TOWARDS A BROADER PERSPECTIVE

A *chaîne opératoire* analysis of the material from an Early Mesolithic site in southern Norway

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Cover illustration: Refit showing a flake sequence. See refit group 5.1. From Sagene B4, Aust-Agder County, Norway. Photo by author.

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Oslo, 12th November, 2018

Hanne Greger

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INTRODUCTION

Archaeological excavations in southern Norway are mainly conducted prior to development of infrastructure such as highways or railways. Potential sites are surveyed in connection to this, from which a selection of sites are chosen for full archaeological excavation. In Stone Age surveys, the choice for excavation is preceded by test pits to determine the extent and richness of a site and to recover worked flint or quartz, which is the criteria for denoting a specific area as a Stone Age locality (Glørstad 2006:94). This selection process is an initial, but important step within an excavation project, as it determines which sites are chosen for a full archaeological excavation. The selection of which sites to excavate is largely based on the presence or absence of diagnostic tools in the survey process, as well as the specific interests of the excavators. These criteria for the selection of excavation often result in a bias towards larger sites that demonstrate an abundance of material. Site interpretations reflect this by focusing on the diagnostic tools, the distribution of debris and rudimentary technological attributes.

In recent years there have been a number of large archaeological projects along the southern coast of Norway. In line with this, a wealth of Stone Age sites have been identified and excavated, mainly within the framework of large museum-based projects (e.g. Solheim 2017a; Melvold and Persson 2014; Solheim and Damlien 2013; Jaksland 2012a and Jaksland 2012b). The excavated sites normally represent a variety of periods, offering the chance to observe long time changes and developments in a historical perspective, simultaneously, the chosen sites are also frequently more of what we already know. I believe this is partly due to the similarity of the sites selected for an archaeological investigation, but also because every site is interpreted by focusing on, and examining, the same aspects of the archaeological material, such as tools and distribution. In this way, research tend to confirm what is already known. By continuing in this vein, smaller short-term sites without extensive assemblages are often overlooked in research, creating a bias in our understanding of prehistory. It has been stated that smaller, undisturbed sites are probably more widespread than we are aware of, but they have not been demonstrated convincingly so far (Bang-Andersen 2003:11). However, with the more recent projects mentioned above, it should be stated that an abundance of new Stone Age sites have been excavated. This includes smaller sites, although the majority of excavated sites are larger with extensive assemblages. To address this imbalance in focus, I propose to examine an Early Mesolithic small short-term site from within a large project, with a small lithic assemblage with an alternative methodological approach to explore how a small site can yield information on this under-represented area to see how these results can contribute to research today.

Current research questions within Mesolithic excavation projects in southern Norway are mainly concerned with determining the age of the sites and chronological developments (e.g. Jaksland 2014:8; Glørstad 2014:58f; Stene 2010b:4), interpreting changes in settlement patterns and mobility (e.g. Jaksland 2014:8 Damlien 2013:29f; Solheim 2017b:41), and if the people had a marine or terrestrial-based economy (e.g. Glørstad 2014:58f; Damlien 2013:28; Solheim 2017b:41; Stene 2010b:4). This provides a generalised image of the human occupation, and covers the larger cultural processes occurring in the early settlement phase of Norway. Interpretations of the lithic material assemblage within recent excavation projects are based on morphological attributes, typologies and associated technology. Publications from these excavation projects frequently include tables of excavated material and artefact categories. They mainly use the typological classification guideline created by Helskog et al (1976) for these initial examinations, which largely focuses on the different categories of artefacts and their morphologies (to name but a few, Koxvold 2013:51; Koxvold and Fossum 2017:85; Melvold, Reitan, Eggen and Eigeland 2014:67f). This perpetuates a static perspective on lithic material and excludes any dynamic behavioural indications that could potentially be found in the material if another methodology or analytical approach were applied. Today's predominant methodological approach rarely discusses the material further than rudimentary descriptions and classifications, which provide a generalised image of technology that can be used to track similarities with other sites for a comparative dating framