flake, quartz crystal	Layer 3	
26109	12	Medio flake, quartz crystal	Layer 6	

Table 6: Overview over the refits between the layers 1-8

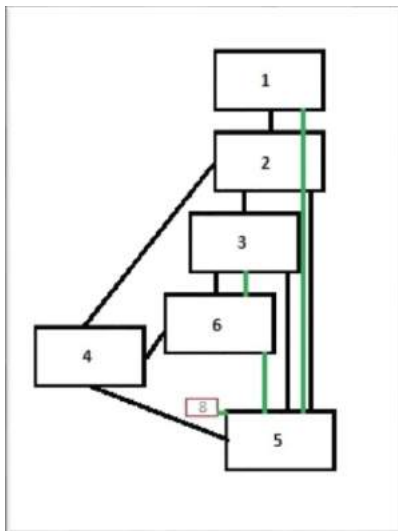


Figure 14: Stratigraphic relationship on western part on Mohalsen-I. The green connection lines indicate refits between artefacts. Layer 8 is a hearth in Layer 5 (after Lorentzen, 2013, 2014)

The refits from different layers show connections between Layer 1 and Layer 5, Layer 5 and Layer 6, Layer 3 and Layer 6, and Layer 5 and Layer 8.

The majority of the refits from the 2012/13 assemblage were found on the southern and south-western part of the site. The connection lines are short, and most of the refitted artefacts are found in the same quadrants or quadrants adjacent to each other, and within the same layer. Only three refits contain more than two artefacts.

There are also six refits that contain artefacts from different layers. Three of these refits are found within the northern part of the site excavated in 2012-2013.

I have chosen to examine 12 refits from the western part of Mohalsen-I, numbering them from W1 to W12.

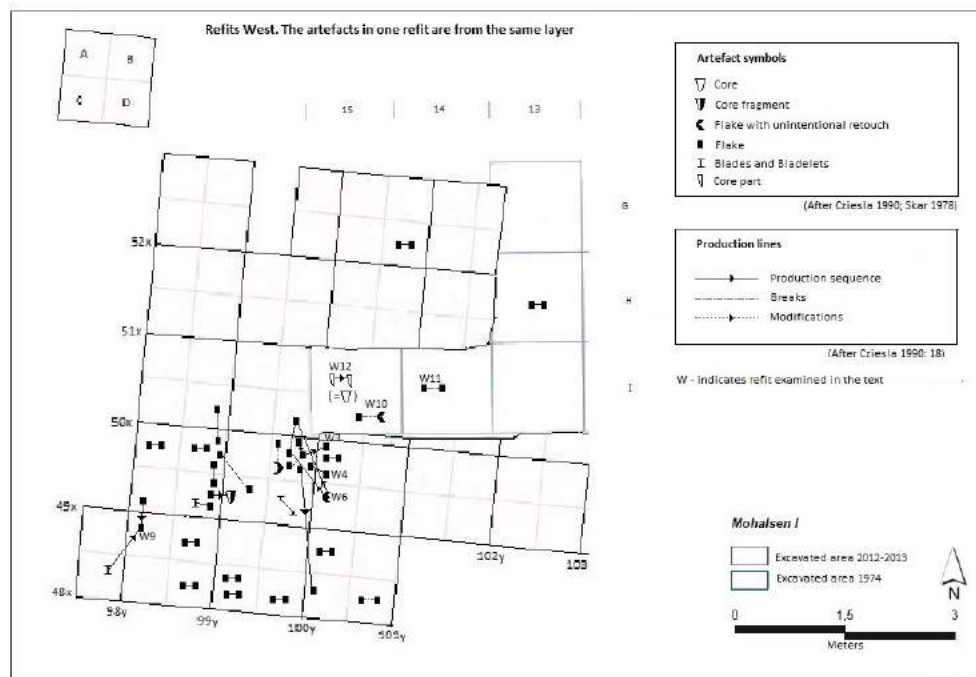
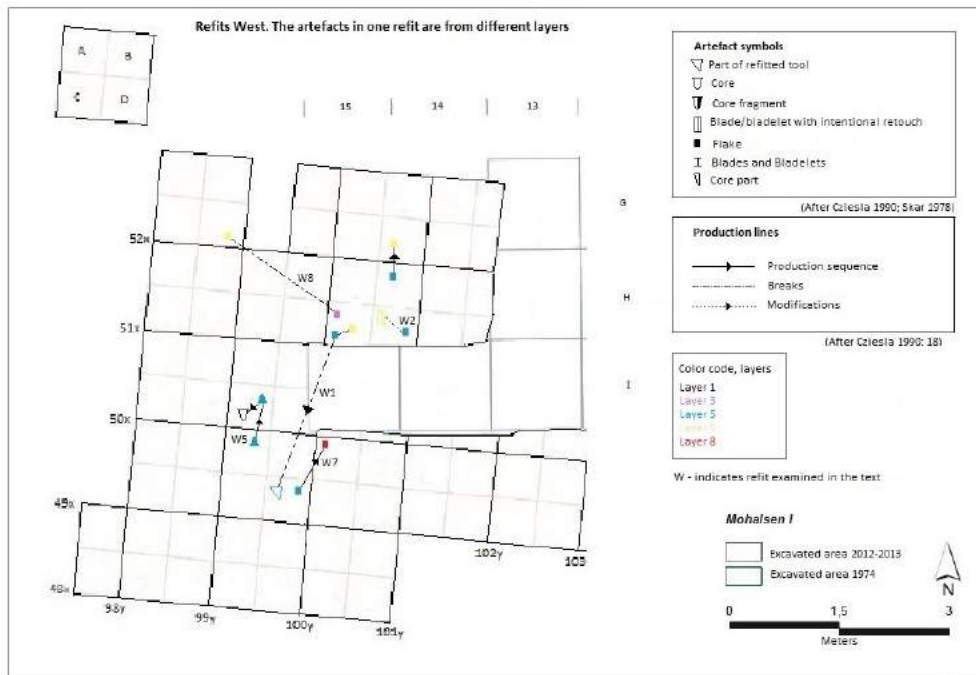


Figure 15: Overview over all the refits on Mohalsen-I, West

Refit W1: 25950: 141 + 343 + 416 – Layer 5 and 6. Quartz crystal. Break

This refit has a longer connection line than any of the other refits in the western part, and the artefact moves from 51x-100yC to 49x-99yD which makes up a movement of a maximum of 2.5 meters and minimum of 1.5 meters. In addition to this, the refits are between breaks and are not the result of knapping. The artefact has wear trace; it is a flat and wide macro flake made from quartz crystal. The movement sequence indicates that the tool broke in two or three pieces, in 51x-100yC, as the two smaller flakes were discovered here, however, the larger flake was discarded in 49x-99yD. There does not seem to be any wear trace to the fracture surface of the larger flake. The refits W6 and W9 are possibly made from the same core as this refit. W9 and the present refit have the same cortex. The flakes could not be fitted together. As seen from Spjelkavik's analysis of the raw materials in his thesis from 2016, there is one fine type of clear quartz, and one fine type of smoky quartz found on Mohalsen-I. These are very similar,



Figure 16: Measuring scale: 3 cm.

as the smoky quartz is very clear in itself. Refit W6 could therefore either belong to the smoky quartz type or the clear quartz.



Figure 17: Refit W2. Measuring scale: 3 cm

**Refit W2: 25950: 143 + 595 – Layer 5 and 6.
Flint. Break**

The retouched macro blade 143 is here refitted with its proximal 595, which was originally catalogued as a medio flake. The fracture is caused by damage to the dorsal side, probably inflicted during knapping. Both pieces were found in the same quadrant, 51x-100yD, just north of I15.

**Refit W3: 25950: 168 + 168 + 168 + 201 – Layer 5.
Flint. Production sequence**

The medio flake 201 is the last of these four flakes knapped from a larger core. The knapping was conducted with a direct hard hammer. Two of the flakes share butt, and are therefore originally one flake broken in two due to the force of the blow. The flakes are found in two quadrants next to each other: 49x-99yB and 49x100yA.

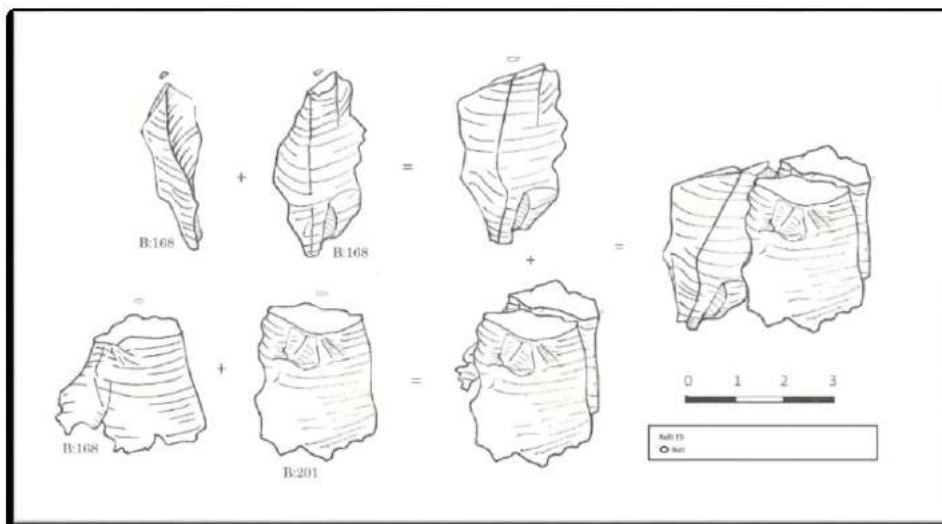


Figure 18: The refitting of W3, illustrated by Øyunn Wathne Sæther

Refit W4: 25950: 201 + 387 – Layer 5. Flint. Production sequence

The medio flake 387 was knapped off the core first, at least one more flake or blade has been knapped before medio flake 201. Their butts are in a 90-degree angle to each other, thus they are not knapped from the same platform. Flake 201 has *esquillement du bulbe*. Both have been knapped with a direct soft technique. The flint material is of high quality. No

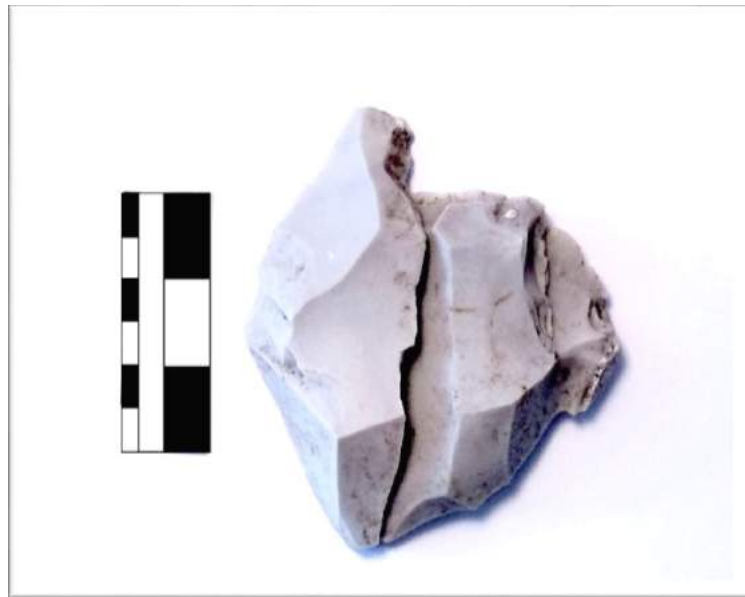


Figure 19: Refit W4. Measuring scale: 3 cm

core, and only a small amount of debris from this raw material was found at the site. The flakes were found in two quadrants adjacent to each other: 49x-99yB and 49x-100yA.

Refit W5: 25950: 23 + 161 + 275 – Layer 1 and 5. Quartz. Production sequence

Artefact 23 is cataloged as a core. Fragment 161 is knapped from this core first, followed by fragment 275. The core and fragments are found in two quadrants next to each other, 49x-99yA and 50x-99yC. They are, however, from different layers. The raw material is a coarse-grained conglomerate of large angular fragments that would have hindered any controlled knapping sequence, and is therefore not very suitable for blade production. Core 23 does not differ from its fragments, and the knapping indicates the testing of raw material rather than a production sequence per se.



Figure 20: Refit W5. Measuring scale 3 cm

Refit W6: 25950: 223 + 280 + 392 – Layer 5
5. Quartz crystal. Production sequence and break

The knapping is an attempt to remove cortex. 280 and 392 is one bladelet with a break. 223 was knapped first. This flake has wear trace. The broken bladelet was discovered in 49x-99yB and 50x-99yD. The flake 223 was discovered in quadrant 49x-100yC.



Figure 21: Refit W6. Measuring scale 3 cm

Refit W7: 25950: 413 + 743 – Layer 5 and 8. Coarse quartzite. Production sequence

The macro flake 743 is knapped off the macro flake 413. They were found in 49x-99yD and 49x-100yA. There are some debris from this raw material on the site, however, there are no tools produced from it, and as the most likely provenience of this raw material is Vega, one could argue that the size of the flakes indicates testing of local raw material.



Figure 22: Refit W7. Measuring scale: 3 cm. Notice the differences in colour due to iron precipitation

**Refit W8: 25950: 111 + 26109:12 – Layer 3 and 6.
Quartz crystal. Break**

The refit is a break between two medio flakes found in 52x-98yD and 51x100yC. The break appears to be unintentional, however; the pieces are found a minimum of 1 meter and a maximum of 2 meters from each other, and in different layers. The flake is flat and thin, and the raw material bare strong resemblance to the raw material in Refit W1 and W9.



Figure 23: Refit W8. Measuring scale 3 cm

Refit W9: 26109: 116 + 146 + 219 – Layer 5. Coarse quartzite. Production sequence

The macro flake 219 was discovered in 48x-98yA, the macro flake 146 in 49x-98yC, and the bladelet 116 in 48x97yD. Ochre was discovered in the same area. Flake 146 and bladelet 116 were knapped from each side of the flake 219, before this flake was knapped from the core. There is no clear trace of the technique applied, the size of the flakes indicates testing of the same local raw material as refit W7.



Figure 24: Refit W9. Measuring scale 3 cm

Refit W10: 19464: 385 + 421 – Layer 1. Quartz crystal. Break

These two flakes make up a distal of a macro flake, and are found in I15. The distal have wear trace. What caused the break is difficult to say, as the flake is large and broad and is not easily broken (as by step). The raw material bares the same cortex as Refit W1, and is most likely from the same quartz crystal core.

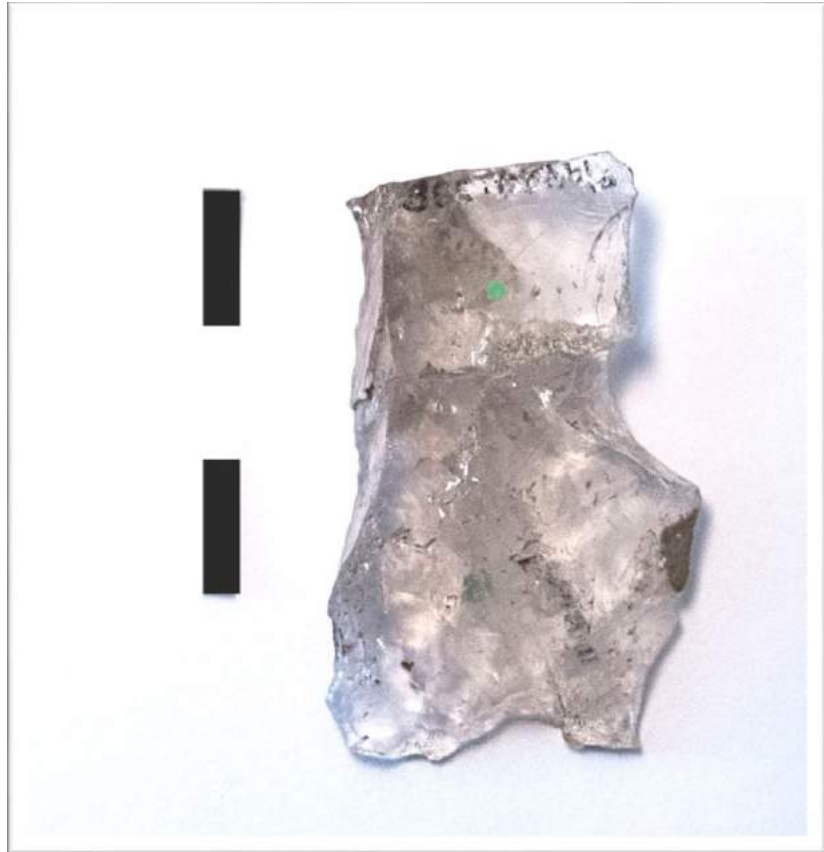


Figure 25: Refit W10. Measuring scale: 3 cm.



Figure 26: Refit W11. Measuring scale: 3 cm

Refit W11: 19464: 343 + 365 – Layer 1. Quartzite. Break

The break is between 343, which is cataloged as a flake, and 365, which is cataloged as the proximal end of a blade. The artefact can be regarded as a bladelet/blade as it seem like the initial intent of the knapping is to create a blank or blade. The quartzite is medium coarse, and the knapping is conducted through the application of hard technique.

**Refit W12: 19464: 424 + 424 – Layer 1.
Flint. Production sequence**

The refit consists of a core in two pieces knapped to exhaustion. Found in I15.

4.5.3 Result, refits West

The refitting has resulted in the discovery of connection lines both vertically and horizontally on the western part of Mohalsen-I, especially with the refits W1, W2, W5, W7 and W8. In addition to this, refit W1 has uncovered how a tool could have been moved around on the site after being broken.



Figure 27: Refit W12. Measuring scale 3 cm

The refits W2 and W11 show that artefacts could easily be placed in the wrong categories, thus generating incorrect information regarding the assemblage.

The fact that there are refits representing all the different raw material categories in the western assemblage could provide information on the techniques applied to the different types of raw material. The techniques applied to the local coarse quartzite and quartz are not easily detectible, however, both raw materials have flakes and fragments that indicate that they have been tested at the site.

Through the thorough work conducted on the material in order to discover the refits, the material has also yielded information about artefacts that belong to the same core or tool, even though they are not refitted, as can be seen in W1 and W9 and possibly W6.

Refit W6 shows movement both vertically and horizontally on parts of a flake that has been broken in two. The reason for this movement is unknown as none of the flakes have wear traces.

Refit W12 shows a last attempt to retrieve blanks from an exhausted core.

4.5.4 Refits, East

The refits from 1974 are evenly dispersed throughout the site, however, only one of them can be found further west than the *12-Shaft*, as such a refit is found in H13. It is not easy to

determine whether this refit belongs to Eastern or Western assemblages, however it is probable to assume that the artefacts knapped/used here are affiliated with the possible hearth Layer 9 (I will return to this possible hearth in the distribution analysis).

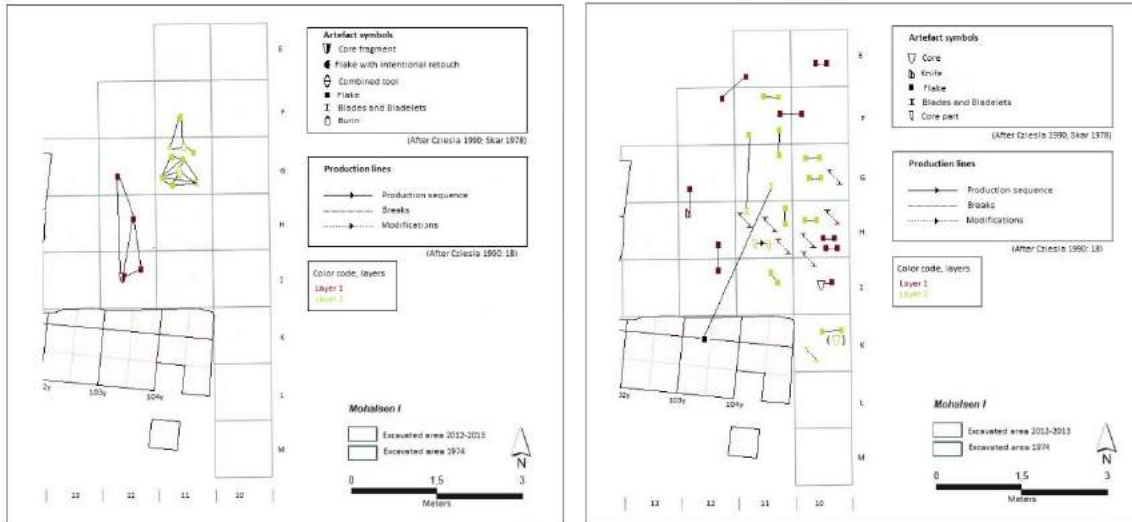


Figure 28: Overview over all the refits on Mohalsen-I, East

I have chosen to examine 8 refits more closely; they are numbered from E1 to E8.

Refit E1: 19464: 114 + 472 – Layer 2 and unknown. Flint. Production sequence

This is the refit from the 1974 material with the longest connection line. The maximum length travelled is 3 meters, whereas the minimum is 2 meters. 114 was discovered in G11 while 472 was discovered in K12. 114 was cataloged as a bladelet, knapped off 472 which is a hinged medio flake.



Figure 29: Refit E1. Measuring scale 3 cm

Refit E2: 19464: 102 + 102 + 102 + 102 + 108 + 128 – Layer 2. Flint. Production sequence



The medio flakes and bladelet are knapped from the core by applying a soft technique. The main part of them are knapped with proximal from the cores main platform. Only one flake; the first knapped, is knapped from the opposite side. Core fragment 128 is knapped so that its proximal is situated at an almost 90-degree angle on the core platform.

Figure 30: Refit E2. Measuring scale 3 cm

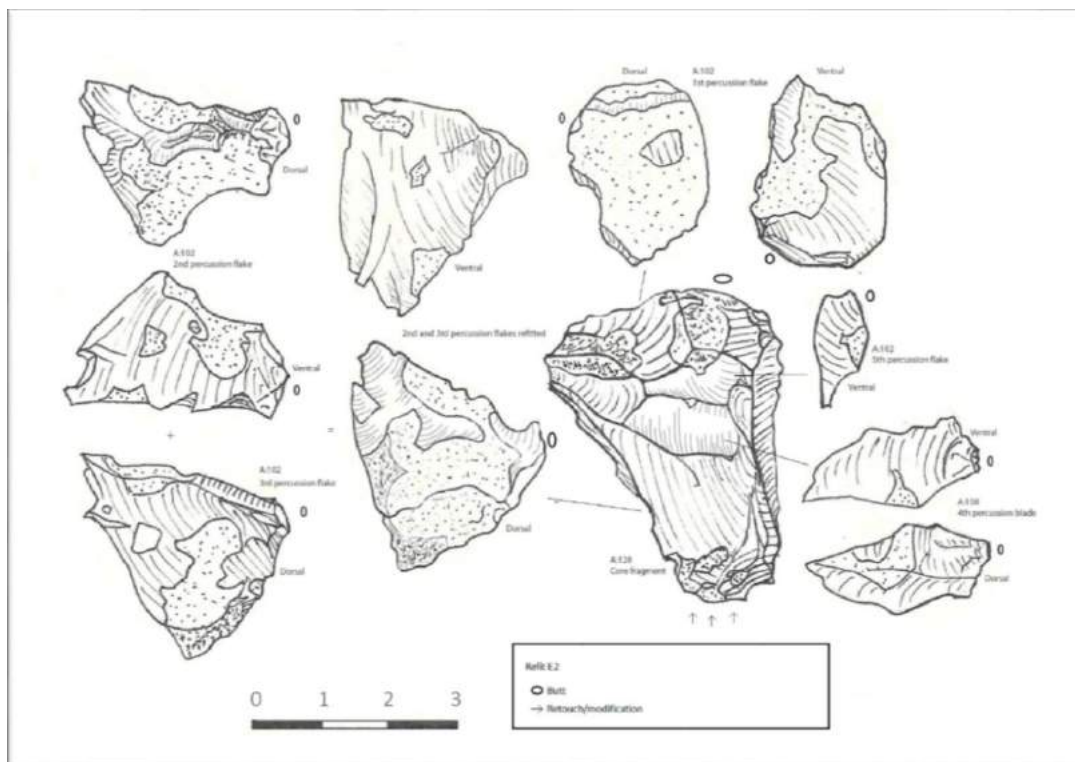


Figure 31: Refit E2, illustrated by Øyunn Wathne Sæther

The technique for this particular strike to the core is applied with a hard hammer, resulting in a large butt and large bulb. The initial flakes are all cortex flakes, and the main focus during the knapping has been the decortication of the nodule. The core fragment is also knapped from the core with the purpose of removing the cortex and scars from the previous flakes, however, it also has wear trace, and is registered as a multitool in Callanan (2007). All parts were discovered in G11.

Refit E3: 19464: 49 + 102 + 129 + 129 – Layer 2. Flint. Modification sequence

129 was initially a macro flake where the main purpose of removing it from the core was to remove cortex. Medio flake 49 is 129's distal end, and is separated from 129 by a forced break to create a burin on 129. The small 129 flake has popped off when the burin spall was knapped off to create the burin. The technique applied to knap 129 off the core was conducted with a hard hammer, resulting in medio flake 102 being indirectly knapped off at the same time. Medio flake 49 itself has retouch. It was discovered in F11; the rest of the flakes were discovered in G11.

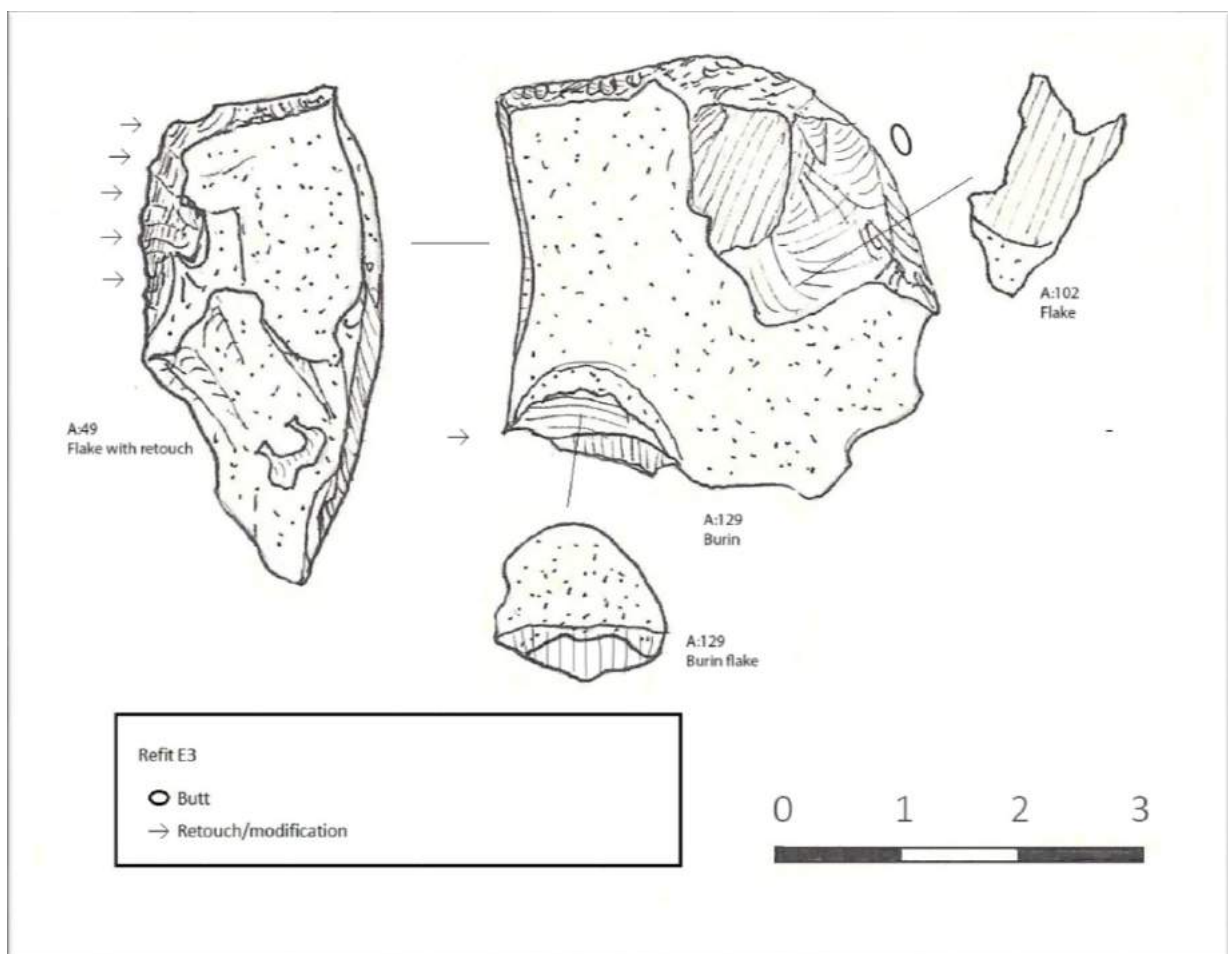


Figure 32: Refit E3, illustrated by Øyunn Wathne Sæther

**Refit E4: 19464: 144 + 228 – Layer 1. Flint.
Production sequence and modification**

Bladelet 228 is knapped off 144 with a direct soft hammer. Flake 144 is knapped with a direct hard hammer; it is shorter and has a hinge. This bladelet has retouch and is registered as a knife in (Callanan, 2007). 144 was discovered in G12, while 228 was discovered in H12.



Figure 33: Refit E4. Measuring scale 3 cm

Refit E5: 19464: 149 + 223 + 319 + 324 – Layer 1. Flint Production sequence

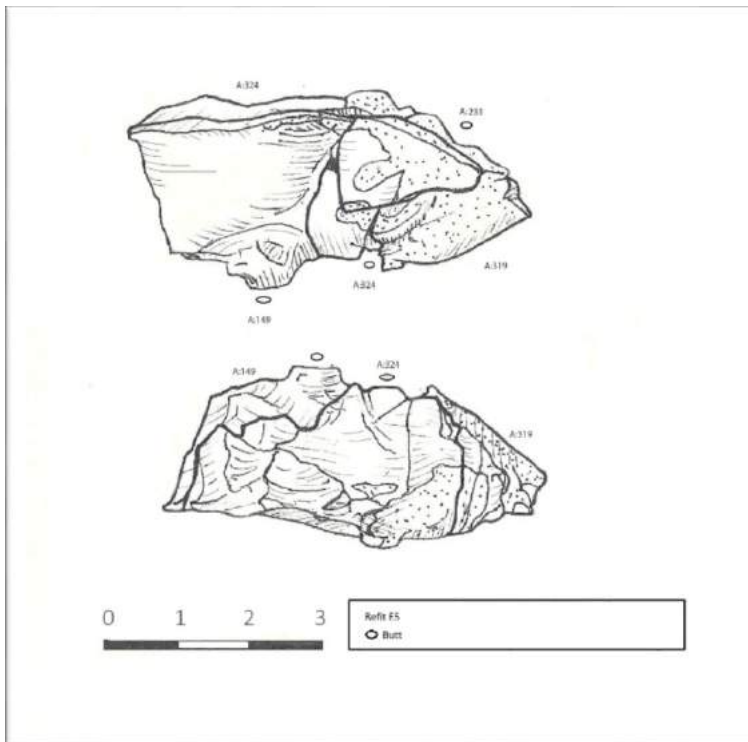


Figure 34: Refit E5, illustrated by Øyunn Wathne Sæther

The artefacts were knapped off a core with a large platform. Artefact 149 and artefact 324 are knapped from opposite side of the platform. Artefact 324, which is registered as a core fragment, is knapped first, followed by the flake 319, flake 223 and finally flake 149. The knapping attempt was to remove cortex and a large inclusion. One or two of the flakes have a large platform. Two of the artefacts have large butts and large bulbs. The core fragment and flake 319 were discovered in I12, flake 149 was discovered in G12, and flake 223 was discovered in H12.

Refit E6: 19464: 433 + 433 – Layer 2. Flint.
Production sequence

The refit consists of a core comprised of two pieces, knapped to exhaustion. Both pieces were found in K10, and both were cataloged as medio flakes.



Figure 35: Refit E6. Measuring scale 3 cm

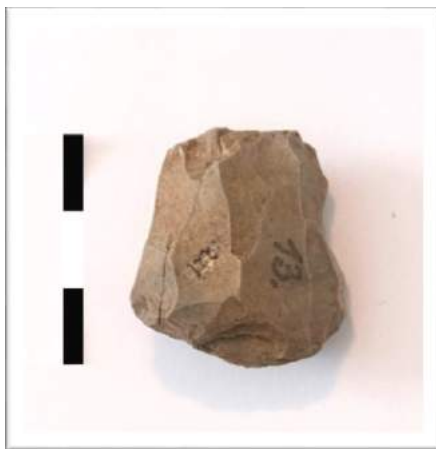


Figure 36: Refit E7. Measuring scale 3 cm

Refit E7: 19464: 270 + 276 – Layer 1. Flint.
Production sequence

The refit consists of a core comprised of two pieces, knapped to exhaustion. Both pieces were found in K10. Artefact 270 was cataloged as a medio flake.

Refit E8: 19464: 221 + 221 – Layer 2. Flint.
Production sequence

The refit consists of a core comprised of two pieces, knapped to exhaustion. Both pieces were found in H11.

4.5.5 Results, refit East

The refits from the eastern assemblage shows no refits between the two layers from the 1974 excavation. In addition to this, they show very little movement horizontally on the site except for refit E1; between a bladelet and a hinged flake. There is no obvious reason for this movement as none of the artefacts show wear trace.



Figure 37: Refit E8. Measuring scale 3 cm

Refit E2 and E3 indicate a lack of raw material at Mohalsen-I, as macro flakes from decortication of a nodule are either retouched or modified to be further used.

The refits E6 and E7 show that artefacts can easily be cataloged in the wrong categories, thus providing incorrect information regarding the assemblage. This is especially worth noting with E6, as this was a core where both pieces initially were cataloged as medio flakes.

The short connection lines show that tools were utilised on the place they were knapped.

The refits E6 to E8 all depict a last attempt to retrieve blanks from an exhausted core.

4.5.6 The technological analysis and the refitting combined

As seen from the refitting, direct hard technique is used when the objective was to remove parts of a core that could present a challenge, such as an area with negatives from knapping errors. The main technique applied on both areas of Mohalsen-I was direct medium hard or direct soft hammer, whether it was during decortication of a nodule, during a production sequence or when the work was conducted following a set blade production scheme.

4.6 Distribution analysis – Mohalsen-I

In order to conduct a spatial analysis, it is important to uncover the different activity zones at the site. The micro and medio debitage distribution is a good way of detecting the different knapping zones as this debitage is more likely to stay in the activity zone where it was knapped as opposed the larger artefacts. If viewed in relation to the distribution of tools and cores, this could provide an addition to the refit analysis and perhaps reveal a clearer picture of whether the tools and cores were knapped and processed at the place they were discovered, or if they had been moved around the site. This does however require a closer study of the raw material if it is to provide the correct data. My study does not permit this level of analysis as there was discovered 23 different raw materials on Mohalsen-I (Spjelkavik, 2016: Appendix A) which I am unable to distinguish between. I will therefore only be able to provide a general overview based on the basic divisions between the raw material, such as flint vs. quartz crystal and flint types that are easily distinguishable.

What would have to be taken into consideration are the layers, and if the debitage can prove whether the site has been visited several times or not. The refitting suggests a connection between the layers, however, this could be a result of the reuse of raw material from one visit to another, and is not in itself proof of a single visit. The layer analysis is a stratigraphic control

that can state whether the impression given by the refitting is correct (Ballin, 2000: 111), or whether the interpretation of there being at least two hearths on the site is a proof of several visits to the area (Lorentzen, 2014: 18)

I will begin by pinpointing the possible hearths on the site and examine the extent to which this corresponds to the information provided by the refitting and the initial distribution overview. Based on this information, I will consider how to conduct the following distribution analysis of the material.

4.6.1 The hearths

Although I have previously mentioned the hearths in chapter 3.5, I will touch upon them further in this section within the context of the analysis.

As noted, Alterskjær detected three different coal concentrations during his excavation in 1974. The first was discovered at a depth of 30-40 cm in the quadrants F11, G11 and H11 as well as F10 and G10, with the largest amount discovered in G11; thus, interpreted on site to be a hearth. The next coal concentration was detected in I13, I14 and I15, where the excavation depth reached approximately 30 cm. The last coal concentration was situated in L10, it is described as smaller than the other concentrations (Alterskjær, 1974: 5).

As stated previously, two hearths were discovered during the 2012 excavation. One hearth was considered to be in I15, with some coal in the northern and southern parts excavated in 2012. This hearth is described as Layer 8 in the report despite the uncertainty at the time whether it was the same hearth or not (Lorentzen, 2013: 11 and Vedlegg 8b). Another hearth, referred to as Layer 9 was discovered in the northern part of the area excavated in 2012-2013, situated in 51x-101y. Both hearths were situated in Layer 5.

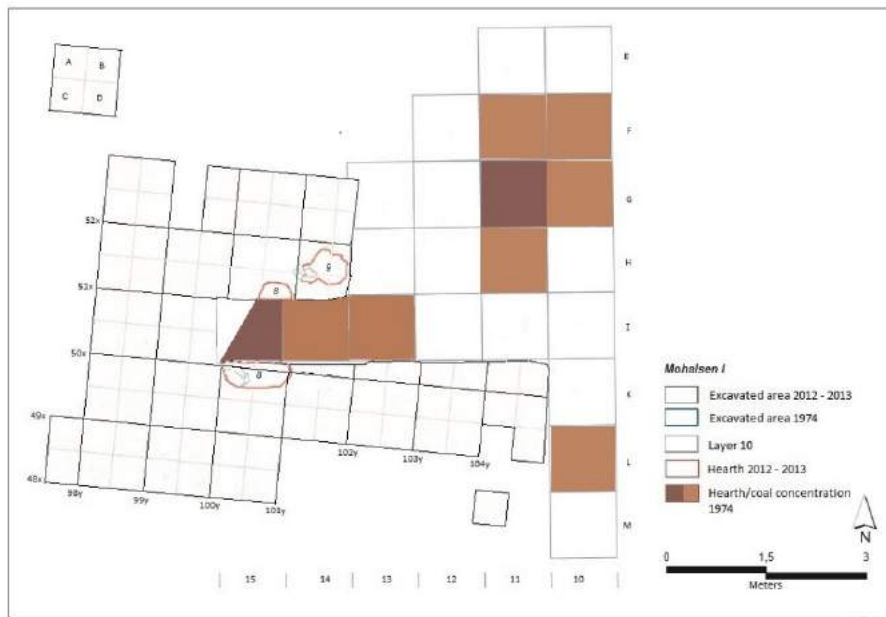


Figure 38: Overview over the hearths and coal concentrations as described in the reports.

It is, however, not certain that the hearth Layer 9 is actually a hearth according to Birgitte Skar, who was the project leader of the excavations in 2012 and 2013. This hearth was much less dense than hearth Layer 8, and appeared less like a hearth. There was no red burnt sand in the area, only sot. This makes it different from the hearth Layer 8, where the sand was coarsely burnt. Skar’s interpretation is that this might be a result of movement on the site, or tidying of hearth Layer 8 (personal communication).

4.6.2 Additional notes on distribution

In the reports from the excavations in 2012 and 2013, the interpretation of the horizontal and vertical distribution is that in the areas that have been exposed to erosion, the artefacts have moved both vertically and horizontally due to the shifting sand. Some artefacts have possibly also been removed by hikers passing through. Most of the areas excavated in 2012-2013 was however covered by turf, and they are interpreted to be intact in terms of the initial on-site distribution. These artefacts are therefore found in situ (Lorentzen, 2013, 2014).

4.6.3 Combined results from the refitting, the general overview and the hearths

Based on the lack of refits between the material from the 1974 and the 2012-2013 assemblages, the apparent division in the material distributions between the eastern and the western part of the site, and recognising at least one main hearth in each area, I have decided to separate these

two areas further in my analysis, as I did in the technological analysis and the refit analysis. The material discovered in the western part of the site during the excavation in 1974 will be treated as belonging to the western area, hence belonging to the same assemblage as the material found in 2012 and 2013. As noted, Layer 4 from the most recent dig and Layer 2 from 1974 are described in a similar manner in the reports from the two excavations. The same goes for Layer 5 from 2012-2013 and Layer 2 from 1974. However, if there are two different visits on the eastern and the western part of the site, it should have been visible in the layers between the two areas, possibly indicated by a change in composition. A division of this kind has not been recognised during any of the excavations. The reason for this could be that the excavation conducted in 1974 was in the area where the main division would have been identified. In addition to this, the focus during the excavation conducted in 2012-2013 was on the area with a visibly high concentration of finds. Thus, the area left undug from 1974 that could have highlighted a division, was not a focus point during the latest excavation. In addition to this, the 10 000 years between the utilisation of the site and the excavations has probably led to some sort of impact on the visible composition and quality of the layers.

4.7 Distribution analysis from the western part of Mohalsen-I

In order to discover the answer to the question of whether or not the layers actually portray different visits, and whether both hearths recognised in the western area are actually hearths, I will begin by analysing the layers in accordance to the reports from the excavations, the vertical dispersal of the finds by amount, following on from this I will view the results in context to the results from the refitting. Based on these results, I will analyse the distribution of tools, blades, micro debitage, and the preparation, modification and production debitage.

4.7.1 The layers

According to the reports from the 2012 and 2013 excavations, up to 12 layers (including the hearths) was recognised at the site during the dig (Lorentzen, 2013, 2014). Layer 1 is the top layer consisting of turf. Layer 2 is the bottom of the turf layer, mixed with sand. Layer 3 consists of shifting sand. Layer 4 is organic and contains soot and coal with Layer 5 both over and under it. Layer 5 is described as red-brown, coarse sand. Layer I consist of pockets of gray sand situated in Layer 5. Layer 6 is a gray-brown sand containing coal, on top of Layer 5, covering the northern part of the site. Layer 7 is erosion surfaces containing pebbles. Layer 8

is a hearth in Layer 5. The layer called Ildsted is part of Layer 8. Layer 9 is a hearth in Layer 5. Layer 10 is a pit in Layer 5 and contains soot.

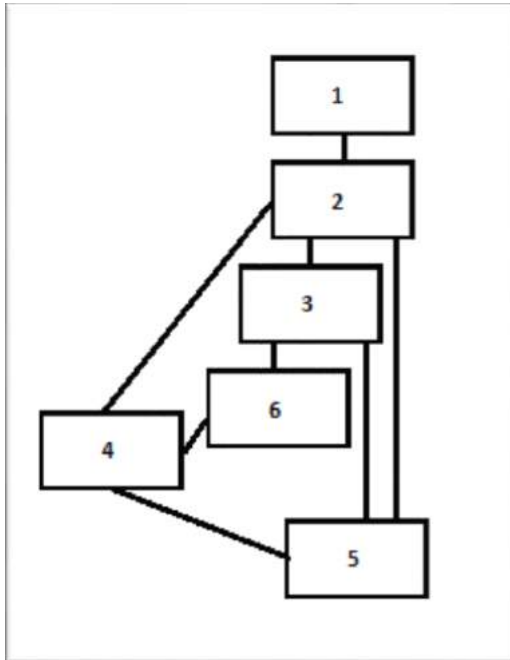


Figure 39: Stratigraphical relationships of the main layers on Mohalsen-I, West (Lorentzen, 2013, 2014)

Layer I is described as sand pockets in Layer 5. These two layers were excavated as two separate layers in order to see whether this division was man-made or if they were the result of natural conditions (Lorentzen, 2014: 8). Due to no differences in artefact distribution, the conclusion was that the pockets were natural, and were probably at the site before the habitants arrived (Lorentzen, 2014: 11). Layer 5 and Layer I are therefore treated as the same layer in this analysis, and no distinction will be made between them. This is the only layer that covers the whole excavated area.

Layer 10 is interpreted as a pit with a diameter of almost 120 cm at the northern part of the site. This layer was not recognised during the excavation in 2012 due to poor weather conditions, and as a result, the southern section was therefore partially removed. Due to this there is no complete control on what artefacts belong to this layer, however, the main part of the pit was excavated in 2013, and the discoveries from this can provide some valuable information in relation to the site itself. The pit contained a knapping stone and 10 pieces of micro, and medio debitage from flint, quartz and quartzite.

4.7.2 The vertical dispersal of finds in each layer in west, by number

Layer	Number of finds
1	26
2	124
3	16
4	66
5	4361
6	197
Hearth*	76
8	51
9	9
10	9
Sum	4934

Table 7: Vertical dispersal of finds; all artefacts, 2012-2013. * same as Layer 8

Layer	Number of finds
1	306
2	21
Sum	327

Table 8: Vertical dispersal of finds; all artefacts, 1974 - I14 and I15

4.7.3 Summary of distribution analysis from the western part of Mohalsen-I

The conclusion from the report is that Layer 5 and Layer I are the same layer. The hearths Layer 8 and Layer 9 are situated in Layer 5.

The highest number of discoveries were located in Layer 5, with 4392 finds. The second highest number of discoveries were in Layer 6, with 197 finds.

There are refits between Layer 5 and the layers 1,6 and 8, and between Layer 3 and Layer 6.

The conclusion drawn from the results gathered suggest that the layers represent the same visit.

4.8 Distribution analysis of tools, debitage and cores, west

This analyses can provide a clearer picture of the different activity zones on the site if one examines the distribution of the different elements, and where they can be found in comparison to each other. Considering the results from the layer analysis, I will analyse all the finds from 2012-2013 as well as the finds from I14 and I15 as belonging to the same visit to Mohalsen-I West.

4.8.1 Cores, and core preparation and rejuvenation

Cores and core fragments: The cores and core fragments are evenly distributed. They are either single or pairs, mainly in the area from west to south of the hearth in I15, all the way to the edge of the excavated area. In addition to this there is a high concentration in 49x-99yB, and its neighboring quadrants. There are no cores or core fragments just north of the hearth in I15, and only one core and one core fragment at the northern end of the excavated area.

Core preparation and rejuvenation flakes and blades: The core preparation and rejuvenation flakes and blades indicate core preparation and work areas as well as which types of production that have been conducted on the site. They contain crested blades, platform flakes and core rejuvenation flakes with dorsal negatives from blade production. These are evenly distributed in a circular shape in and southwest to south of I15. Some were also discovered north of I15. Two were discovered in H13, situated just east of hearth Layer 9.

Cortex: The cortex covered artefacts indicate decortication of the nodules. The artefacts with cortex were discovered south and southwest of I15, with the largest distribution covering almost the same circular area as the core preparation flakes and blades. The surrounding quadrants also contain some of these artefacts, and there was also some discovered north of the *I-Shaft*. The blades with cortex grade 2 (50-100% coverage) were found inside and slightly outside of this circular area

4.8.2 Blades and bladelets

The main cluster of blades and bladelets were in 49x-99yB and 49x-99yA and B, with the rest distributed in an oval shape surrounding I15. There was a fair number of blades and bladelets both in I15 and I14, and also inside the immediate quadrants north of these, however, not to the same extent as in the southwest. To the east, in the *I3-Shaft* from the 1974 excavation there was a small number of blades and bladelets.

4.8.3 Debitage and waste products

Micro and mediodebitage: Micro and mediodebitage indicates main activity areas. Thisdebitage shows an oval shape surrounding I15.

The different raw materials depict relatively similar clusters on the site. The flint represents the largest amount of thedebitage products. This raw material depicts a high concentration ofdebitage just south, and on the southwestern corner, of I15. It also shows a cluster; however,

this is not as large, in and just north of I14 and I15. In comparison, there is a remarkable drop in quantity at the northwestern corner of I15.

Quartz is the only raw material that has a somewhat different distribution. This is the only raw material where a higher concentration can be found on the Northwestern corner of I15 in addition to south and southwest of I15.

Macro debitage

Macro debitage provides an indication as to whether the site has been a subject to tidying or not.

In the west, the macro debitage is scattered all over the site, with the main distribution within and just south and north of I15.

Heat effected debitage

The heat effected flint is mainly distributed in an almost straight line going from southwest towards northeast with the main amount on the southwestern corner, and in I15

Modification and production debitage: There are four different types of modification and production artefacts at the western part of the site. These are distributed in a southwest-northeast axis straight across the area.

There are four projectile points abandoned during manufacture, two of them were found together at the northern edge of the site, close to the hearth Layer 9, and two of them were found towards the eastern edge of the site, not close to any hearth.

There are four debitage products from axe production and resharpening discovered at the site, these were discovered in 51x-100yD. They appear to belong to the same axe or possibly two axes.

There are three debitage products from production and resharpening of scrapers. Two were discovered together in 48x-99y B, one was discovered just on the southwestern corner of I15.

There is one burin spall in total on the western part of the site, this was found in I15.

4.8.4 Modified artifacts and tools

The modified artefacts and tools are mainly gathered across a circular area, and cover a bit more than 4 m² in and around I15.

Knapping stones: There are two knapping stones found in the western part, both of which were situated far from the initial circle, one near the southern edge and one near the northern edge, in the pit Layer 10. The knapping stone in Layer 10 was the largest, measuring 88.85mm in length and 60.2mm in width, and can be considered as a hard stone. The knapping stone near the southern edge measured 49.39mm in length and 41.86mm in width and is softer than the other.

Flakes with intentional retouch: 14 flakes with intentional retouch were discovered in the western part. Seven of them were discovered on the southwestern corner of the quadrant I15. One of them was discovered in I15 itself, and one in I14. Another was discovered just north of I15 and one just south of I14. Two others were found further from the initial circular area, one was all the way up in the northwestern corner of the excavated area, and the other one near the southernmost edge.

Blades with intentional retouch: There are nine blades with intentional retouch in the westernmost assemblage. Six of them were discovered south of I15 and I14, within the initial circular area, two were also discovered in I15 and another just north of I15.

Blades with unintentional retouch: There are 21 blades with traces of wear (unintentional retouch) on Mohalsen-I West. The largest cluster was in I15, while the rest were scattered both north and south of this area. Four were however discovered in 49x-101yC. One was located in the pit Layer 10.

Projectile points: Projectile points indicate retooling and manufacturing. They can also indicate butchering, which means that they are brought to the site inside an animal and taken out during the preparation of the animal. To find only the tips of the projectile points is a good indication of this. The projectile points are scattered around on the site, within two main areas. The first area can be described as a row of projectile points just south to southwest of I15, going from 49x-98yA to 49x-100yA, containing 9 projectiles all together. The other area was clustered just north of I15, in 51x-100y, and contained 10 projectiles. Nearly all of the projectile points in these two areas have impact fractures and/or traces of retooling. Only one, in 51x-100y, seems to be unused.

Knives: Seven knives were discovered on the western part. Five of them can be considered to be in near proximity to each other, three of these in I14, one in I15 and one in 49x-99yB. Two

of the knives were found north and south of the site, in 48x-98y C and 51x-100yA, both were close to a knapping stone.

Scrapers: The five scrapers discovered in the western part were found two places. Two of them on the northwestern corner of I15, and three in I14.

Multi tools/combined tools and burin-like (from Callanan 2007): I14 and I15 are the only part of the western part of Mohalsen-I that were analysed by Callanan. There are three tools that are cataloged as multi or combined tools, and one burin-like.

Flake axe: The flake axe was found in I15.

Remarks: Only two flakes with unintentional retouch, and no tools, were discovered in 51x-101y where the hearth Layer 9 was situated. However, five tools were recovered just east of this quadrant, in H13. This assemblage consists of two knives, one scraper and two burin-like tools. In addition, there was one knife in I13.

During the excavation in 2013, ochre was discovered towards the end of the project. It was situated where the four quadrants 48x-97yB and D and 48x-98yA and C intersect.

The flake axe and the axe production and rejuvenation debris are not from the same raw material. Thus, giving the impression that at least two flake axes were utilised on Mohalsen-I West, and one was discarded on the site.



Figure 40: Flake axe discovered in I15. Rejuvenation debris from flake axes, discovered in 51x-100yD

4.8.5 Summary of distribution analysis of tools, debitage and cores, west

There were considered to be two hearths on the western part of the site, named Layer 8 and Layer 9, both situated in Layer 5. The Layer 8 hearth has its main part in I15, and stretches in to 49x-100y A and B in the south, 51x-

100y D in the north and I14 in the east, with coal scattered into I13. The Layer 9 hearth is found in 51x-101y. The two hearths are situated right next to each other; “hearth” Layer 9 might be the result of movement on the site.

The only cluster of cores was found on the southwestern corner of I15, the rest were scattered around, mainly in the area to the southern and western part of the site. There are no cores just north of I15, or in the immediate vicinity to the Layer 9.

The core preparation and rejuvenation flakes were mainly discovered south and southwest of I15 and I14. There were some in I14 itself.

The main amount of micro and medio debitage and blades and bladelets were found shaping a circular or oval shape just south and southwest of I15 and I14, with the main cluster on the corner of I15. However, there were also a good number of both types of artefacts north of and in the *I-shaft*. These two distributions create an oval shape on the site, with the center lying on the southwestern corner of I15.

The micro and medio debitage shows that flint, quartz crystal and quartzite has a somewhat similar distribution, while quartz is the only raw material that has a cluster also northwest of I15.

The main tool discovered on this part of Mohalsen I was projectile points. These were mainly found in two areas. One that stretches from southwest to south of the *I-shaft*, and one that was mainly situated in 51x-100y, next to both hearths. Nearly all the projectile points in these two areas have impact fracture and/or traces of retooling. The projectile points with only impact fracture and no traces of retooling are the projectile points where only the tip was discovered at the site. I will examine this further during the impact fracture analysis.

The other modified artefacts and tools were mainly distributed in an oval shape around and in I15. Some were just east of Layer 9. None were found in the Layer 9 quadrant.

The modification, tool production and resharpening debitage was a bit more scattered, while axe production and resharpening were discovered north of I15.

One flake axe was discovered in I15.

No knapping stones are related to any clusters of debitage.

The initial impression overall is an oval shaped cluster of artefacts, with the center situated on the southwestern corner of I15.

The macro flakes are widely distributed on the site, and show no sign of tidying.

4.9 Distribution analysis from the eastern part of Mohalsen-I

4.9.1 The layers

During the excavation in 1974, only two layers were recognised. Layer 1 is described as a 10-15 cm deep layer of shifting sand which went darker the deeper it got due to coal, before it transitioned to a red-brown sand which also contained coal (Layer 2). The division between these two layers was therefor set at the transition between the light layer of shifting sand, and the darker red-brown layer of sand. In some areas, there were no Layer 1 between the turf and Layer 2. Quadrant E10, E11 and 2/3 of G10 were affected by shifting sand due to not being covered by any turf. There were only two finds south of the *I-Shaft* from Layer 1. There were no finds north of the *F-Shaft* in Layer 2.

4.9.2 The vertical dispersal of finds in each layer, by number

Layer	Number
Layer 1	899
Layer 2	845
Unknown layer K12	5
Artefacts without context	79
Sum	1828

Table 9: Vertical dispersal of finds; all artefacts, East

The two layers have approximately the same number of finds, however if the artefacts from I14 and I15 are excluded, Layer 1 has less artefacts than Layer 2. The artefacts from K12 were not linked to any layer in the catalog, hence the Unknown layer category.

4.9.3 The distribution of material on the site based on the overview

The initial impression received through the examination of the distribution of finds in the two layers individually, is that Layer 1 had its main quantity across three quadrants around G11. Layer 2 had its main quantity in I10 and K10, as well as in G11 itself.

4.9.4 Additional notes on distribution

In the report from the excavation in 2012, Lorentzen mentions a possible tent ring in the area excavated in 1974 (Lorentzen 2013:12). It would be interesting to see if the distribution of the

artefacts can provide a clearer picture of this tent ring, however, since no documentation of this exists from 1974, it may be difficult to interpret. Many of the stones that were situated in the area excavated in 1974, and that were not large and/or grounded in the soil itself, was used to weigh down tarpaulin. The possible tent ring seen in 2012 were not visible when the 2013 excavation started (personal communication with Birgitte Skar).

The quadrant H13 is towards the western side of the area with very few finds between this quadrant and the eastern area, and thus might belong to the western part. The quadrants from 102y and eastwards are probably part of the eastern part of Mohalsen-I.

4.9.5 Summary of distribution analysis from the eastern part of Mohalsen-I

There was one or maybe two hearths on the eastern part, based on the distribution of finds and coal. One in G11, that was recognised during the excavation in 1974, and perhaps one east of L10, that is the origin of the coal concentration in L10. The excavation did, however, not stretch further east than the *10-Shaft*, so this remains only a hypothesis.

There are the same number of finds in both layers of the area that was excavated in 1974. There are no refits between these two layers.

There might be a tent ring in the area excavated in 1974, based on an identification of a possible structure during the excavation in 2012-2013. This structure was not recognised during the excavation in 1974, and not visible in 2013, it might therefore be difficult to reach a certain interpretation of it.

There are only two finds south of the *I-Shaft* from Layer 1. There are no finds north of the *F-Shaft* in Layer 2.

4.10 Distribution analysis of tools, debitage and cores, east

In this analysis, the focus is to find the main activity areas, and see if the two layers recognised on the eastern part are the result of two separate visits. I have therefore chosen to analyse the layers separately.

4.10.1 Cores, core preparation and rejuvenation

Cores and core fragments:

Layer 1: The six cores and four core fragments in Layer 1 are distributed in a half circle going from G10 to K10, up to I- and H12.

Layer 2: There were more cores in Layer 2 than Layer 1. Of the 14 cores in Layer 2, eight were discovered in K10, and one just next to it, in L10. Of the six core fragments found in this layer, four were discovered in H10. The cores and core fragments from Layer 2 form almost the same crescent shape as Layer 1, Layer 2 however extends slightly further out than Layer 1.

Note: In the area of the eastern part of Mohalsen-I that was uncovered in 2012 and 2013, one core and two core fragments were discovered south at the site.

Core preparation flakes and blades:

Layer 1: The three core preparation flakes and blades from Layer 1 were discovered in I11, and H12 and -13.

Layer 2: Here the core preparation flakes and blades were discovered in a triangular area passing through F10 to H13 to K10, with the main part towards the north.

Note: H13 may belong to the western part of the site.

In the area of the eastern part of Mohalsen-I that was uncovered in 2012 and 2013, two preparation flakes or blades were discovered.

Cortex on blades and flakes:

Layer 1: There are nine cortex covered blades in both layers. Only one, situated in I11 in Layer 1, has cortex grade 2. The rest are scattered in ones and twos in the shafts from F to I, and the shafts from 10 to 13. The quadrants with the highest quantity of flakes with over 50% cortex are F- and G10. Flakes with under 50% coverage are in H12.

Layer 2: The cortex covered blades in Layer 2 have somewhat the same distribution as in Layer 1. One was however discovered in M10, more than two meters from the next cortex covered blade. The quadrants with the highest quantity of flakes with over 50% cortex are I- and K10. The highest number of flakes with under 50% coverage were discovered in K10.

4.10.2 Blades and bladelets

Layer 1: There are three clusters containing blades and bladelets in Layer 1 at the eastern part of Mohalsen-I, one in H10 with 13 finds, and one in H12 with 11 finds. The next quadrant with a smaller cluster of blades and bladelets is I11 containing six

finds. The rest of the blades and bladelets were evenly distributed except towards the south. There is only one blade south of I10 in Layer 1. This was discovered in M10.

Layer 2: The largest number of blades and bladelets in Layer 2 was situated in G11 containing 20 finds. The next largest cluster was in K10 containing 11 finds. The rest of the blades and bladelets were mainly distributed in the south and southwest. There were no blades and bladelets north of the *F-Shaft* and very few in the *F-Shaft* itself in Layer 2.

Note: There were 14 blades and bladelets together in both layers in the *I3-Shaft*. From the eastern part of area excavated in 2012 and 2013, there were blades and bladelets in a triangle going from 50x-102y D down to 49x-103y and 104yC and D up to 50x-104y D. There were some quadrants within his triangle that contained no blades and bladelets.

4.10.3 Debitage and waste products

Micro and medio debitage:

Layer 1: The micro debitage in Layer 1 was mainly clustered in three squares; G10, F11 and H12. The rest of the micro debitage was evenly distributed in a circular shape around the three clusters with G11 in the middle. There was no micro debitage south of the *I-Shaft*.

Layer 2: The main cluster of micro debitage in Layer 2 was discovered in I- and K10. The rest of the micro debitage had a somewhat crescent shape from F10 to G-, H- and I11 down to M10.

Note: From the eastern part of area excavated in 2012-2013, the micro debitage shaped a triangle going from 50x-102y C down to 49x-104y D up to 50x-104y D.

Macro debitage

Layer 1: The four macro debitage artefacts were discovered individually in G- and H10 and -12.

Layer 2: The five macro debitage artefacts were mainly discovered from F11 to I11. There are no clusters representing this material.

Heat effected flint

Layer 1: The heat effected flint dispersal was highest in G- and H10, with a lower quantity in H11.

Layer 2: In this layer, the heat effected flint was mainly situated in K10.

Modification and production debitage:

Layer 1: There were only four modification and production artefacts in Layer 1, all towards the northern area. Two artefacts are from axe production or resharpening and were found in G- and F11 and one burin spall was discovered in G10.

Layer 2: The modification and production debitage in Layer 2 was mainly discovered in the southern area of the site. Three burin spalls and one artefact from scraper production or resharpening were discovered in the north, approximately the same area as in Layer 1. Two burin spalls were discovered in the east of the *I-* and the *H-Shaft*. In K- and L10 five burin spalls were discovered, as well as one unknown rejuvenation flake, one axe production or resharpening artefact and two unfinished projectile points in H- and L10 close to coal concentrations.

4.10.4 Modified artefacts and tools

The initial impression garnered from the distribution of the modified artefacts and tools is that there was almost a lack of them in the *I2-Shaft*, where only a flake with intentional retouch is found in Layer 2, and a knife is found in Layer 1, both reside in H12. There were no modified artefacts or tools south of the *I-Shaft* in layer 1, and no modified artefacts or tools north of the *F-Shaft* in Layer 2. There were no modified artefacts or tools in G11 in Layer 1.

Knapping stones: There were no knapping stones gathered from the eastern part of Mohalsen-I.

Flakes with intentional retouch: There are 12 flakes with intentional retouch at the eastern part of Mohalsen-I, 10 of them were discovered in Layer 2. These 10 are widely distributed around the site, where the only “cluster” is identified with the 3 discovered in K10. The 2 in Layer 1 were discovered at the northern part of the site.

Flakes with unintentional retouch: There are 20 flakes with unintentional retouch on Mohalsen-I East: 10 in each layer. The only cluster was in F10 with four discovered in Layer 2, the rest of them were scattered in the area across both layers

Blades with intentional retouch:

Layer 1: There are two blades with intentional retouch in Layer 1. One in F- and one in H10.

Layer 2: There are two blades with intentional retouch in Layer 2. One in G11 and one in M10.

Projectile points:

Layer 1: There are three projectile points with impact fracture and/or traces of retooling in Layer 1. These were discovered in F12, H11 and H10. There are two unused points in Layer 1; one in I10 and one in H12.

Layer 2: There are six projectile points with impact fracture and/or traces of retooling in Layer 2. Four of these were discovered in G11, G12 and F11. One was discovered in I10 and one in L10. Three unused projectile points were discovered in Layer 2, in G-, H- and L10.

Knives: There is an excessive quantity of knives discovered on the eastern part of Mohalsen-I, most of them recognised by Martin Callanan in his master thesis from 2007. Except from those mentioned earlier in **Knives** on the western part of Mohalsen-I and the one mentioned in the introduction to tools on the eastern part, there are six knives in Layer 1 and ten knives in Layer 2. One was also found in K12 - unknown layer.

Layer 1: The knives from Layer 1 were discovered in H10 and -11 and I11, with two in each quadrant.

Layer 2: The knives from Layer 2 were discovered evenly distributed from F- to M10, and from G- to I11.

Scrapers: Except for the scraper mentioned in **Scrapers** on the western part of Mohalsen I, there are no scrapers in Layer 2, and only one in Layer 1 discovered in F11.

Awl: One awl was discovered on Mohalsen-I, it resided in I10, Layer 1.

Burin: Two burins were discovered on the eastern part of Mohalsen-I, both in Layer 2. One was in G11 and one in L10.

Multi tools and burin-like (from Callanan 2007): There are four burin-like tools on the eastern part of Mohalsen -I. One in Layer 1, I11 and three in Layer 2, in I-, K- and L10. One multi tool was also discovered in G11, Layer 2.

4.10.5 Summary of distribution analysis of tools, debitage and cores, east

All cores, core fragments and core preparation blades and flakes from both layers were discovered within the same crescent shaped area. Layer 2, however, contained more artefacts than Layer 1 and extended further out than Layer 1. Also, Layer 2 had a clear cluster of cores in K10 and core fragments in H10. Layer 1 exhibited no clear clusters.

The blades and bladelets were gathered in and around G11 within both layers. However, Layer 2 also had a cluster in K10, where Layer 1 had no artefacts.

The micro debitage clusters from Layer 1 were discovered in three quadrants surrounding G11, while in Layer 2 the cluster was a slightly further south, in I- and K10.

The modification and production debitage in Layer 1 was only discovered in the northern part of the site. In Layer 2 it was widely distributed on the whole site, however the main part was discovered south of the *I-Shaft*.

The modified artefacts and tools were mainly gathered to the east in the eastern part of Mohalsen-I. Layer 1 did not stretch further south than the *I-Shaft*. There were more modified artefacts and tools in Layer 2 than in Layer 1. There were very few modified artefacts and tools in the *I2-Shaft* and no modified artefacts or tools in the *E-Shaft*. The main modified artefacts/tools within this part of the site were knives, and they were found across the whole eastern part, in both layers.

The main impression presented is that flakes, blades and bladelets covered the whole eastern part of Mohalsen-I, and the two layers represent two different areas addressing one coal concentration or hearth each, while the modified artefacts and tools were mainly found in the two easternmost north-to-south running shafts.

There might be a tent ring in the area.

The few macro flakes were evenly distributed across the site, showing no signs of tidying.

4.11 Summary of the main results from the analysis

The distribution overview has shown a division in the material between the western and the eastern part of Mohalsen-I. The main division overall is in the *13-Shaft* from the 1974 excavation where approximately 80 of the 6666 artefacts were found. The main division between the two areas with regards to the tools are in the *12-Shaft* from the 1974 excavation.

The coal distribution together with the distribution of debris suggests between two or four hearths on Mohalsen-I. One or two on the western part, and possibly two on the eastern part.

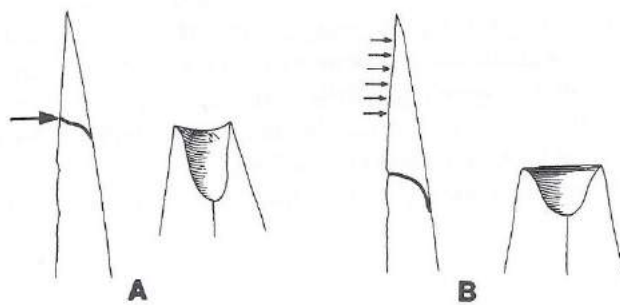
The micro debitage had three main clusters on the site. One on the western part and two on the eastern part. On the eastern part the two different clusters were found in the two different layers.

The main tools found on the western part are projectile points. The main modified artefact/tool found on the eastern part are knives, based on Callanan's master thesis from 2007. Despite this, there are in percentage more projectile points in the eastern assemblage than the western. Both the excavation methods, as well as the differences in the analyses that have been conducted on the two assemblages, must be taken into consideration when they are compared like this.

4.12 Impact fracture analysis on projectile points

The impact fracture analysis conducted on the projectile points is based on the results from an experimental analysis by Anders Fischer, Peter Vemming Hansen and Peter Rasmussen

(Fischer et al., 1984). I will only focus on the macro wear traces in my analysis.



- A. Example of cone fracture (seen in longitudinal section and in dorsal view). The force is applied over a relatively limited area and the fracture initiates in the immediate vicinity of the contact area.
- B. Example of bending fracture (seen in longitudinal section and in dorsal view). The force is applied over a relatively large area and the fracture does not necessarily initiate in the immediate vicinity of the contact area.

Figure 41: Types of fracture seen on projectile points. From Fischer, Hansen, and Rasmussen (1984: 23)

Exact copies of two completely different types of stone age points, i.e. Brommian points and transverse arrowheads were used in the referred experiment, and the macro and micro wear traces they received were analysed to reveal what information the damage can yield (Fischer et al., 1984: 19).

Through inspection, they found

that all macroscopic fractures were variations of two main groups; cone fractures, which are the result of force distributed over a small area, and bending fractures, which are the result of force distributed over a larger area (Fischer et al., 1984: 22). The fact that the same fractures could be identified on different points indicate that it is likely the types of macroscopic fractures identified in the experimental analysis can be applied to other types of projectile points that are not described in the article (Fischer et al., 1984: 25). It was often possible to subjectively distinguish between points that had hit hard and soft materials, however; several of the macro fractures occurred on projectile points that had only hit soft tissue, and no exact differentiation could be made between the two types of impact (Fischer et al., 1984: 24). 40% of the points used in the analysis had macro wear traces, and it is assumed that the percentage is universal for projectile points shot into what they refer to as “largish” animals (e.g. boar and sheep) (Fischer et al., 1984: 43).

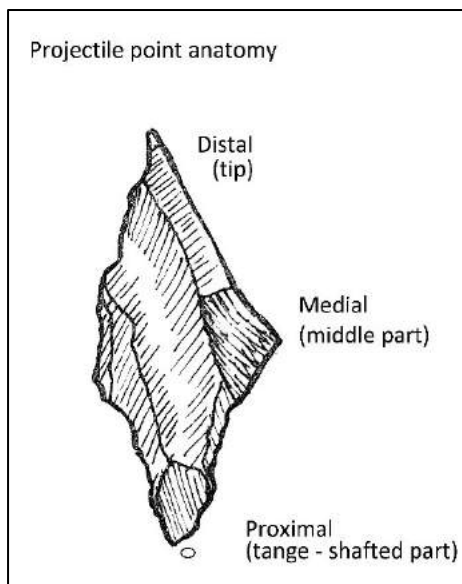


Figure 42: Projectile point. The tange is in the proximal part of the blank the point is made from. Illustrated by Øyunn Wathne Sæther

There are 38 projectile points discovered on the western part of Mohalsen-I and 15 on the eastern part. What must be taken in to consideration in this respect, is the lack of sieving during the 1974 excavation. According to Bang-Andersen’s analysis of the amount of lithic material lost without sieving, more than 40% of the tools are overlooked, with a predominance on arrowheads. Despite this, he says, the tools represented compared to the rest of the assemblage are the same before and after sieving (Bang-Andersen, 1985: 16). This means that of the 4918 artefacts discovered on the western part of Mohalsen-I, 0.77% are projectile points, while on the eastern part the number of projectile points are 0.85% of the 1748 artefacts.

The length and width of the projectile points from Mohalsen-I have been measured using a calliper of the brand Cocraft (2 decimals).

At Mohalsen-I west, 38 points were found, of which one is unused and four are abandoned during manufacture. The unused point has its tip in the proximal end. There are 33 points, or 86.84%, that have impact fracture, of which 21 have bending fracture to either distal or proximal or both. 23 of the points found are complete with impact fractures, of which 15 are

bending fractures. Of these 23 points, there are 17 with damage to the proximal and small or no fracture to the distal, these are most likely taken back to the site imbedded in the hunted animal. Some of them might have broken in the shaft, and been taken home and removed from the shaft during the retooling. Two are complete with damage to the proximal, and rounded fractures on distal. Two points are complete with no or little damage to proximal, and only small fractures to the distal end. These points show little damage and might have hit soft tissue or not hit an animal at all. They have, however, still been subject to retooling. One point has no damage to the distal end, and might have been damaged during insertion into the shaft. This point has cortex. One of the complete points is large in comparison to the others. It has indeterminable fractures.

Six points from Mohalsen-I west are proximal fragments, of which 4 have bending fractures. In these six instances, the distal part has broken off in the animal or via other means, the proximal part of the point has been left in the shaft. There are no distal parts in the material that corresponds to these proximal parts.

Three projectile points from the western assemblage are distal fragments. One has broken due to heavy impact, one is heat affected, and in one the proximal has broken straight off, resulting in a spin-off fracture (which is a type of bending fracture). In these instances, the proximal part might have been left in the shaft while these broke off in the animal. The tip with heat effect might have been in an animal that was placed on a fire.

There is one medial part of a point with bending fracture found in the western assemblage. This point might have broken in three pieces due to heavy impact, and could have been left in the animal together with the tip. It might also have broken off the proximal end during re-shafting due to weakness in the rest of the point due to the impact. This piece does not refit with any other piece.

At Mohalsen-I East, 15 projectile points were found, of which 9, or 60%, have impact fracture and one is undeterminable. 7 of the points are complete with impact fracture to either distal or proximal or both, 5 were discovered in Layer 2 of which 4 have bending fractures, and 3 were discovered in Layer 1. One of these only has a spin-off from the tip, and no obvious sign fracture (can also be described as a splinter gone off, however, it has more similarities with a spin-off than a splinter). Two are cone fractures.

There are two proximal parts of points discovered in the eastern assemblage. One in Layer 2, which has a bending fracture, and one in Layer 1.

Three of the points discovered are unused, two of which are large compared to the others. One of the large points is found in Layer 1. The two other points were both found in Layer 2, where the large one is angled and might have been discarded due to it not being useful.

There are two points discovered which were abandoned during manufacture, both were in Layer 2.

The interpretations of the different fragments and fractures are the same for east as for west, as the explanations are the same, I will not cover them again.

Note: There are two quite large projectile points on Mohalsen-I that have been used; T19464:132 and T26109:376, one in each assemblage. They both have a width over 13 mm, which makes them considerably larger than the other projectile points discovered on the site, where the width rarely reaches 10mm. They are also thicker than the other points. One of them is short (u.nr. 376), and measures only 15 mm. The other measures over 35mm in length. Both have impact fractures.

Two other large projectile points were discovered in the eastern assemblage. However, both projectile points were discarded; one was not unused due to being angled, and one was discarded during the manufacturing process.

The average size of the projectile points at Mohalsen-I are approximately 20mm if projectile point T19464:132 is removed from the equation.

4.12.1 Results of the impact fracture analysis

There are projectile points abandoned during manufacture at both parts of Mohalsen-I, which indicate production of projectile points at the site.

None of the distal and proximal parts discovered on the site belong to the same projectile points, which indicates that parts came from or were taken to other sites, either still within the prey or within the shaft. The lack of refits between fragments from the eastern part of the site may be due to the lack of sieving.

Fractured proximal ends indicate retooling at the site.

The heat affected distal end located in the western part indicate that the prey has been taken back and subjected to heat at the site.

There is a high frequency of projectile points with impact fractures on Mohalsen-I, compared to the amount in the experimental analysis conducted by Fischer et.al., particularly in the western assemblage. This could indicate an impact with large animals or animals with compact/thick skin.

4.13 The results from the analyses in a *chaîne opératoire* context

In the *chaîne opératoire* analysis I will take the previous analyses into consideration, and view them in relation to each other. The different phases, as described in Eriksen (2000a: 80) will here be presented accordingly.

Phase 0

- According to Spjelkavik (2016: 65) no testing of nodules was conducted on Mohalsen-I. However, the refitting indicates that the local coarse quartzite and coarse quartz were tested on site based on the size of the flakes and fragments. This is in addition to the lack of tool or blade production from these raw materials at the site, as well as the poor quality of the raw materials. There are no obvious traces of testing other types of raw materials however, and Spjelkavik conducted his analysis on raw material types where blades and cores were available. There were no cores or blades from the coarse quartzite on Mohalsen-I, and it was only through refitting that the information of the quartz core was available. Spjelkavik assumes that raw material has been found locally as well as transported to Vega from other areas (Spjelkavik, 2016: 106).

Phase 1

- Some decortication of the flint nodules was conducted on both parts of Mohalsen-I, as seen from the cortex analysis.

Phase 2

- The number of blades and core rejuvenation flakes with dorsal negatives from blade production at Mohalsen-I indicates production of primary artefacts on both parts of the site. Blades have been made from both quartzite and quartz crystal as well as flint on the western part of Mohalsen-I. The focus on gathering flint in favour of other types of

raw material in the eastern part during excavation make it difficult to achieve any interpretation concerning raw material from this part.

- The blades have been produced applying direct medium hard or direct soft reduction technique. There are traces of differences in both trimming and the applied technique from the eastern to the western part of Mohalsen-I.

Phase 3 and 4

- As seen from the distribution analysis and impact fracture analysis, projectile points have been manufactured, used and retooled on both parts of Mohalsen-I. Projectile points are the main tool found on the western part of Mohalsen-I.
- As seen from the refitting analysis and distribution analysis, other tools, such as scrapers, burins and flake axes, have also been manufactured, modified and utilised at both parts of Mohalsen-I.
- There is a certain degree of opportunism when tool making is regarded, as several tools are made on both cortex flakes as well as other flakes, blades and bladelets. This can also be seen in Callanan (2007).

Phase 5

- Projectile points, blades, one scraper, the tool from refit W1, one flake axe, several cores and two knapping stones as well as knives and other tools made on flakes or blades are discarded, lost or abandoned at Mohalsen-I West. According to Spjelkavik (2016: 105) there is differentiated utilisation of the different qualities of flint types, as some of the cores are discarded earlier than other cores.
- Burins, projectile points, blade knives, cores and several other types of tools made on flakes and blades are discarded, lost or abandoned at Mohalsen-I East.
- Both areas also contain fragments of blades as well as burin spalls and traces of manufacturing and resharpening of flake axes, which indicate that tools have been manufactured and then transported away from both parts of Mohalsen-I.
- A simple MANA analysis of raw materials represented by a few artefacts on Mohalsen-I indicate that artefacts and cores have travelled to and from other sites. Cores have been worked on Mohalsen-I and brought further, while flakes have been discarded. Some of the artefacts produced have also been brought further, and some artefacts (blanks), have been brought to Mohalsen-I and been discarded at the site. Both the

quartz crystal and chert have seemingly been transported to the site from quite far away – thus potentially linking the site to a large network of communication both along the coast towards the north and from the coast to inland and back.

5 The results from the preceding analyses combined

5.1 The morphological analysis

The morphological analysis resulted in the recognition of several more projectile points than what was initially recognised during the cataloging of the two assemblages. When analysing the blades and bladelets at Mohalsen-I based on whether they represent a blade concept, instead of being based in the set metric dimensions, several bladelets from the 2012-2013 material received status as blades and vice versa from the 1974 material. This is however not reflected in the overview in Appendix A.

There were some general changes made to the inventory, however, this had no direct effect on the artefact's typological affiliation to the EM Cronozone.

As shown, an earlier analysis of the 1974 material conducted by Martin Callanan in 2007 has made alterations to only one assemblage, which means that there are differences in the inventories that can be traced not only to the excavation method, but also to the different morphological analyses conducted on the material.

5.2 Technological analysis

The amount of blades and core fragments with negatives from blade production indicate that blade production has been one of the primary focuses on the site. The technological analysis of the blades and bladelets indicates the same technology, where a direct medium hard or direct



Figure 43: Examples of ideal blades from the eastern part of Mohalsen-I

soft hammer is favored on both parts of Mohalsen-I, however with slightly different techniques

in both the application of the hammer and in the trimming of the cores. The fact that there is an overwhelming amount of blades with normal/regular shape on both parts of Mohalsen-I, shows a high degree of regularity in the production (cf. Sørensen, 2006b: 26). There is a high quantity of complete blades at the site, at the same time as there are traces of ideal blades being utilised for further modification.

5.3 Refitting

The refitting combined with the analysis of the horizontal dispersal of finds from the 2012-2013 excavation resulted in a rejection of the initial interpretation of several different visits to this part of the site.

The refitting has also revealed that most of the connection lines on both parts of the site are shorter than two meters. However, some of the connection lines are longer than two meters, and revealed some sort of movement at the site.

Both production sequences, breaks and a modification sequence were uncovered at the site due to the refitting.

Refits, the initial overview of the dispersal of finds made by Astrid Lorentzen, and the dispersal of the hearths combined led towards an interpretation of the site representing at least two different visits, divided on the eastern and the western parts of the site. This led to a division in the assemblages belonging to either West or East, independent of which excavation they belonged to.

5.4 Raw material

The technological analysis and the refitting has shown that there are different modes of knapping the various raw materials found on Mohalsen-I. These analyses do not contain an in-depth study in the different types of qualities found in the various raw material categories, however, some conclusions can be made: there seem to have been a somewhat similar reduction strategy conducted on the flint, the fine quartzite and the quartz crystal, which are all “finer” raw materials discovered at the site. However, in regards to the coarse quartz and quartzite, it appears that these have been subjected to raw material testing and not much more on Mohalsen-I.

5.5 Distribution analysis

In the West, most of the debris shows a circular to oval shape around I15, where the possibly only hearth in this area was situated, if hearth Layer 9 represents movement on the site or cleaning of hearth Layer 8.

The pit Layer 10 and the presumed second hearth, Layer 9, is situated just north and northeast of this circular shape. One of the knapping stones was discovered in the pit Layer 10.

The scraper rejuvenation flakes were discovered in close proximity to each other south of the hearth Layer 8 on Mohalsen-I West. The axe rejuvenation and production flakes and the flake axe were discovered in I15 (axe) and in the same quadrant just north of the same hearth (axe rejuvenation and production flakes). The rejuvenation and production debris does not belong to the flake axe, indicating the usage of at least two axes on the site, in close proximity to each other. One of them was also discarded on the site.

The projectile points that were discovered mainly north and south to southwest of the hearth Layer 8.

The blades and flakes with intentional and unintentional retouch were mainly discovered south to southwest of the hearth Layer 8.

Almost all tool groups were discovered in I14 and I15, except for the projectile points.

Some tools are located just east of hearth Layer 9.

In the East, there were no refits between the two layers recognised during the excavation in 1974. In addition to this, there were two coal concentrations on this part of the site, in G11 and L10, and the clusters of debris from the two layers are addressing each of these two coal concentrations.

There are notably more burin spalls in the 1974 assemblage than in the 2012-2013 assemblage.

There are traces of axe production or resharpening in both layers in the eastern assemblage, which addresses a coal concentration each. In Layer 2, the axe rejuvenation flake is in the same area as five burin spalls.

There might be a tent ring in the area.

Layer 1 has no tools south of the *I-Shaft*.

5.6 Impact fracture analysis

The impact fracture analysis indicates that both parts of the site have been the subject of the retooling and manufacturing of projectile points. Two of the projectile points abandoned during manufacturing in the west were close to the presumed hearth Layer 9, while lying north of the pit Layer 10. In the east, both projectile points that were abandoned during manufacturing were related to one coal concentration each.

Several other types of artefacts, like flake axes and scrapers indicate that other types of work have been conducted on both parts of the site. This will be discussed in the next chapter.

5.7 The *chaîne opératoire* analysis

The *chaîne opératoire* analysis has depicted both parts of Mohalsen-I as sites where the phases 1 to 5 from Eriksen's model (2000a: 81) are represented. It has also revealed that Mohalsen-I might be part of a larger network of sites, as there are raw material categories on the site that are represented only by flakes, blanks or projectile points.

6 Discussion

In this chapter, I will discuss the results from the analyses with reference to the initial research questions. I will also examine the results in the context of other *chaîne opératoire* analyses. However, it is first necessary to view the results in context with the two different excavation methods applied during the two excavations on Mohalsen-I, and establish how this can affect the interpretation of the *chaîne opératoire*.

6.1 The excavations

The differences in the excavation methods that Mohalsen-I has been subjected to has made comparing the analyses of the two areas on the site (west and east) challenging. It is difficult to know whether the differences in the raw material exploitation in the two areas is a result of the excavations, or whether there was an increased differentiation in raw material utilisation on the western part as opposed to the eastern part. As stated, there was a higher quantity of different raw materials discovered in the west than in the east during the excavation in 1974, and this can reflect a difference in raw material utilisation within the two areas. This will however always remain a hypothesis, and there is reason to believe that the main focus during the 1974 excavation was largely based on flint, and that this is the reason for the differences in the raw materials found in the two areas.

Due to the lack of sieving during the excavation in 1974, up to 50% of the artefacts from the eastern part of the site can be assumed to be lost. This has had implications on the assemblage, as a larger quantity of artefacts could have provided a more correct overview of the site's distribution and inventory. Despite this, it is reasonable to assume that the artefacts found are representative of the relative assemblage, and that some interpretations can be extracted from it.

In 2012-2013 the excavation was conducted in $\frac{1}{4}$ m² quadrants while in 1974 the excavation quadrants measured 1m². This difference resulted in an uneven distribution pattern from one part of the site to the other, and has an impact on the part of the western area excavated in 1974. Excavations conducted in 1m² quadrants will always result in a more diffused picture of where each artefact was found, and makes it increasingly difficult to distinguish where the possible structures might have been.

The lack of documentation during the earlier excavation has had an impact on the statement value of the material, especially in regards to the distribution analysis of the eastern part of the site. The fact that one or perhaps two possible structures (a tent-ring and a hearth) went unnoticed during the initial excavation has had implications on subsequent interpretations. There are however tendencies in the material that can help gain some sort of understanding of the eastern part of the site.

6.2 Artefacts

The morphological analysis revealed some artefacts that were not recognised during the initial cataloging.

Flake axes

A flake axe was recognised by Alterskjær during the excavation in 1974 (Alterskjær, 1985: 40), it was however not identified when analysed in connection to cataloging at the later stages. From the analysis of the axe production and rejuvenation flakes together with the flake axe, it is evident that at least two if not three flake axes were produced and used on the site. This interpretation is based on the differences in the flint raw material. They are all crafted from light flint of fine quality, there are however differences in the color and gloss.

Tests of flake axes, conducted by K. Thorsberg in 1985, indicate that these have been used in the processing of hide (Schmitt et al., 2009: 14 with reference to Thorsberg).

Scrapers, cores and micro burins

The in-depth study of the inventory of Mohalsen-I resulted in the recognition of a scraper-rejuvenation flake and the refitting resulted in the recognition of a core in two pieces, as well as a part of another core.

The micro burins recognised during cataloging of the eastern part of the site, were during this analysis found to be other types of artefacts. This indicates that the micro burin technique that exists on other EM sites in Norway (Bang-Andersen, 2012; Waraas, 2001) was not applied to the material from Mohalsen-I.

Projectile points

Several projectile points were also recognised during the morphological analysis, and this revealed both production, usage and discarding at the site. The impact fracture analysis of the projectile points indicates that several different activities took place on the site.

The fractures to the points shows that this site might have been a part of a larger network of sites. The reasoning behind the network interpretation is the fact that there are no refits between the proximal or distal fragments from the site. The parts that belong to these points may have been transported to another site, still attached to the shaft or still lodged within the game.

What should be taken in to consideration is the lack of sieving during the 1974 excavation. According to Bang-Andersen's analysis of the stone artefact material lost without sieving, more than 40% of the tools are overlooked, with an emphasis on arrowheads. Despite this, he says, the tools represented are the same before and after sieving (Bang-Andersen, 1985: 16). Thus, if the site had been sieved during the 1974 excavation, there might have been some refits between fragmented points, this does not change the interpretation of the network of sites. The reason why this interpretation can be substantiated is the lack of refits between proximal and distal fragments of points from the 2012-2013 excavation, which was subject to sieving.

The unfinished projectile points show that Mohalsen-I has been a manufacturing site. In accordance to this, the fractured points are a clear indication towards retooling at the site. The fractured points might have been brought back lodged within the prey, and perhaps removed during preparation of the meat or during the meal. The distal fragment T26109:205 has been affected by heat, this suggests that it has been near contact with fire, and may have been in the meat while it was being cooked.

The evidence of one, or maybe two quite large points (T19464: 132 and T26109: 376) might suggest the hunting of larger game, such as whale or other types of large marine mammal. The smaller projectiles may indicate the hunting of smaller sea mammals, birds, fish or terrestrial animals of various size. However, the fact that so many points from Mohalsen-I, compared to the analysis conducted by Fischer et al. (1984), had impact fractures could indicate that most of the projectile points had been used to shoot game with a relatively thick hide,. This could thus be perceived as indirect evidence that the hunting of marine thick-skinned species was the primary reason for visiting the site. However, this should be analysed closer with an impact fracture analysis of projectile points used on thick skinned marine mammals.

Vega has evidently been an important area for hunting. The quantity of projectile points that have traces of use is substantial compared to other sites where the same analysis has been conducted. Out of the 47 finished points, only four appear to be unused. Six points were abandoned during manufacture. That means that 81% of the points discovered have been used, 11% have been abandoned during the manufacturing phase, and 7-8% were unused. If we examine the western area of Mohalsen-I, the number changes slightly. 38 of the points from the western part were discovered during this excavation, and 33 of these, or 86-87% have traces of damage. Between 10-11% were abandoned during manufacturing and between 2-3% were unused. In comparison to the EM site Rørmyr II (Høgnipen) which was re-examined by Birgitte Skar and Sheila Coulson through refitting, Mohalsen-I has more projectile points with impact fractures. On Rørmyr II 64% of the projectile points had impact fractures, 10% were abandoned during production, and 26 % were unused. There are also differences in the utilisation of the sites. Høgnipen is situated on what would have been an island in the eastern Oslo fjord during the Preboreal times (Skar & Coulson, 1986: 90). The site is concluded to have been a single occupation with three main activity areas, where Area II has been interpreted as being a retooling area based on evidence of the manufacturing of points in various stages, in addition to damaged points (Skar & Coulson 1986: 93), while Area III, which also contained points, but with no indication of manufacture, was interpreted as a butchering area (1986: 97). There is a much clearer distinction in the areas in Høgnipen than in Mohalsen-I if one considers the condition and dispersal of the points.

On Mohalsen-I the 38 points from the western area were mainly distributed in two clusters on two sides of the hearth in I15, one on the northern side and one on the southwestern side. On the southwestern side, the points were spread out in a larger area than on the northern side where they were mainly discovered in 51x-100yB and D. The only unused point from the west was also found on the northern side, in 51x-100yA. There appears to have been retooling on both sides of the hearth, as the points with impact fracture are evenly distributed across the two main areas from where the points were discovered. The 4 unfinished points from the 2012-2013 were also discovered on both sides of the hearth. These however, had no immediate connection to the hearth, as all four were found near the edge of the excavated area; two of them together near the northern edge, and two of them further apart from each other, one towards the south-western edge and one more directly south of the hearth.

Compared to Høgnipen, Mohalsen-I exhibits an extensive usage of the available raw material, which might be what is portrayed through the high quantity of points that have been used, and the low quantity of points abandoned during manufacture. There has been scarcity in the raw material, which is also evident from the cortex on two of the points. It is also very likely that there has been scarcity with the wood material that was used to manufacture the shafts due to the lack of vegetation along the Norwegian coast during this early period after deglaciation. There might even have been more scarcity of wood than of lithic material, and the main focus during the shafting and retooling may have been to keep the shaft itself in good condition, and not necessarily the lithics. This may explain some of the damage to the proximal parts on some of the points since it could have been necessary to damage the point in order to save the wood during the retooling phase.

6.3 Technology, technique and raw materials

Mohalsen-I West is a site where all phases of an operational chain are present. Spjelkavik's analysis of the procurement of raw materials provides an insight into where the different raw materials could have originated from, and it is highly probable that the coarse quartz and quartzite, as well as the flint were gathered on Vega. The flint was most likely found within the beach zone, while the quartz and quartzite were procured further up in the terrain (Spjelkavik, 2016). In addition to this, the quartz and quartzite were tested at the site, possibly by applying a hard, direct technique, while the finer raw material gives an impression of a softer direct technique where one of the main aims has been to withdraw as many useful artefacts and blanks from the most promising cores. The decortication of the nodules was conducted utilising both methods.

The analysis of the techniques applied to the different raw materials indicates that the coarser types of stone could have been exposed to a harder direct technique than the finer materials. It is however difficult say that this interpretation is completely accurate, as the applied technique is not very evident on these lithics. The result from Mohalsen-I could thus be somewhat similar to Schäfer's analysis on a site in Germany and Johansen's analysis on Uransbrekka in Sør-Trøndelag (K. Johansen, 1990; Schäfer, 1990), where different techniques were evident on different quality raw materials.

The flint on Mohalsen-I varies somewhat in quality, which has led to the cores being discarded at different stages during the reduction sequences (Spjelkavik, 2016: 105). The evidence of a

“bipolar” technique on Mohalsen-I could be the result of an exhaustion of the most sought after raw materials, and not of the bipolar technique per se. This could be the reason for the existence of the bipolar technique in the northern region of the Norwegian coast, and be an indirect proof of the lack of what the hunter-gatherers perceived to be “good” raw material during the pioneering phase. The differences in quality do not seem to have had a profound effect on the outcome of the knapping process, and this coupled with the high regularity of the blade material, indicates that the Mohalsen-I visitors brought at least one skilled knapper on each visit. The number of hinged blades was 13-14% on each part of the site. A closer analysis of raw materials, artefacts and knapping errors combined could provide a clearer picture of the types of people visiting Mohalsen-I.

The technology of Mohalsen-I does not vary too much from other EM sites, and can thus be placed in relation to other sites found along the Norwegian coast. Therefore, it can be considered as a coastal derivation of the Ahrensburgian technology known from the North-European continent, with its direct soft or medium hard percussion technique and the production of tanged projectile points constructed from blades (Fuglestad, 2005, pp. 74-75). Both the MANA analysis, Spjelkavik’s raw material analysis and the projectile point analysis indicate that Mohalsen-I was part of a larger network.

6.4 Refitting and distribution – did the analysis reveal anything new?

The small number of refitted artefacts from Mohalsen-I may largely result from my inexperience with both the material as well as the method of refitting itself. Despite this, the refitting has not been futile as the results have led to an increase in information on the site. The majority of the refits from both excavations at Mohalsen-I contain only two artefacts, however, this does not mean that they are without importance, as they can still depict on-site movement and changes in reduction strategies.

It was quite evident at an early stage of my analysis that Mohalsen-I contained two activity areas based on the overview created by Lorentzen (2014), with one hearth in each area. It was therefore essential to the rest of the analyses to see if the two areas represented separate visits or not, in order to understand the context of the lithic assemblages. The technological analysis revealed small differences in knapping attributes on the blades from the two different parts, and the refitting yielded no refits between the two areas. This, combined with the knowledge of two hearths and the very clear separation between the two areas, led me to conclude that

they do represent separate visits. It can be pointed out that the small quantity of refits that I managed to obtain from the assemblages do not yield a qualified empirical presentation of the relationship between the sites, and I will state that refits between them may occur during a subsequent analysis. I will however, note that later refits between them might only depict the reuse of raw material discovered at the site. The previously mentioned parameters that led to my conclusion are still present, and help substantiate my claim towards them representing two separate visits.

The refitting has resulted in the discovery of production sequences, modifications of tools, and intentional and unintentional breaks at the site. It has also provided information surrounding the spatial organisation on the site and information surrounding the layers recognised during the excavations. Nearly all of the refits have what is referred to as short connection lines (under 2 meters) (cf. Cziesla, 1990: 31), and most of the refitted tools were used and discarded where they were produced.

At first glance, the two areas fall within the pattern of spatial organisation seen on several EM sites, with a cleared area, a hearth and a lithic assemblage concentrated around the hearth (Nærøy, 1998: 106; Waraas, 2001: 117). It was however believed that there were two hearths on the western part of the site, and it was therefore speculated during excavation whether this, together with the different layers, were signs of more than one visit (Lorentzen, 2013, 2014). The refitting and vertical distribution analysis revealed that the western part of the site represented one single stay. The layers might therefore represent sand drift covering the site while people stayed there, as well as taphonomic processes during the 10 000 years the site has been covered by soil. The hearth Layer 9 might be the result of movement on the site or a deposit or litter from the hearth Layer 8, as it did not have the same similarities to a hearth such as Layer 8 (personal communication with Birgitte Skar).

Based on Kutschera's course one of the interpretations obtained is that the stay on Mohalsen-I has been either very short-lived, that there have been few people at the site, or that the individuals could quickly and easily create the equipment as and when they needed it and not invest more time and effort than was necessary during in the knapping process. The density of hearth Layer 8, combined with the number of different tools on the western part of the site does, however, not support the interpretation of a short-stay.

Two layers were recognised during the excavation of the eastern part of Mohalsen-I in 1974. The refitting yielded no refits between these two layers, and it is possible that this points towards two different visits to the same spot. A few differences in distribution of the two layers could also indicate that the eastern area was inhabited twice, with Layer 1 belonging to the recognised hearth on the eastern part of the site, and Layer 2 belonging to another hearth outside the excavated area (see below). It is difficult to achieve a clear picture of the exact situation, and the interpretation is therefore quite ambiguous.

Hidden structures

During the more recent excavation on Mohalsen-I, a possible tent ring was recognised in the area excavated during 1974. This tent ring was situated so that the presumed hearth in the area would have been outside the tent. The tent would have been placed in such a way that it protected against the heavy winds coming from the north-west. I am unable to, based on the distribution of the artefacts, validate the possible tent ring on the eastern part of Mohalsen-I. The ring is however, quite visible, and strongly suggests that the stones were placed there deliberately.

There are no evident tent-constructions on the western part of the site. The distribution of artefacts does, however, indicate a circular to oval shape around the hearth Layer 8, which is situated in I15. The main bulk of the tool inventory was found within the compounds of this circular shape. This could of course only indicate the overall dispersal of lithics around a seated knapper, and the lithics are also outlined so that the sitting spot of at least one knapper can be identified. The main circle is however quite distinguishable around a larger area than what the circle surrounding the knapper displays. A possible hypothesis is that the tent ring was created with something other than stones, however, this should have been visible during excavation, especially if it was constructed with earth. It is also a possibility that such a construction could have been destroyed by the heavy winds in the area, if it was constructed by sand. Alternatively, another possibility is that the stones from this tent ring were taken and placed where they were recognised during the last excavations. The reuse of stones for tent rings are amongst other things depicted on Site 48 Nyhamna (Bjerck, 2008a: 223). If this is the case, then the western part of the Mohalsen-I was utilised before the eastern.

If there was a tent on the western side of Mohalsen-I, it appears that the main activities have taken place inside it; all retooling, production of tools and cooking. There is very little activity

outside, especially in the area excavated in 2012-2013. This may indicate a site occupation during a period of very bad weather, such as during Autumn, Winter or early Spring.

Might the lack of activities outside the tent be due to the placement of the excavation? The chance of an unexcavated slaughter place close to the site is quite probable, as it is unlikely that this messy work was conducted inside the tent. However, all other activities seem to have taken place within the tent. The artefacts indicate such an interpretation.

As stated, it is more difficult to make an interpretation such as this regarding the area excavated in 1974, as the soil was not sieved during that excavation, and the area was heavily eroded. There are, however, tendencies in the material that can reveal some unrecognised structures at the site. The heat-affected artefacts are mainly found in Layer 1 around the hearth recognised during the 1974 excavation, except for a cluster from Layer 2 which was found in K10. Only one heat affected artefact was found between these clusters, which might indicate that the cluster in K10 is an indirect indication towards there being another hearth at the site, situated just outside of the excavated area.

Movements on the site

West. An interesting aspect of the whole analysis is the utilisation and movement on the site. It seems like there are two activity areas on the western part, both addressing the hearth Layer 8. One of the activity areas (from now on referred to as area I) is on the northern side of the hearth, and the main activity conducted there was the retooling of projectile points. One scraper was found in close proximity to this area. Rejuvenation of flake axes also occurred here, and this is the only part of the western area that these flakes were found. The flake axe was discovered in



Figure 44: Scraper and scraper rejuvenation flakes from the western part of Mohalsen-I

I15, where the main part of the hearth must have been located. The other activity area (from now referred to as area II) is on the southwestern side of the hearth. Several tools were found in relation to this area, such as flakes and blades with intentional retouch as well as projectile

points with traces of retooling. This is also the only area with scraper rejuvenation flakes, albeit slightly further towards the south and away from the hearth. Two scrapers were found in relation to this area. The main production of blanks and tools must have taken place in area II, as the highest concentration of artefacts and both micro and medio debitage was discovered there. Flakes with unintentional retouch were also found in this area.

The main tool from refit W1 was discovered in area II while the two other parts were discovered in area I. It is possible that the tool was produced in area II, as most of the micro and medio flakes of quartz crystal were found in this area. The only core of this raw material was located near the northern edge of the excavation area, however, as were most of the other tools produced from quartz crystal. The tool could then have been utilised in area I where a subsequent break occurred, before being transferred back to area II where it was discarded after being evaluated as being no longer useful.

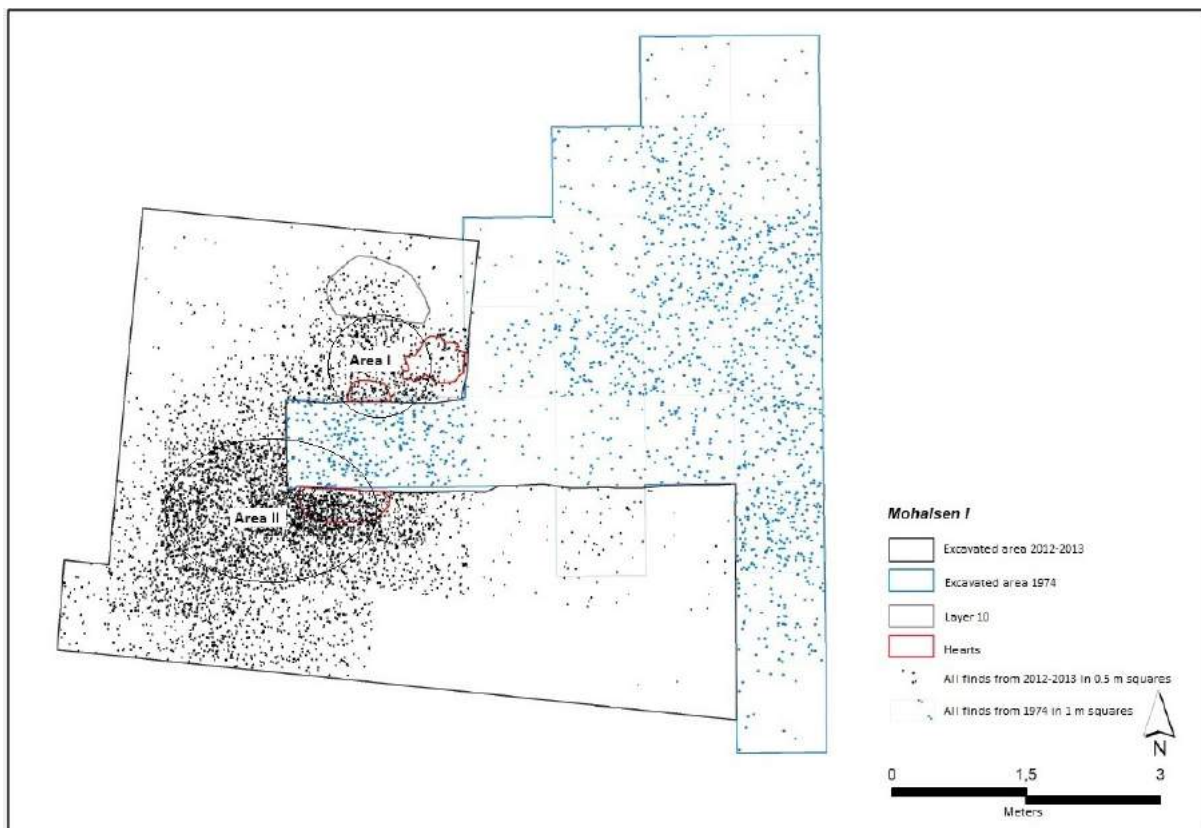


Figure 45: Overview, Area I and II West

Several different tools were found in I14 and I15. It is difficult to say what area these tools belong to as the size of the quadrant makes the pinpointing of artefacts difficult. These quadrants contain the only burins and burin spall on the western part of the site. Seeing the 1974 assemblage was analysed by Callanan in 2007, several multitools and knives are also

found in these quadrants. The burin spall could not be refitted to any of the burins, thus indicating one burin being produced on the western part and possibly two or three brought there from another site and then abandoned.

The distribution of heat-affected artefacts on the western part indicate a movement on the site from southwest to northeast, straight across the hearth Layer 8, with the main quantity of heat affected artefacts towards the southwest. This might indicate movement on the site after removing a possible tent, as this dispersal is different from the distribution of the main assemblage.

The pit Layer 10 and the deposition of ochre are both outside the initial circle, on opposite sides of each other in the area excavated during 2012-2013. The pit Layer 10 is an intended dig out on the site, undertaken by those who lived there 10 000 years ago. The reason for it is not clear, and the only tools discovered in it were the largest knapping stone and a flake with unintentional retouch. The pit might have been constructed with the intention of being utilised for the processing or depositing of animal remains.

The ochre is also quite ambiguous, and the deposition of this could have had a cultural or religious meaning. The smaller knapping stone was discovered close to the spot where the ochre was deposited.

East. On the eastern side both the hearth and the two micro and medio debitage clusters were outside the possible tent. The distribution of tools does not reveal any clear areas, however, the tool rejuvenation debitage provides more information. Two areas can be identified in the eastern part as well. Area I is in close proximity to the hearth recognised during the excavation in 1974, and therefore distributed in the same area as the heat-affected artefacts and micro and medio debitage discovered there. The axe, scraper rejuvenation flakes and burin spalls discovered in this area were found in the two different layers. Area II contains one axe rejuvenation flake as well as burin spalls, all discovered in Layer 2. The artefacts were discovered in K10, and had the same distribution as the heat-affected artefacts, as well as the micro and medio debitage discovered there. This supports the earlier interpretation regarding the hearth being close to the excavated area. The artefacts reveal that the same type of production and utilisation of the artefacts took place in the two areas.

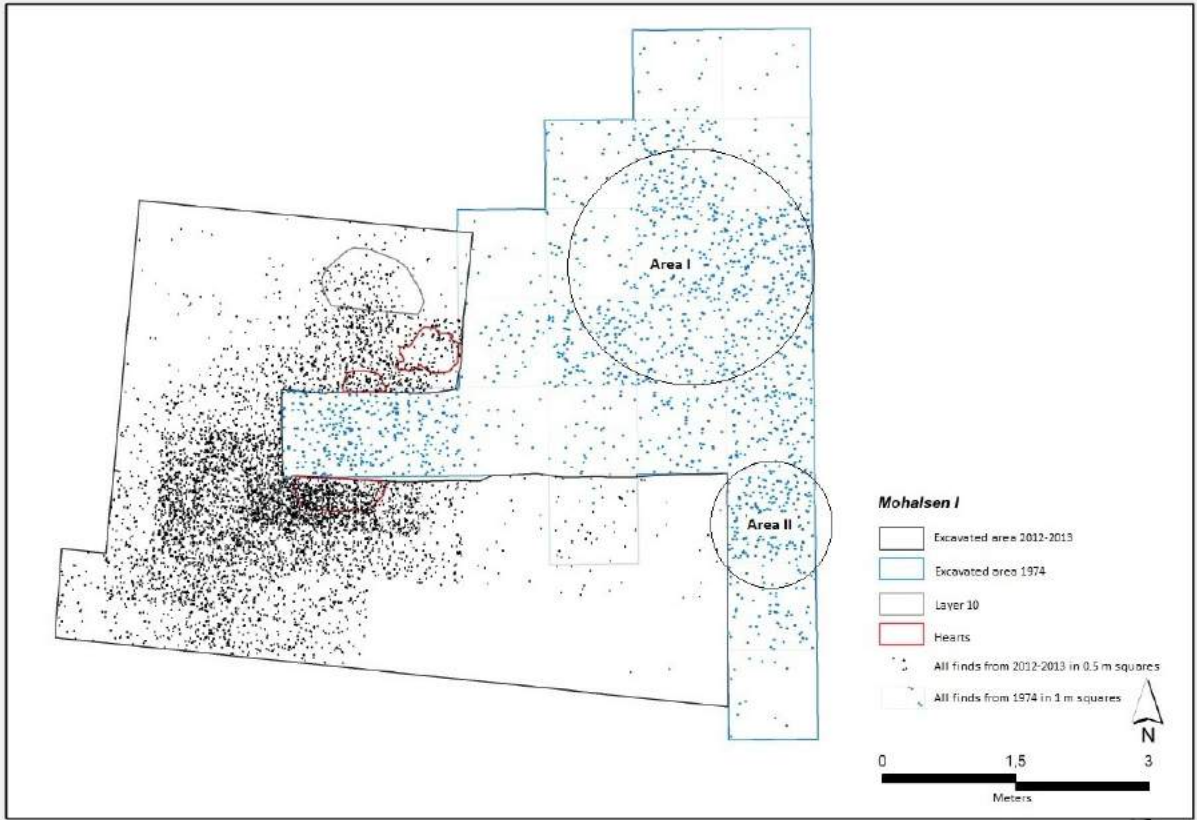


Figure 46: Overview, Area I and II East

7 Conclusion and further research

Through this analysis I have tried to obtain an in-depth understanding of the activities conducted on the site Mohalsen-I more than 10 000 years ago. My focus has been to discover what a *chaîne opératoire* analysis of the EM site Mohalsen-I could reveal with regards to the utilisation of the site on both a “macro” and “micro” level.

To understand the utilisation of Mohalsen-I, I subdivided my initial research question into five segments which I will address in the following conclusion. I will start by providing the context and the possible operational *chaîne* of the location of the site itself, before I continue with addressing the research questions that are related to each other and answering them based on the results from my analyses.

7.1 A *chaîne opératoire* approach to Mohalsen-I - conclusion

The first visited location where inhabitancy occurred on Vega, might have been at Mohalsen-I. The area was more than likely selected due to its natural and favourable harbour (e.g. Bjerck 1989, 1990, harbour C). If the site was visited on several occasions, perhaps it was due to the recognition of earlier settlements in the landscape (e.g. Fretheim et al., 2016), or a combined mixture of these elements. The site was perhaps chosen due to the condition of the main land still being affected by the ice age, though it was most likely chosen due to the fact that it was situated in a highly productive coastal zone (Breivik, 2014; Breivik & Callanan, 2016; Svendsen, 2007). The projectile points indicate a high frequency of hunting, probably of marine species. The site was partially protected by the mountains behind it, while some small reefs acted as wave breakers along the coast. However, the site was still heavily affected by wind (Bjerck, 2008c; Lorentzen, 2013, 2014). This might have had an impact on the individual's choice of how and where they would have constructed shelter. If the site was visited several times, then tent stones could have been reused multiple times (e.g. Bjerck, 2008a).

I will answer the following research questions below, I will address them together as a whole as they relate to the same subject:

- ✓ *What kind of technology is applied to the material on Mohalsen-I?*
- ✓ *Is the technology different from other sites in Early Mesolithic Norway?*
- ✓ *How can the site be understood in relation to other sites in Norway, Scandinavia and northern Europe in the Early Mesolithic period?*

- ✓ *Are the two initially visible activity areas on Mohalsen-I related to each other?*
- ✓ *Are the different layers and hearths found during the excavations a sign of several visits to Mohalsen-I?*

The people visiting Mohalsen-I were highly adapted to a marine lifestyle, utilising seafaring vessels. Their technology, a direct soft percussion technique similar to the technology recognised in the so called Fosna/Komsa/Hensbacka and even Ahrensburgian areas, was taught and passed on through generations, and was adapted to different types of raw materials. It is possible that the continuation of the same technology through thousands of years had social and religious implications and associations to the European continent (e.g. Fuglestad, 2005, 2012), or perhaps it was tested and found to be useful in regard to the marine lifestyle as well as for hunting land mammals such as reindeer in the mountains. Perhaps this was the reason for the continuation of the utilisation of this technology (Breivik & Callanan, 2016). It could have been that social and religious expression was performed on organic material, and that this was also carried on through thousands of years (e.g. Zangrando et al., 2016). The ochre discovered at the site could be viewed in this context.

Where these people originated from, and where they travelled to, is not subsequently revealed in the material. However, the chert indicates contact or travel all the way to Alta (Spjelkavik, 2016), and the MANA analysis and projectile point analysis indicates that the site was part of a larger network where artefacts and raw materials were brought forth and back. It is more than likely that, based on the refitting and the horizontal analysis, Mohalsen-I was visited at least two times, perhaps even by the same group, if not by the same individuals. The technological analysis indicates that the knappers had a somewhat different bodily gesture during the percussion from the eastern to the western part of the site, indicating a different set of people. The exhaustion of the cores, as well as the cortex on projectile points indicates scarcity in the most sought after raw materials.

Below I will answer the following coherent research questions:

- ✓ *If the settlement can be considered clean, in terms of no mixture of later occupation, and relatively short-lived, how can refitting highlight the activities on the site?*

- ✓ *Can the analysis reveal what type of site Mohalsen-I was (e.g. butchering site, hunting station, summer or winter camp, and so forth) (Binford, 1990; Bjerck, 1990)?*

The stay on Mohalsen-I was short, perhaps a few days or a week, thus joining the ranks of other EM settlements in Norway. The people that visited the place arrived, cleaned the area slightly, made a hearth, perhaps erected a tent, and produced artefacts such as blanks and tools. They retooled their arrows, went hunting, returned (or perhaps they brought the game with them when they arrived in the first place) and prepared their meal. It is then likely that they also butchered the animals at the site, and that an extended excavation in the area could have revealed a butchering spot. The pit Layer 10 could be viewed in connection to the handling of animal remains and the processing of food. Based on the presence of a large number of different tools it is likely that Mohalsen-I represents a “base” where perhaps the whole (family) group came and stayed. The tools indicate that a range of activities have taken place at the site, and that the site was a multipurpose residential site as opposed to a butchering site for example. The large hearth Layer 8 on the western part does also indicate that the stay was longer and represented something more than a very short visit for hunting or butchering. The fact that there are layers also “inside” the possible tent might indicate a somewhat open type of shelter, or that the people living there always re-erected their tent whenever they left the island, even if it was only for a few hours. They might have done this on the presumption that they never knew whether they would be coming back.

The site revealed two activity zones on both parts of Mohalsen-I. On the western part the main quantity of work was conducted in area II, south of hearth Layer 8, while retooling of projectile points and perhaps production and utilisation of flakes axes was conducted in area I, north of hearth Layer 8. If the flake axes were used to treat hide, then perhaps area I was the main area allocated to the treatment of meat soon after the butchering occurred prior to being brought inside the tent area. The pit Layer 10 was just north of area I.

A tool made from quartz crystal was perhaps produced in area I on Mohalsen-I, West. It was utilised there, before it broke in area II. Perhaps it was a favoured tool, as it appears that it was taken back to area I again and then perhaps tested and found to be useless before it was discarded.

The two activity areas on the eastern part of Mohalsen-I depicted similar activities. They may belong to two independent hearths and even two independent visits.

The last research question to be answered is:

- ✓ *How have the different excavation methods affected the possibility of an analysis of the site?*

The two methods of excavation have had an impact on the analyses. The thorough excavation conducted in 2012-2013 has led to a greater understanding of the utilisation of the site, more so than the less thorough excavation conducted in 1974. It is evident that excavation method and the method of gathering the material and other information has a great impact on the possibilities of conducting later analyses. The fact that Mohalsen-I is excavated in two different ways has generated some challenges towards understanding the relationship between the two visits. This highlights the importance of the methods utilised in the future excavations of stone age sites, this will be presented in the next chapter.

7.2 Future research

The *chaîne opératoire* approach is a well-developed analytical tool that can reveal hidden secrets about a site. It is useful in gaining an understanding of the utilisation of a site, and can also be used to conduct a comparative analysis between sites in order to understand the differences and similarities between them, for example between a coastal and a mountain site or two similar sites in the same type of landscape. It is possible that the utilisation of the *chaîne opératoire* approach could generate new understanding and insight into the similarities and differences involving the utilisation of sites along the Norwegian archipelago in the EM and the archipelago in Tierra del Fuego. To be able to utilise this analytical tool further, it is necessary to treat the sites accordingly and to extract as much information as possible during the excavation phase.

7.2.1 Excavation method

As the two different periods of excavation on Mohalsen-I have revealed, a *chaîne opératoire* analysis is dependent on a well-executed excavation conducted utilising Single Context Recording in conjunction with quadrants measuring no more than $\frac{1}{4}$ m². It is essential for such an analysis that the artefacts can be traced back to the exact area and layer where they were first discovered, or else important information will be lost. The knowledge regarding the

existence of different types of raw material is essential during excavation, as is the recognition of structures, both latent and evident.

7.2.1 Chaîne opératoire *combined with other analytical methods*

As already seen from Spjelkavik's master thesis a *chaîne opératoire* analysis combined with an analysis of raw material procurement can provide considerable insight into the utilisation of the landscape and seascape in the EM. A *chaîne opératoire* analysis combined with a MANA analysis has the potential to reveal a larger picture regarding Stone Age sites and their relationship to each other. With more sites excavated, the possibilities generated by such a combination are substantial if the inventory of the sites is gathered in the same manner that provides satisfying control and information regarding the layers, and the artefacts position in relation to layers, quadrants and structures.

Knowledge towards both knapping techniques as well as macro and micro wear traces on different tools can also help towards obtaining an understanding of what type of activities have been conducted on a site, and could perhaps in the future provide more information as to what types of materials the different tools were used on.

The possibility of obtaining an even deeper understanding of the people that utilised the sites thousands of years ago is considerable if all the parameters regarding the excavation method, experiments and other analyses are maintained, and the primary focus is to achieve as much information as possible.

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Personal communication

Birgitte Skar, first amanuensis, Norges teknisk-naturvitenskapelige universitet

Morten Kutschera , archaeologist and course holder of the flint knapper course

Appendix A – Mohalsen-I Inventory – morphological overview

Type	Artefact	Found 2012	Found 2013	Sum 12/13	Found 1974	Note
Flakes	Macroflake	23	12	35	18	
	Medioflake	1460	1209	2669	835	
	Microflake	1017	791	1808	489	
Blades	Macroblade	26	16	42	49	
	Medioblade	27	20	47	52	
	Mikroblade	29	33	62	62	Several are chippings
	Cortexblade	11	9	20	1	
	Bladelets	19	12	31	50	
	Hinged blade	9	13	22	6	
	Crested blade	5	10	15	4	
	Cores/core preparation	Bipolar core	3	7	10	16
	Indefinite core	2		2		
	Indefinite core with one platform	4	1	5		
	Indefinite core with several platforms	1	2	3	3	
	Onesided core with several platforms				2	
	Diskos shaped core				1	
	Preparation for core	1	2	3		
	Bipolar core fragment	6	2	8	8	
	Platform core fragment	1	1	2		
	Indefinite core fragment		2	2	4	
	Platform flake	5		5	6	7 before refitting
	Wingshaped platform flake		2	2		
	Front rejuvenation flake	3	1	4	1	
Points/microliths	Single edged projectile point	11	7	17	10	
	Tanged projectile point	5		5	4	
	Tanged projectile point with point in proximal	1		1		
	Oblique projectile point (skjevegget)	1		1		
	Oblique projectile point (skjev tverregget)		1	1		
	Projectile point fragment		5	5		
	Projectile point preparation		4	4	1	Originally cataloged as macroblade
	Unspecified projectile point		2	2	1	
		Oblique microlith	1		1	

Other tools/tool production	Scraper edge rejuvenation		3	3	1	
	Indefinite scraper fragment		1	1		
	Axe production rejuvenation flake	4		4		
	Axe edge rejuvenation	2		2	3	
	Scraper	2		2	4	3 from Callanan 2007
	Backed flake	9	2	11	10	
	Backed blade	5	1	6	4	
	Flake with use wear	15	4	19	18	
	Bladeknife	2	2	4	24	23 from Callanan 2007
	Angle burin				2	
	Medial burin				1	
	Core burin				1	
	Burin like Callanan 2007				8	
	Burin spall				11	2 was originally cataloged as bladelike flakes
	Multitool Callanan 2007				4	
	Microburin/edge rejuvenation				4	
	Mohalsen group Callanan 2007				1	
	Needle/piercer Callanan 2007				1	
	Knapping stone		2	2		
	Fragment	9		9	29	
	Knoll	1		1		
	Unworked raw material	20		20		
	Sum	2740	2179	4918	1749	

Appendix B – Condition of the proximal part of blades

Condition of Proximal end West		%
Bulb	35	20.71
Bulb; scar	2	1.18
Blub; lip	29	17.15
Bulb; pronounced lip	3	1.77
Bulb; cleaving/fracture	11	6.5
Blub; butt striken off	2	1.18
Bulb; lip; scar	2	1.18
Bulb; lip; cleaving/fracture	2	1.18
Bulb; splitcone fracture	5	2.9
Bulb; lip; splitcone fracture	4	2.36
Bulb; ripples	1	0.59
Butt striken off	1	0.59
Butt striken off; cleaving/ fracture	1	0.59
Cleaving/fracture	5	2.9
Esquillement du bulbe	22	13.01
Esquillement du bulbe; lip	14	8.28
Esquillement du bulbe; crushed butt	2	1.18
Lip	2	1.18
Lip; cleaving/fracture	1	0.59
Double bulb; splitcone fracture	1	0.59
Double bulb; lip; splitcone fracture	4	2.36
Double bulb; scar	3	1.77
Double bulb; lip	1	0.59
Double bulb	2	1.18
No cone formation or bulb	14	8.28
Sum	169	100 %

Condition of Proximal end East		%
Bulb	15	14.42
Large bulb	2	1.92
Negative bulb	1	0.96
Blub; lip	14	13.46
Bulb; lip; scar	1	0.96
Bulb; lip; ripples	2	1.92
Bulb; cleaving/fracture	12	11.54
Blub; cleaving/fracture; ripples	1	0.96
Bulb; ripples	3	2.88
Bulb; lip; cleaving/fracture	4	3.85
Bulb; splitcone fracture	3	2.88
Bulb; lip; splitcone fracture	2	1.92
Bulb; butt striken off	1	0.96
Ripples	2	1.92
Butt striken off	2	1.92
Butt striken off; cleaving/ fracture	3	2.88
Cleaving/fracture	1	0.96
Esquillement du bulbe	15	14.42
Esquillement du bulbe; lip	5	4.81
Esquillement du bulbe; ripples	3	2.88
Esquillement du bulbe; butt striken off	1	0.96
Lip	1	0.96
Lip; cleaving/fracture	1	0.96
Lip; splitcone fracture	1	0.96
Double bulb; cleaving/ fracture	1	0.96
Double bulb; lip; ripples	1	0.96
Double bulb; esquillement du bulbe	1	0.96
Double bulb; lip	5	4.81
Sum	104	100 %

Appendix C – Condition of blades – all parameters

Blade shape West		%
Normal shape	176	78.22
Early outcome	10	4.44
Overtly curved	11	4.88
Normal to overtly curved	16	7.11
Normal to early outcome	12	5.33
Sum	225	100 %

Platform preparation West		%
Small dorsal trimming and/or abrasion	75	44.38
Trimming	39	23.08
Large trimming	2	1.18
Coarse trimming	5	2.96
No preparation	48	28.40
Sum	169	100 %

Cone formation West		%
None	83	49.11
Esquillement du bulbe	37	21.89
Bulb scar	7	4.14
Splitcone fracture on butt	1	0.59
Splitcone fracture on butt and ventral	8	4.73
Butt striken off	8	4.73
Cleaving/fracture	25	14.79
Sum	169	100 %

Blade shape East		%
Normal shape	97	74.61
Early outcome	8	6.15
Overtly curved	7	5.38
Normal to overtly curved	10	7.69
Normal to early outcome	8	6.15
Sum	130	100 %

Platform preparation East		%
Small dorsal trimming and/or abrasion	34	32.69
Trimming	42	40.38
Large trimming	4	3.85
Coarse trimming	2	1.92
No preparation	12	11.54
Unknown - butt striken off	10	9.61
Sum	104	100 %

Cone formation East		%
None	45	43.27
Esquillement du bulbe	22	21.15
Bulb scar	1	0.96
Splitcone fracture on butt and ventral	6	5.77
Butt striken off	7	6.73
Cleaving/fracture	23	22.11
Sum	104	100 %

Bulb formation West		%
Prominent	2	1.18
Bulb	132	78.11
None	24	14.20
Double	6	3.55
Striken off	5	2.96
Sum	169	100 %

Bulb formation East		%
Prominent	1	0.96
Bulb	81	77.88
None	10	9.61
Double	8	7.69
Negative	1	0.96
Striken off	3	2.88
Sum	104	100 %

Butt West		%
Two facets	7	4.14
Point/shattered	59	34.91
Striken off	14	8.28
Wide, narrow	19	11.24
Large	33	19.53
Small, broad	25	14.79
Small, narrow	12	7.1
Sum	169	100 %

Butt East		%
Long and narrow	1	0.96
Point/shattered	31	29.81
Striken off	18	17.31
Wide, narrow	23	22.11
Large	15	14.42
Small, broad	8	7.69
Small, narrow	8	7.69
Sum	104	100 %

Lip formation West		%
None	101	59.76
Lip	62	36.68
Pronounced lip	6	3.55
Sum	169	100 %

Lip formation East		%
None	66	63.46
Lip	38	36.54
Sum	104	100 %

Appendix D – Cortex on flakes and fragments - flint

Amount of cortex east Layer 1	Flakes and fragments	% of cortex flakes and fragments	% of all flakes and fragments (260)
50% and over	62	50.81	23.84
Under 50% - focus to remove cortex	39	31.69	15
Under 10% - no focus to remove cortex	21	17.21	8.07
Sum	122	100	46.92

Amount of cortex east Layer 2	Flakes and fragments	% of cortex flakes and fragments	% of all flakes and fragments (385)
50% and over	60	55.04	15.58
Under 50% - focus to remove cortex	33	30.27	8.57
Under 10% - no focus to remove cortex	16	14.67	4.15
Sum	109	100	28.31

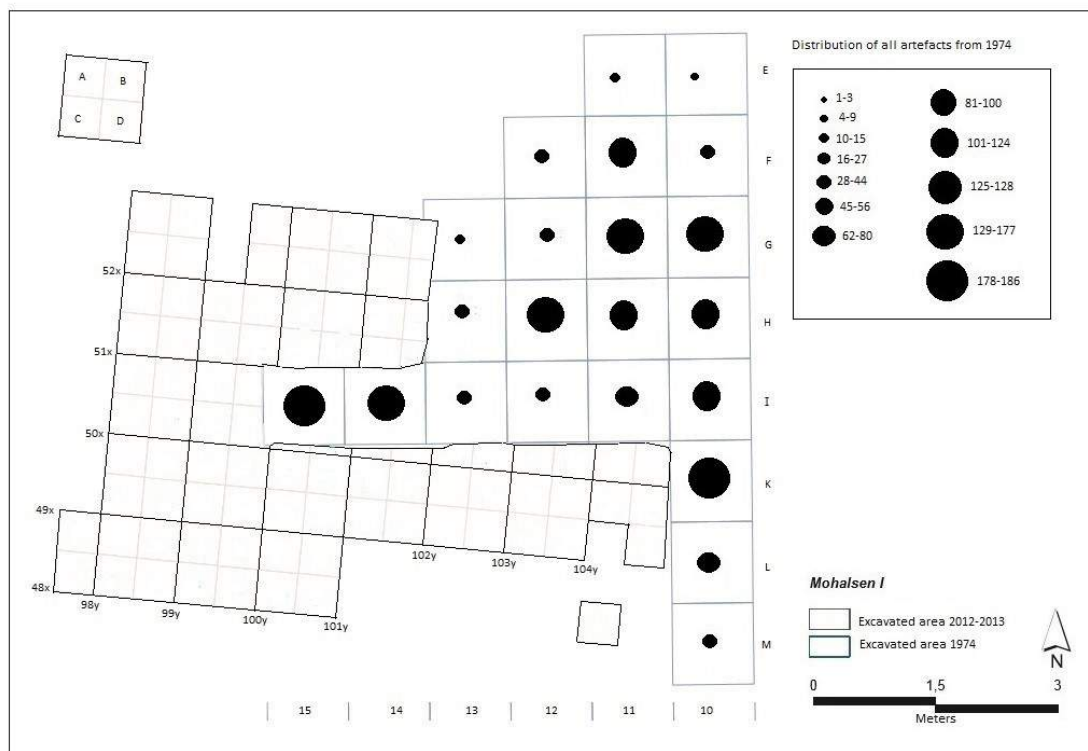
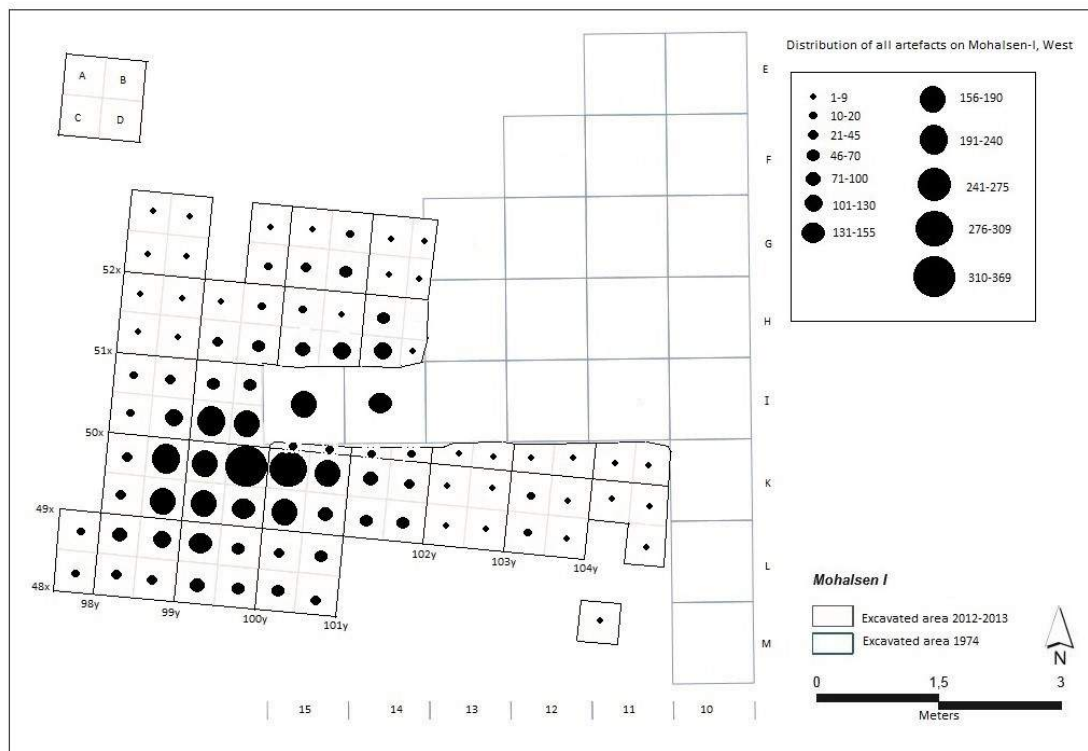
Amount of cortex west	Flakes	% of cortex flakes	% of all flakes (2085)
50% and over	291	47.16	13.95
Under 50% - focus to remove cortex	236	38.24	11.31
Under 20% - no focus to remove cortex	123	19.35	5.89
Sum	617	100	29.59

Appendix D – Cortex on flakes and fragments - flint

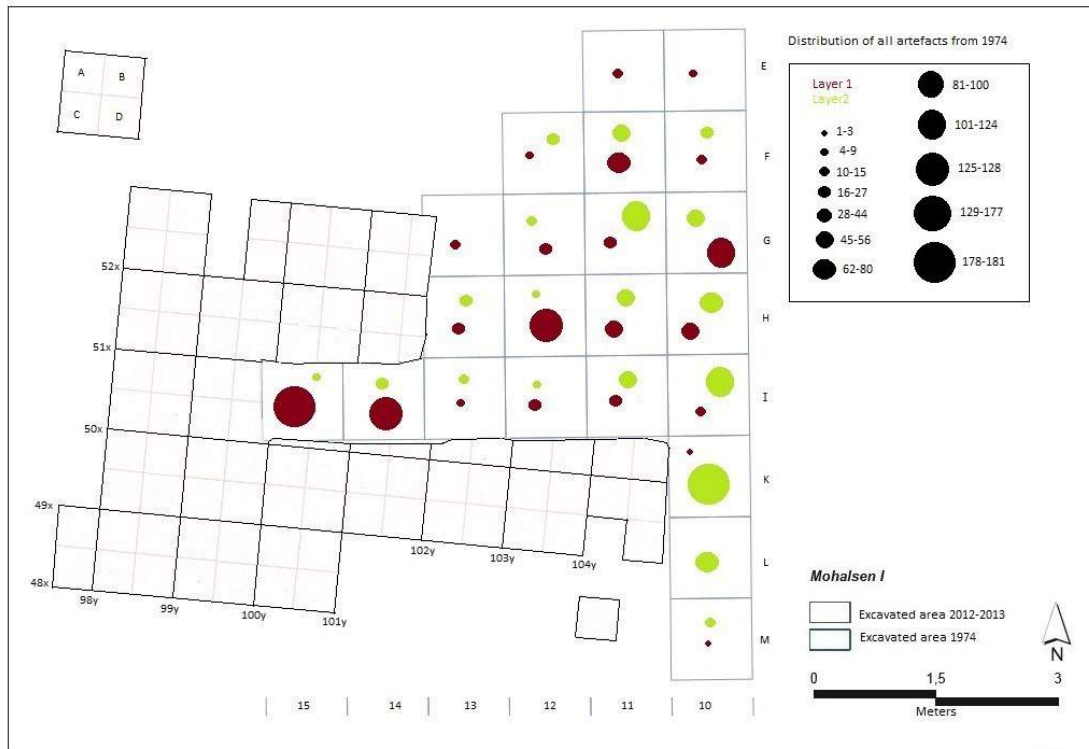
Appendix E - Map showing the distribution of all artefacts

Area/layer	Amount of flakes	Heat affected flakes	% of all flakes
West	2085	103	4.94
East Layer 1	260	45	17.30
East Layer 2	385	15	3.89

Appendix F – Map showing the distribution of all artefacts

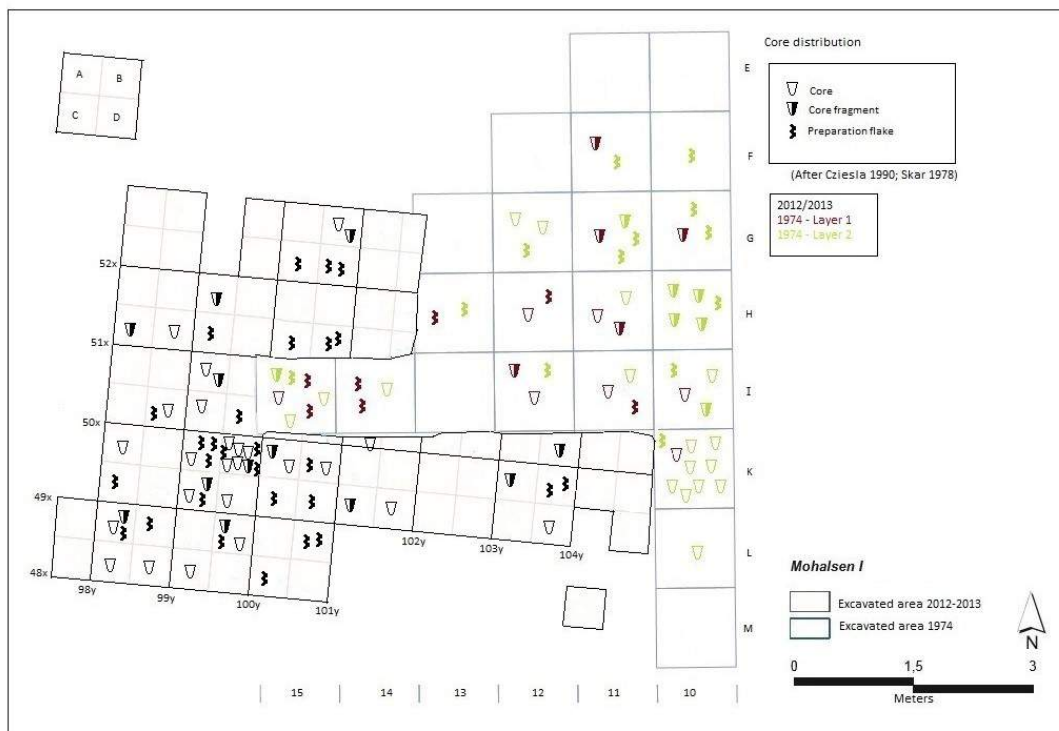
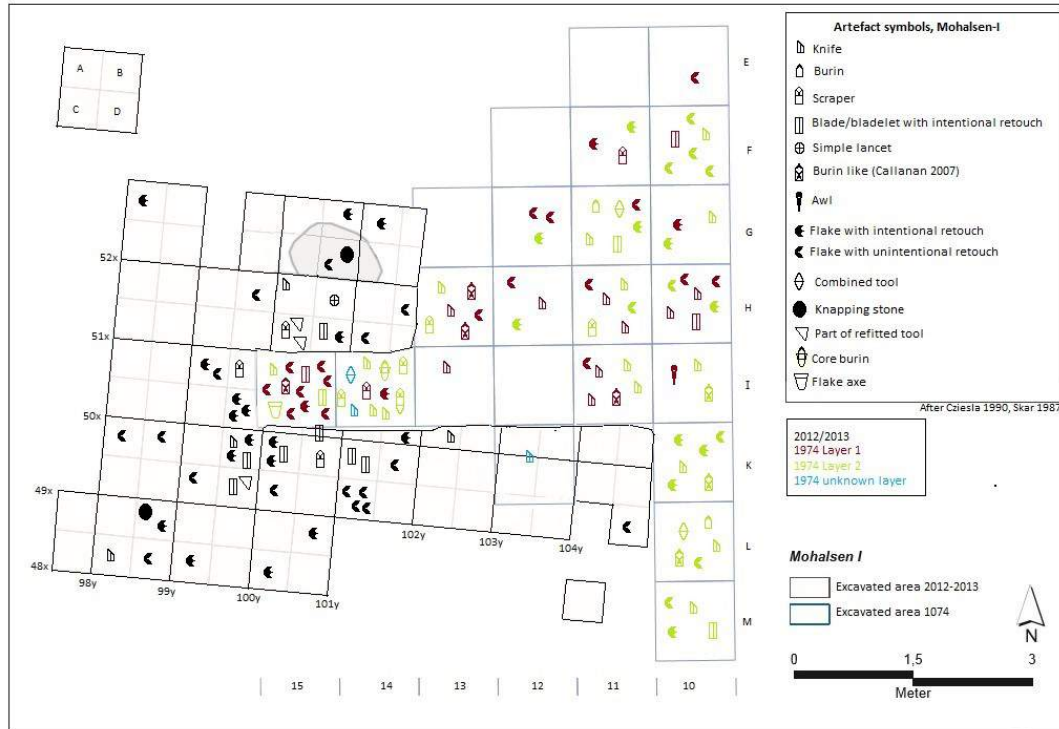


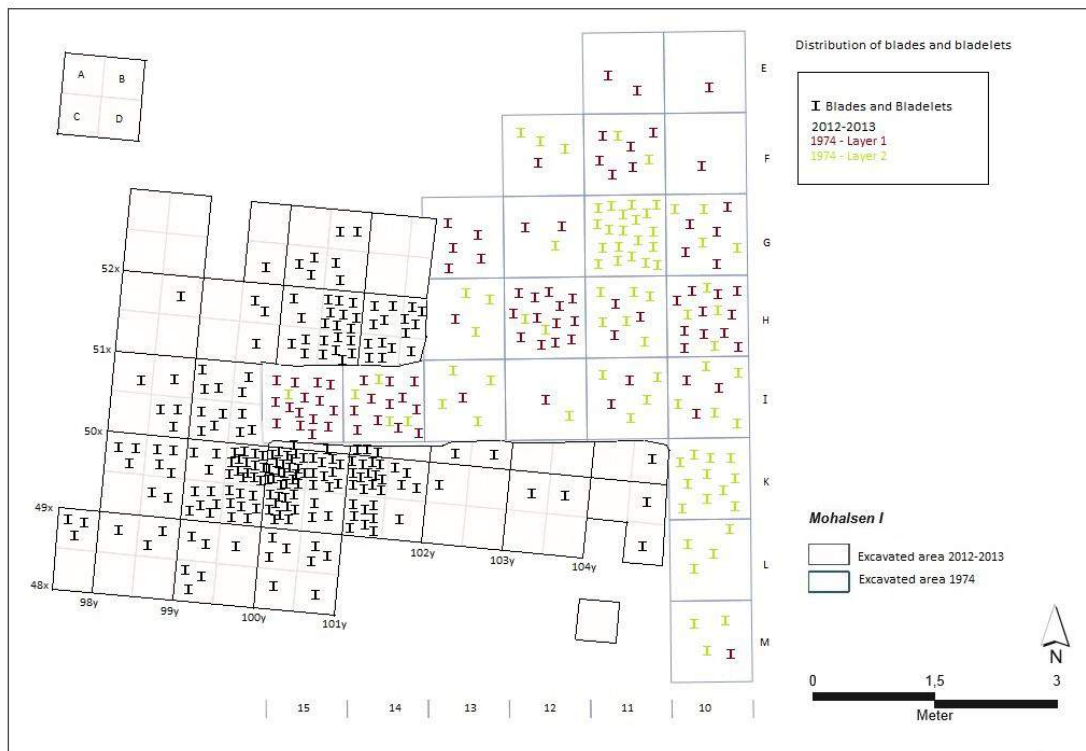
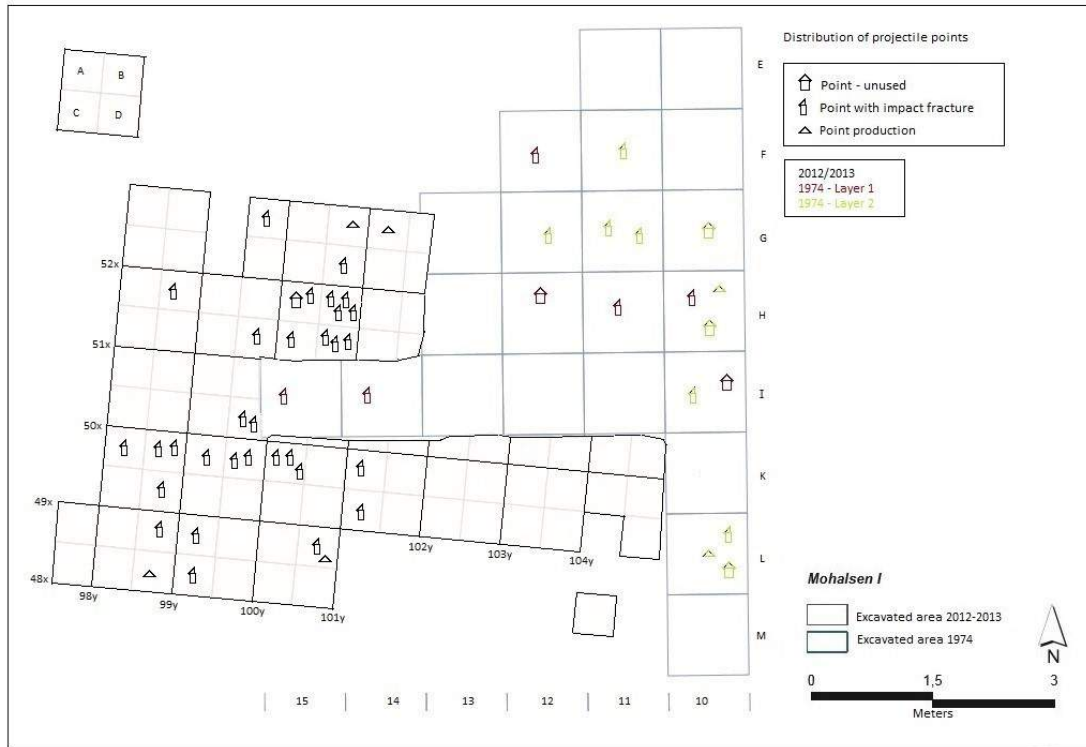
Appendix F – Map showing the distribution of all artefacts



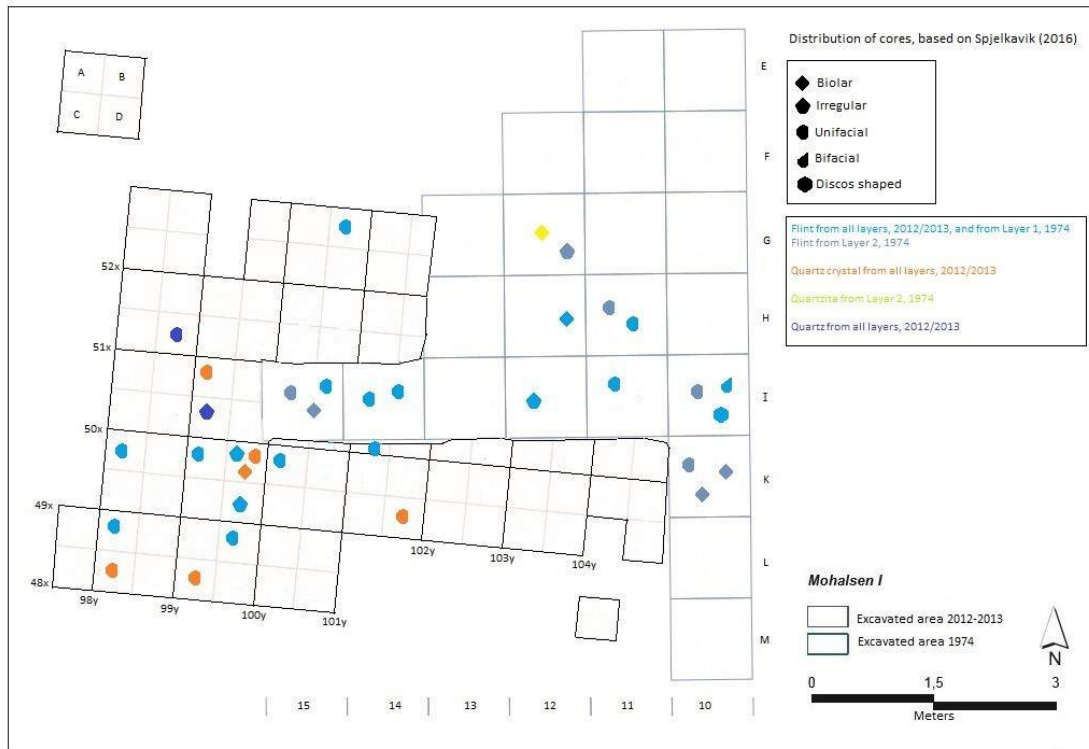
Appendix F – Map showing the distribution of all artefacts

Appendix G – Map showing distribution of tools, blades and rejuvenation flakes



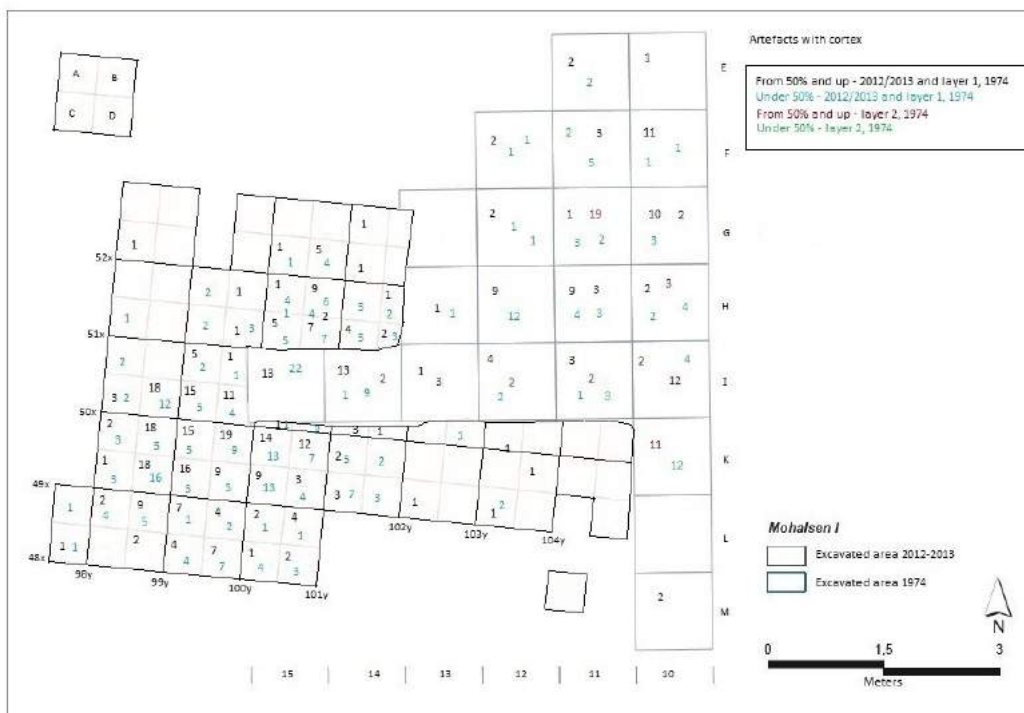
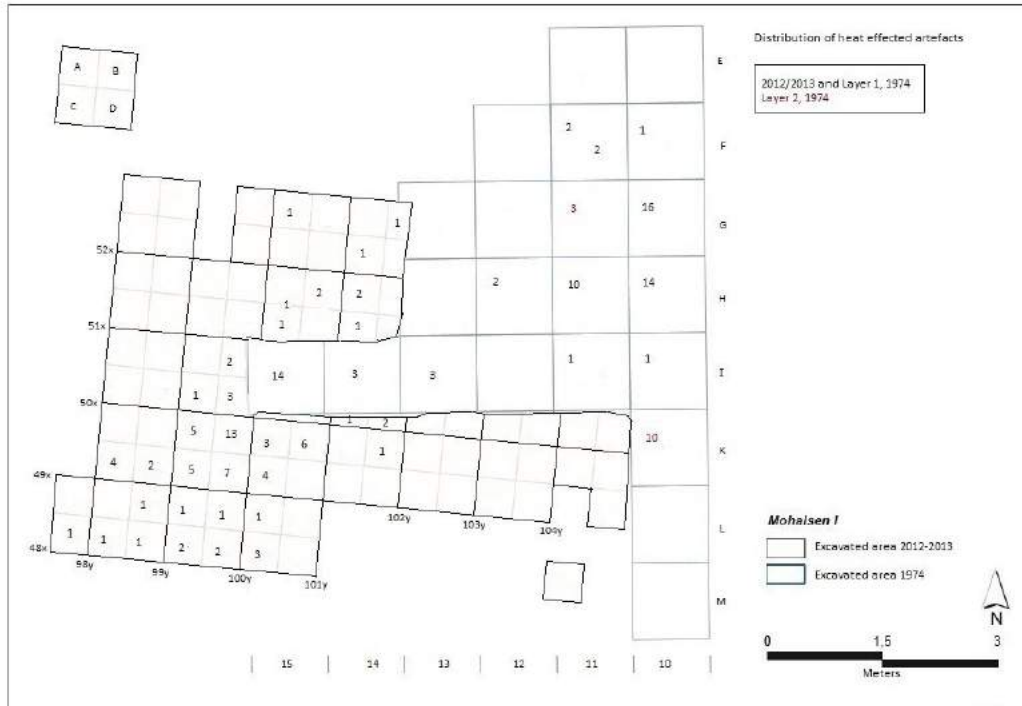


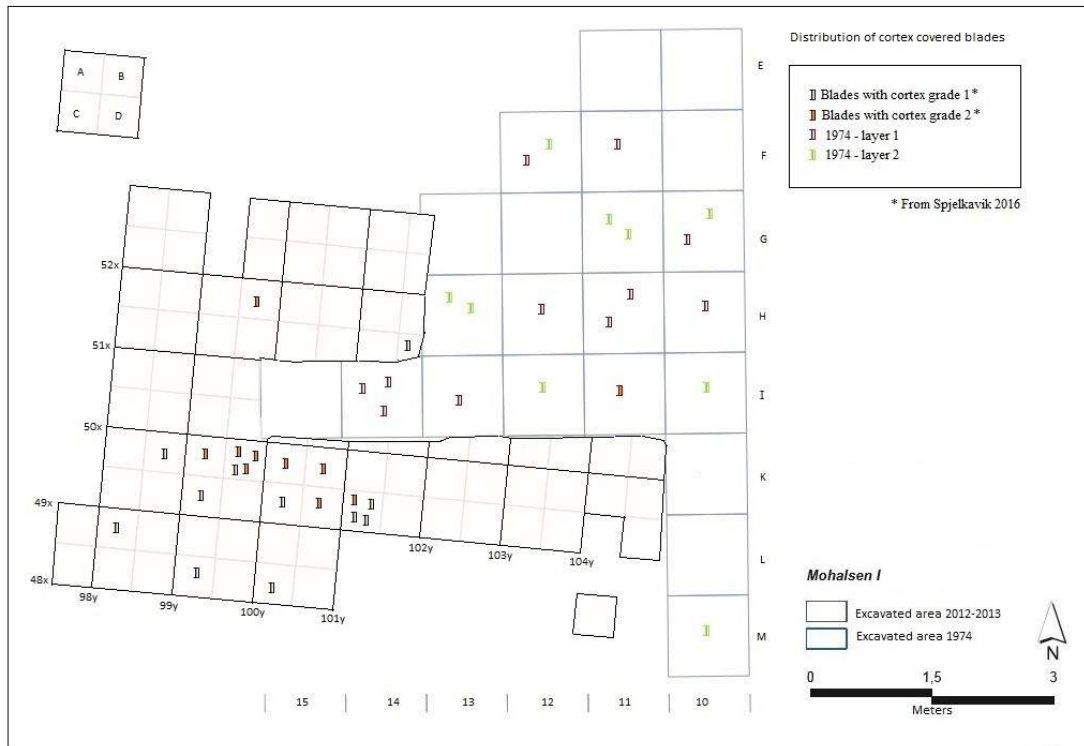
Appendix G – Map showing distribution of tools, blades and rejuvenation flakes



Appendix G – Map showing distribution of tools, blades and rejuvenation flakes

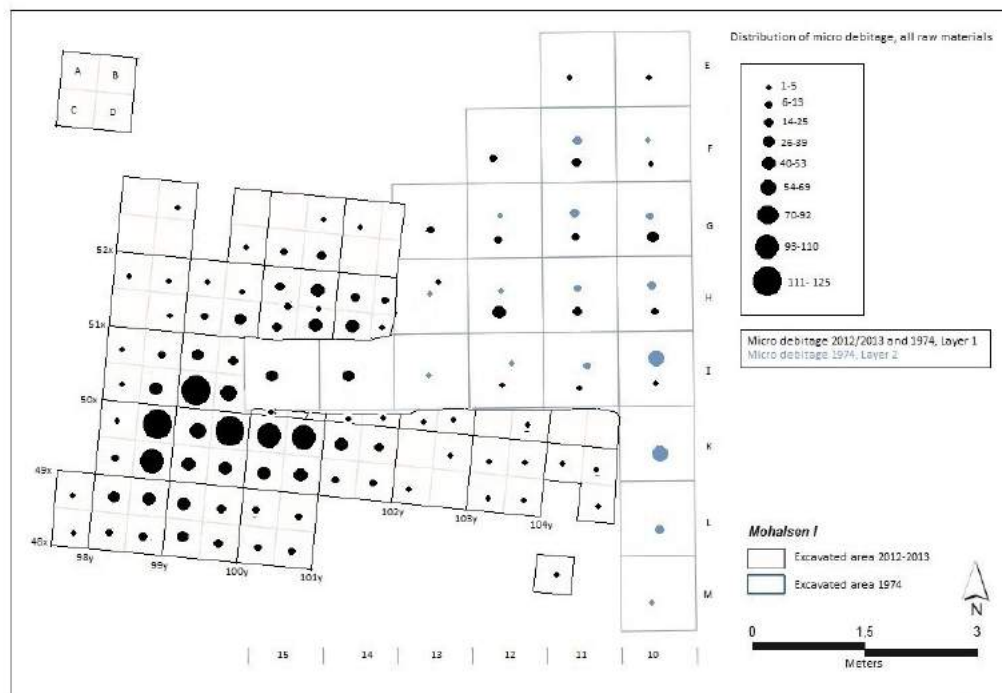
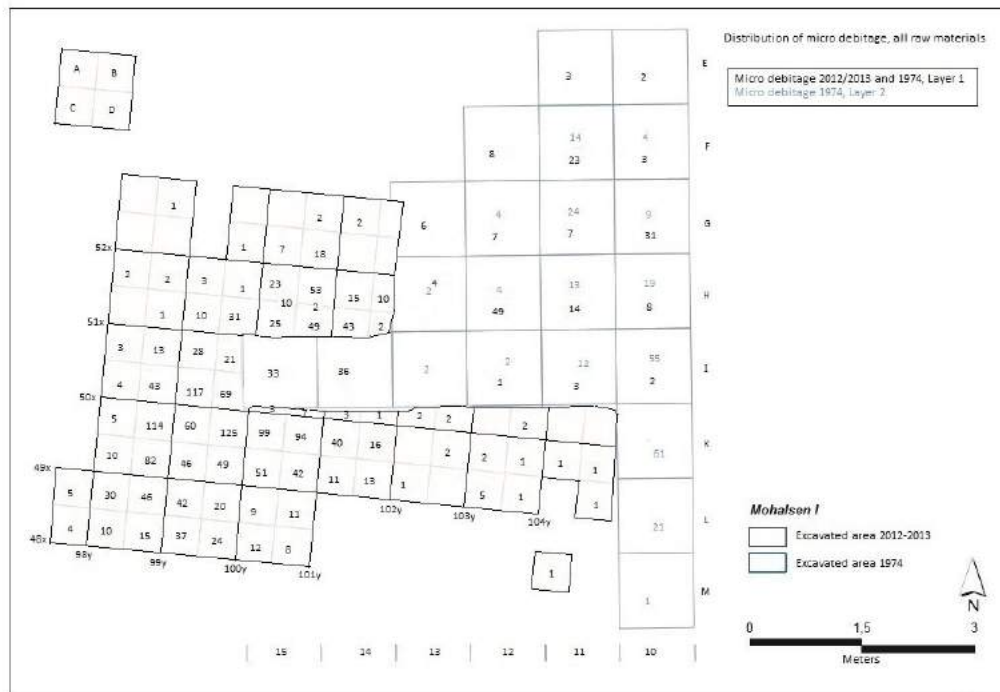
Appendix H – Map showing distribution of cortex covered and heat effected artefacts – flint



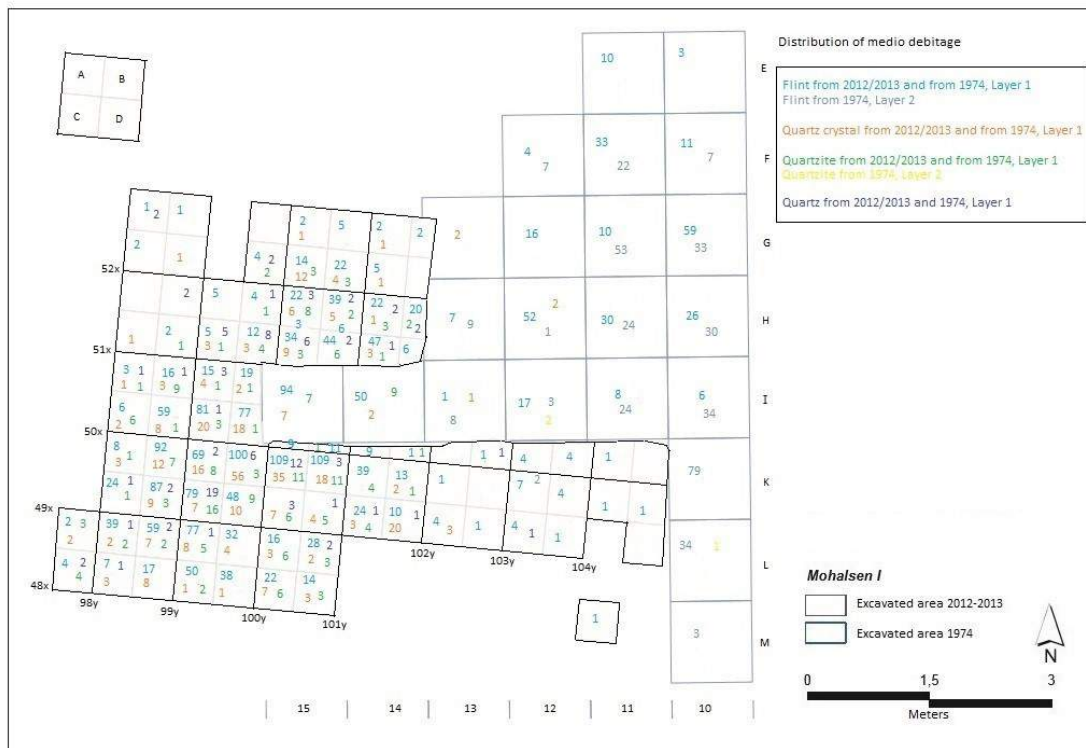
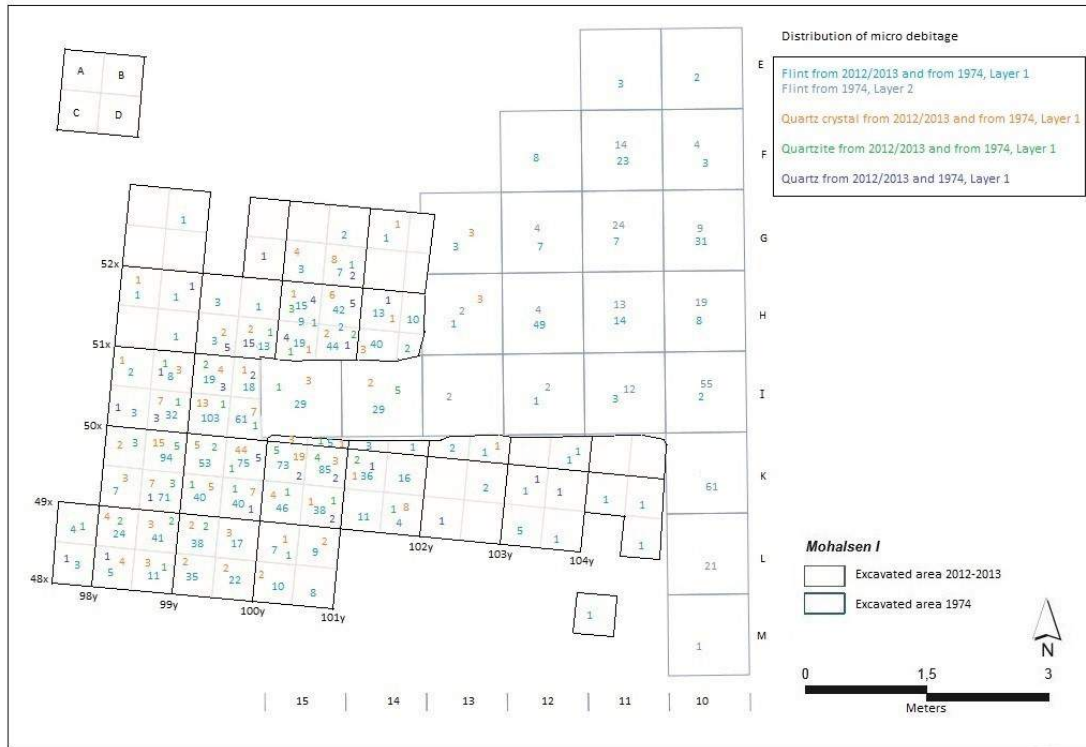


Appendix H – Map showing distribution of cortex covered and heat effected artefacts – flint

Appendix I – Map showing distribution of micro, medio and macro flakes

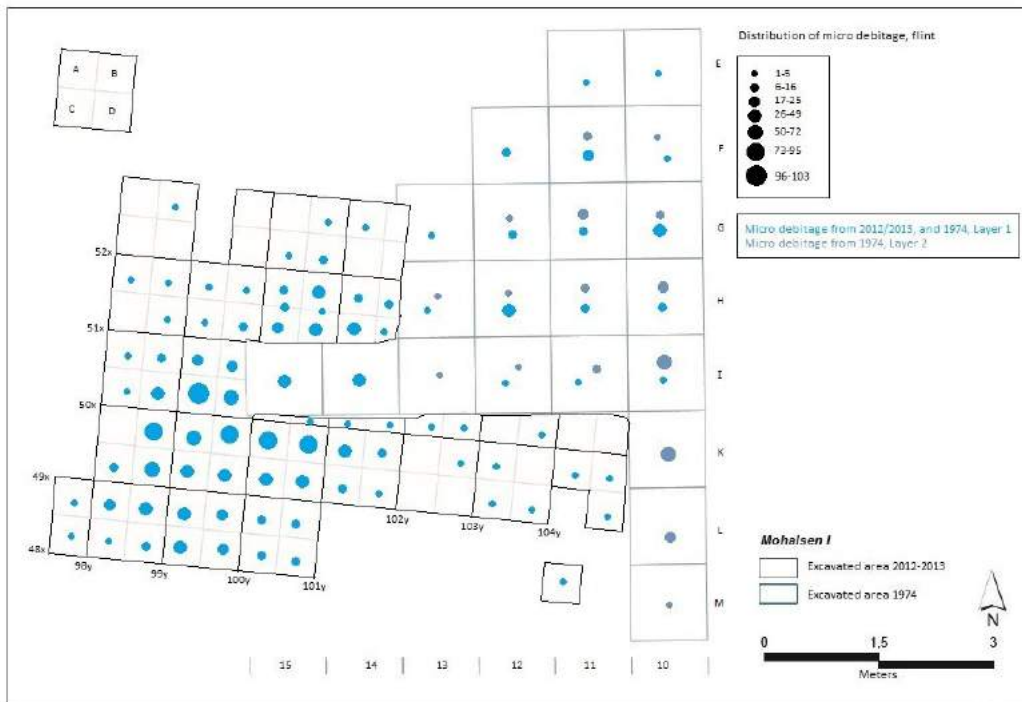


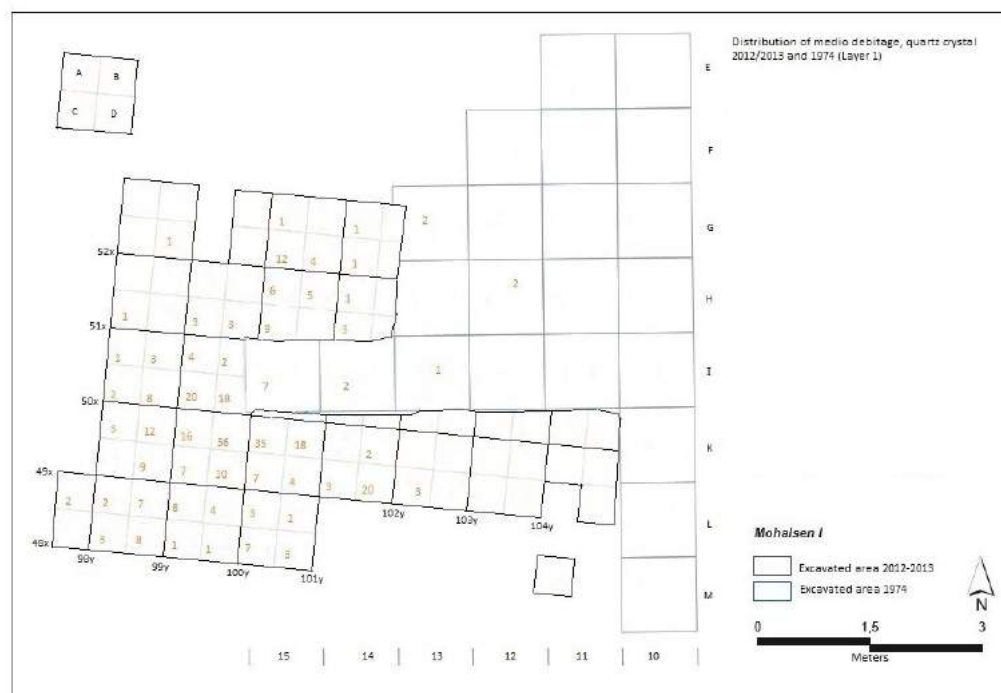
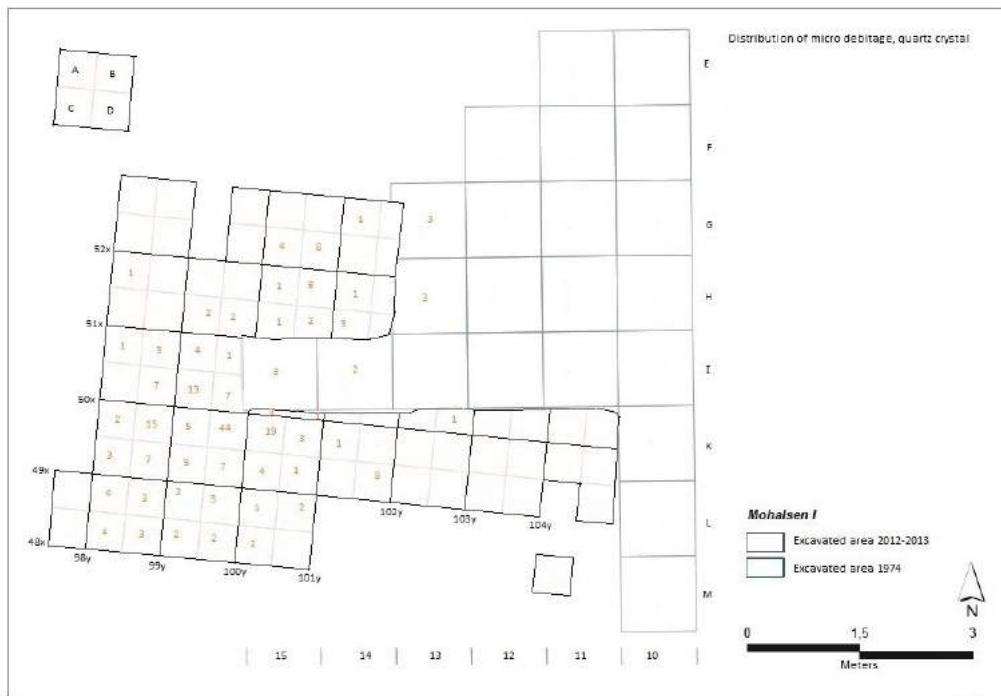
Appendix I – Map showing distribution of micro, medio and macro flakes



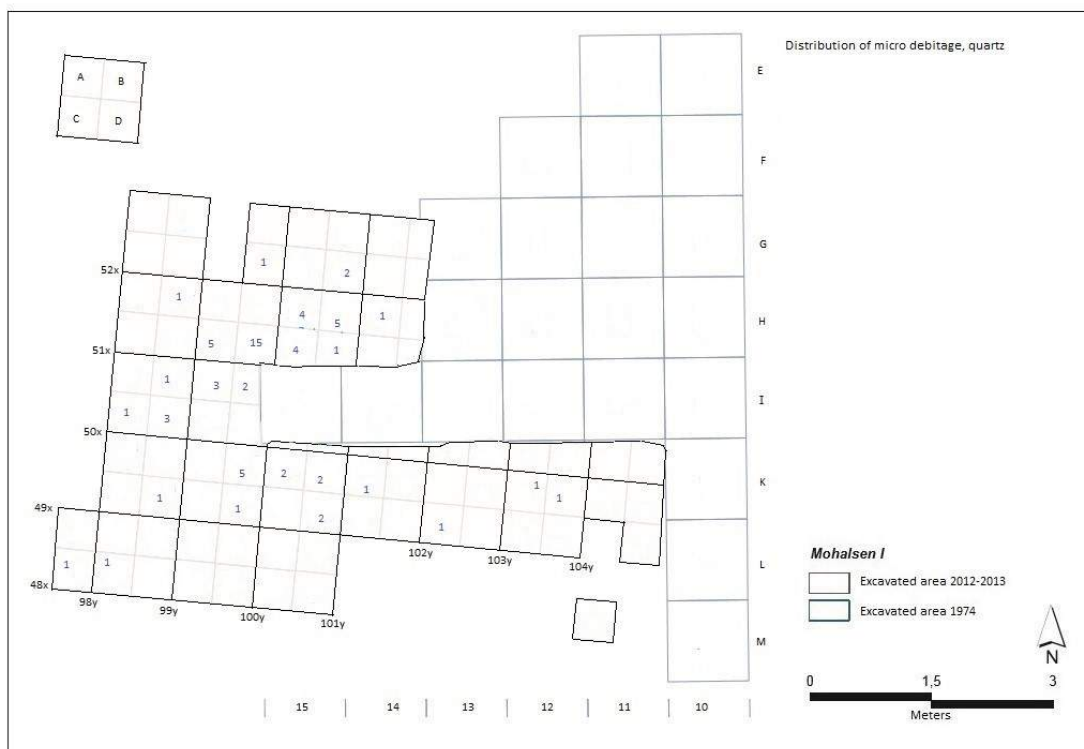
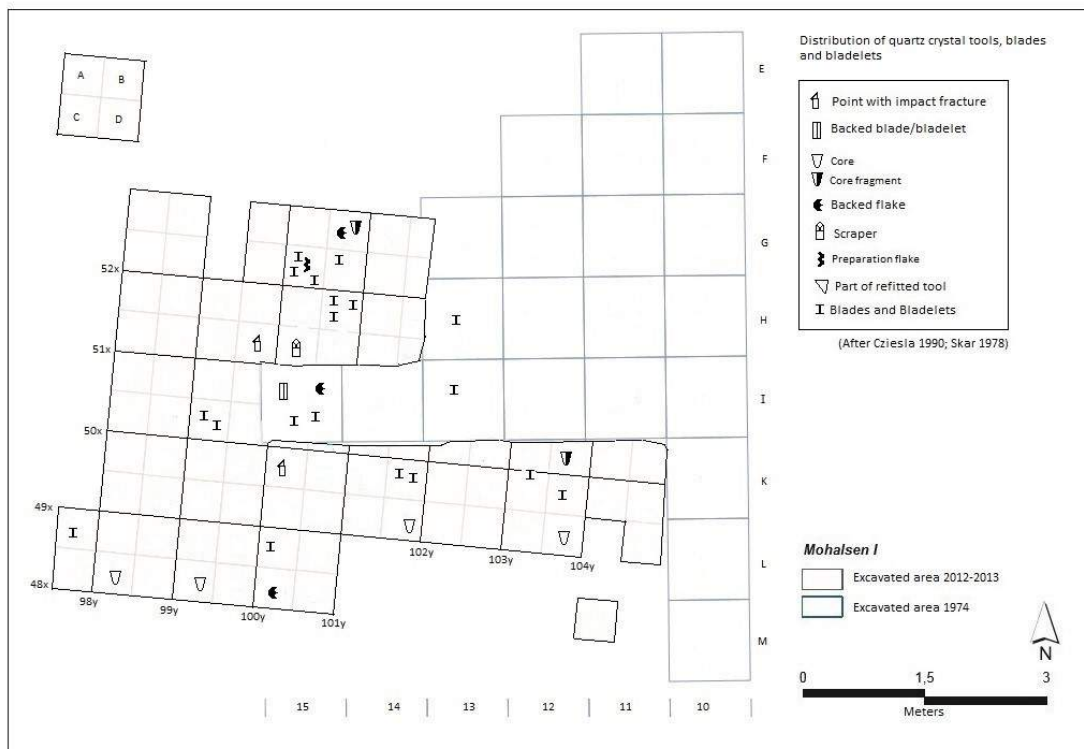
Appendix I – Map showing distribution of micro, medio and macro flakes

Appendix J – Map showing the distribution of the different raw materials

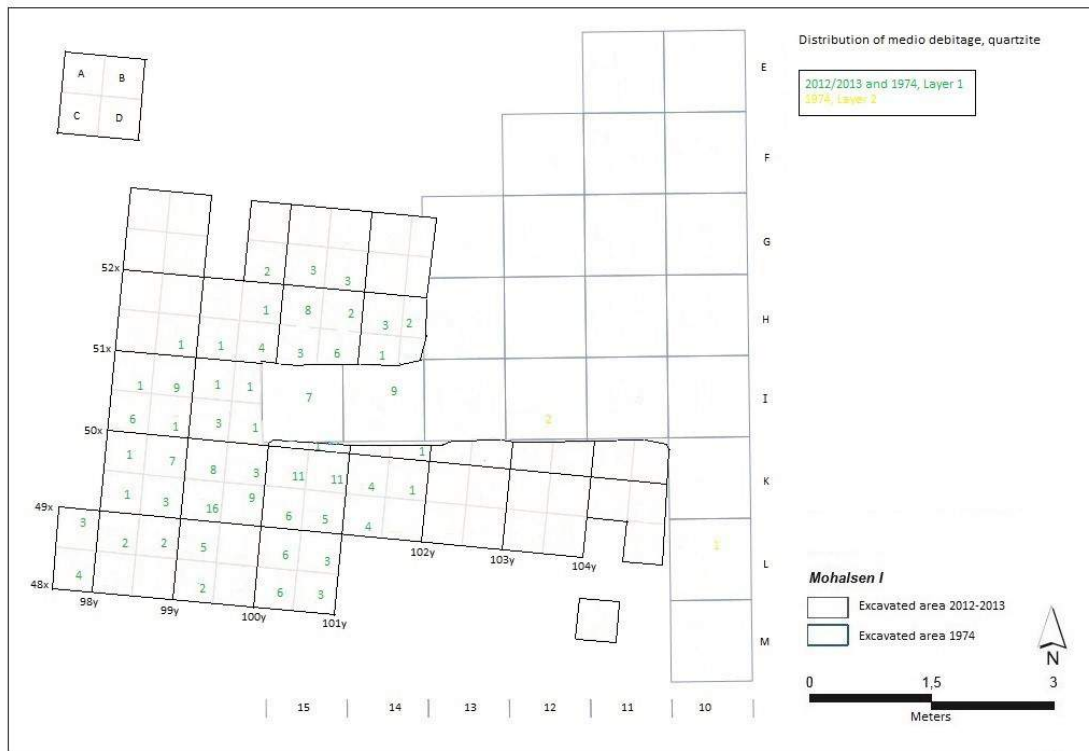
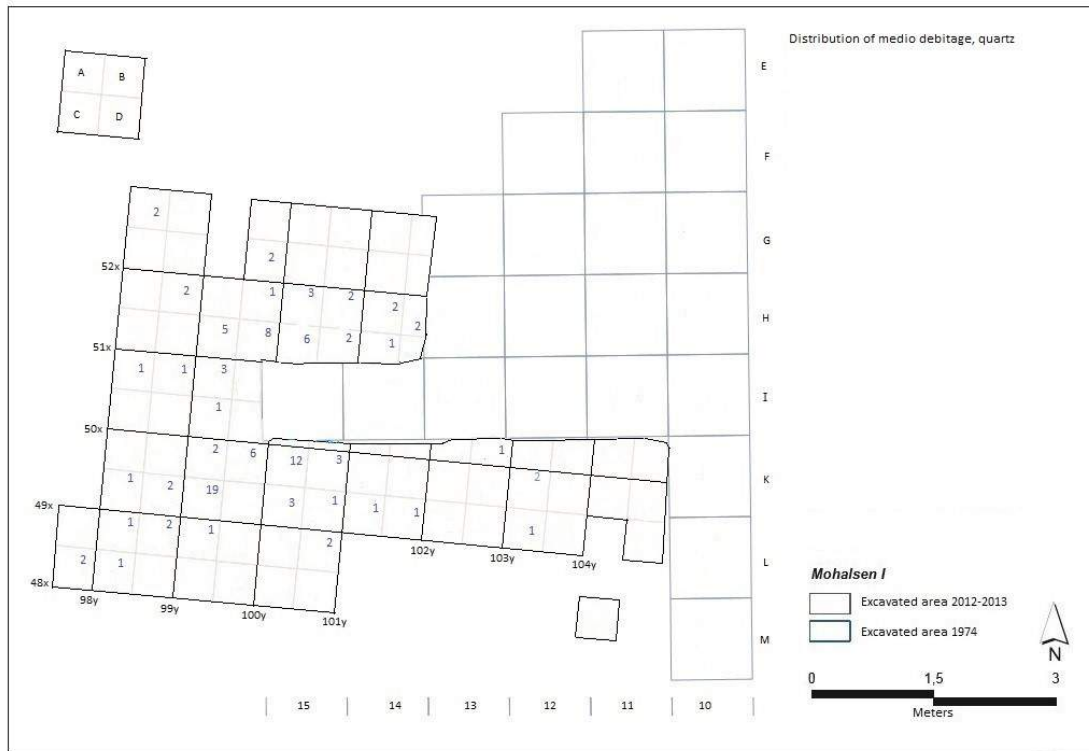




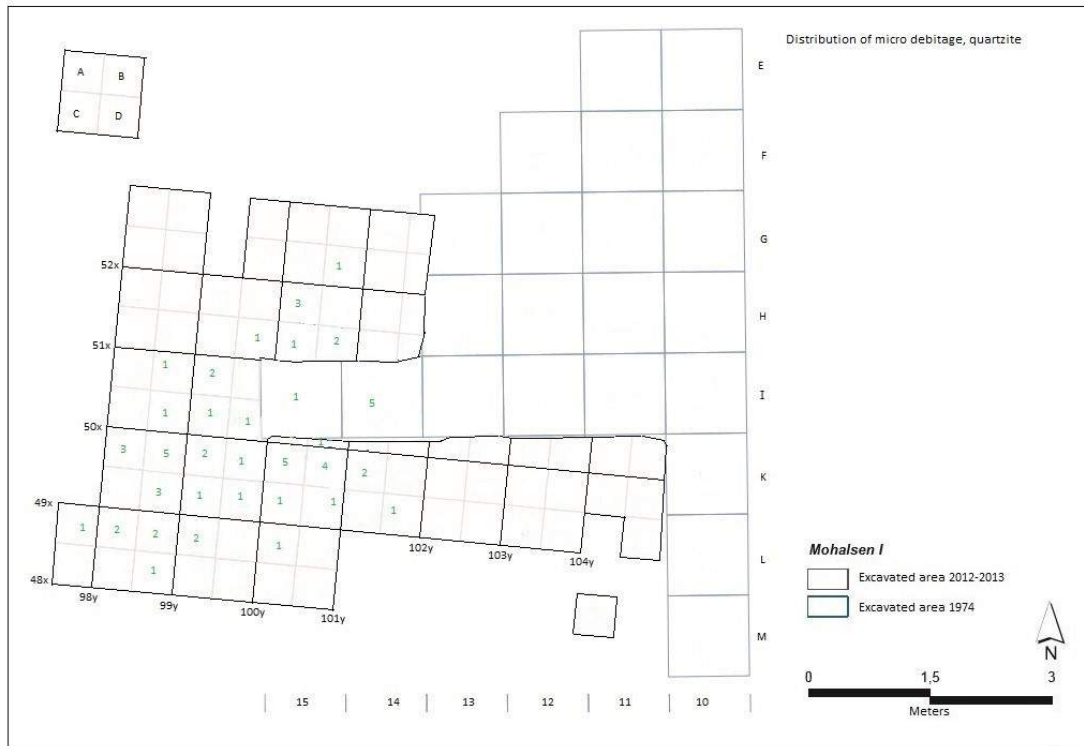
Appendix J – Map showing the distribution of the different raw materials



Appendix J – Map showing the distribution of the different raw materials










Appendix J – Map showing the distribution of the different raw materials










Appendix J – Map showing the distribution of the different raw materials

Appendix K – Projectile points – impact fractures and photos








West

T-nr	ID	Classification	Fragment	Length	Width	Place ment	Wear trace	Notes	Picture
19464	368	Tanged projectile point	Proximal. Shafted piece	10.86mm	6.77mm	I14 layer 1		Only fragment left	
19464	422	Tanged projectile point	Proximal. Shafted piece	13.41mm	6.95mm	I15 layer 1		Thin point, possibly hit stone or bone	
25950	431	Tanged projectile point	Proximal. Shafted piece	7.21mm	6.90mm	49x 100y A layer 5	Bending fracture		
25950	536	Tanged projectile point	Proximal. Shafted piece	11.33mm	6.86mm	50x 99y D layer 5	Bending fracture		
26109	254	Tanged projectile point	Proximal. Shafted piece	10.76mm	8.17mm	48x 99y A layer 5/1	Embryonic bending fracture	Clean straight break.	
26109	397	Tanged projectile point	Proximal. Shafted piece	19.15mm	8.39mm	48x 100y B layer 5	Spin off bending fracture	Heavy impact	
25950	758	Tanged projectile point	Distal. Tip of point	8.27mm	6.52mm	51x 100y D layer 5		Proximal might have broken off due to heavy impact	








Appendix K – Projectile points – overview over impact analysis

26109	205	Single-edged projectile point	Distal. Tip of point	13.51mm	9.7mm	52x 100y D layer 5		Effected by heat	
26109	472		Distal. Tip of point	12.44mm	7.85mm	49x 101y A layer 5	Spin-off fracture	Proximal broken straight off. No obvious damage to tip, besides a tiny piece that has gone off	
26109	423	Medial fragment	Medial	10.74mm	7.85mm	49x 99y B layer 5	Step terminating bending fracture	Distal part missing	
26109	376	Single-edged projectile point	Complete	15.13mm	13.93mm	48x 98y B layer 5	Large point similar to point T19464:132		
25950	307	Tanged projectile point	Complete	28.14mm	10.53mm	51x 100y A layer 5	Seems unused	Tip in proximal	
26109	24	Preparation for projectile point	Unfinished	16.7mm	8.88mm	52x 100y B layer 6		Preparation	
26109	54	Preparation for projectile point	Unfinished	27.12mm	9.21mm	52x 101y A layer 6		Preparation	








Appendix K – Projectile points – overview over impact analysis

26109	296	Preparation for projectile point	Unfinished	19.1mm	7.34mm	48x 100y B layer 5		Preparation	
26109	386	Preparation for projectile point	Unfinished	19.78mm	7.59mm	48x 98y D layer 5		Preparation	
25950	109	Single-edged projectile point	Complete	26.64mm	11.38mm	51x 99y D layer 3	Snap fracture at proximal, and tiny splinter gone off at distal		
25950	319	Single-edged projectile point or drill-bit	Complete	19.46mm	8.22mm	51x 100y B layer 5	Step terminating bending fracture at distal. Also fracture at proximal		
25950	320	Single-edged projectile point	Complete	15.28mm	7.43mm	51x 100y B layer 5	Splinter gone off at proximal, and possible big splinter gone off at distal.		
25950	321	Single-edged projectile point	Complete	19.93mm	8.14mm	51x 100y B layer 5	Point with a tiny fracture at distal. Might also have a big bending fracture at proximal		
25950	322	Single-edged projectile point	Complete	14.86mm	6.87mm	51x 100y B layer 5	Proximal is fractured with feather terminating bending fracture		




Appendix K – Projectile points – overview over impact analysis

25950	432	Single-edged projectile point	Complete	19.48mm	10.9mm	49x 100y A layer 5	Bending fracture at proximal. Might be a little splinter gone off at distal	
25950	441	Single-edged projectile point or drill-bit	Complete	13.93mm	7.01mm	49x 99y B layer 5	Step terminating bending fracture to the right side of distal, seen from dorsal side. Big fracture to proximal	
25950	535	Single-edged projectile point	Complete	15.53mm	10.02mm	50x 99y D layer 5	Clean break end at proximal. Small traces of wear on distal. Snap fracture	
25950	573	Single-edged projectile point	Complete	20.86mm	8.87mm	51x 100y A layer 5	Quite intact distal end. Bending fracture to the proximal part of the point	
25950	586	Single-edged projectile point	Complete	17.59mm	9.72mm	51x 100y C layer 4	No obvious damage to the tip. Snap fracture on proximal part of point	
26109	125	Single-edged projectile point	Complete	13.94mm	6.54mm	49x 98y A layer 5	No obvious damage to the tip. Snap fracture on proximal part of point	
26109	134	Single-edged projectile point	Complete	22.93mm	9.57mm	49x 98y B layer 5	Rounded tip. A bit of cortex on the point. Feather terminating tendency fracture on distal. What looks like step terminating bending fracture to proximal	







Appendix K – Projectile points – overview over impact analysis

26109	183	Single-edged projectile point	Complete	18.41mm	8.37mm	51x 98y B layer 5	Cone fracture to distal. Broken proximal		
26109	315	Single-edged projectile point	Complete	19.72mm	8.55mm	49x 98y B layer I	Rounded tip and splinter on ventral side. Cone fracture. Bending fracture to proximal		
26109	327	Oblique projectile point	Complete	22.11mm	7.62mm	49x 98y D layer I	Bending fracture at proximal. A splinter has gone off at distal		
26109	419	Single-edged projectile point	Complete	17.09mm	7.78mm	49x 99y A layer 5	Step terminating bending fracture at proximal, and a bit of breakage at distal		
26109	560	Single-edged projectile point	Complete	17.13mm	8.34mm	51x 100y D layer 5	Fracture on right side of distal, seen from dorsal side. Difficult to say what kind of fracture. Maybe snap fracture. Broken proximal		
25950	430	Single-edged projectile point	Complete	12.82mm	8.76mm	49x 100y A layer 5	Cone fracture at distal and broken off proximal. Rounded tip	Might have hit bone.	
26109	274		Complete	13.76mm	8.13mm	48x 99y C layer I	Broken distal which lead to rounded tip and fractured proximal		








Appendix K – Projectile points – overview over impact analysis

25950	480	Oblique projectile point	Complete	18.27mm	7.83mm	49x 101y C layer 5	A small step terminating bending fracture at tip		
26109	13	Single-edged projectile point	Complete	20.24mm	7.11mm	52x 99y B layer 6	Bending step fracture on dorsal side of distal. Intact proximal		
25950	344	Tanged projectile point	Complete	20.86mm	5.6mm	51x 100y D layer 5	Point with damage to proximal end. The whole proximal is fractured and a big splinter has gone off.	The point has cortex	

East

T-nr	ID	Classification	Fragment	Length	Width	Placement	Wear trace	Notes	Picture
19464	57	Single-edged projectile point	Proximal. Shafted piece	14.60	5.70mm	F12 layer 1	Bending initiating fracture	Point where tip has gone off and taken a splinter with it down along the dorsal side	
19464	498	Tanged projectile point	Proximal. Shafted piece	9.72mm	6.26mm	L10 layer 2		Thin point, heavy impact. Only fragment left.	
19464	154	Single-edged projectile point	Complete	22.23mm	10.45mm	G12 layer 2	Point with snap fracture to distal, and fracture to ventral side of proximal		
19464	296	Single-edged projectile point	Complete	20.91mm	7.55mm	I10 layer 2	Small wear trace on distal end. Step terminating bending fracture on dorsal side of proximal		
19464	48	Single-edged projectile point	Complete	14.78mm	8.73mm	F11 layer 2	Rounded tip and broken proximal. Snap terminating bending fracture.	The point might have hit bone	
19464	133	Single-edged projectile point or drill bit	Complete	20.46mm	8.50mm	G11 layer 2	Rounded tip. Snap terminating bending fracture		
19464	132	Single-edged projectile point	Complete	35.75mm	15.36mm	G11 layer 2	Small fracture at the tip and down left side when seen from dorsal side	Large projectile. Size might be the reason why the wear trace is so small if it has been used	

Appendix K – Projectile points – overview over impact analysis

19464	173	Single-edged projectile point	Complete	19.66mm	7.77mm	H10 layer 1	Point with a little damage at the tip. Spin off without fracture		
19464	206	Tanged projectile point	Whole	25.8mm	12.19mm	H11 layer 1	Point with cone initiating fracture. This point has a tiny splinter gone off at the right side of the tip (point seen from dorsal side). A little broken at proximal		
19464	246	Single-edged projectile point	Whole	23.07	7.37	H12 layer 1	Uncertain about use. Might have a splinter gone off at the side of distal		
19464	500	Tanged projectile point	Whole	25.66mm	10.03mm	L10 layer 2	No traces of wear at distal or proximal.	The point does have a linear striation in 45-50-degree angle off the longitudinal axis, most likely due to weakness in the stone	
19464	92	Tanged projectile point	Whole	26.51mm	13.77mm	G10 layer 2	Seems unused	Big angled point that probably has been discarded as unuseful	
19464	275	Single-edged projectile point	Complete	17.12	7.66	I10 layer 1	Seems unused		
19464	193	Preparation for projectile point	Unfinished	22.77mm	9.51mm	H10 layer 2		Discarded during preparation	
19464	499	Preparation for single-edged projectile point	Unfinished	29.83mm	13.69mm	L10 layer 2		Discarded during preparation	

Appendix K – Projectile points – overview over impact analysis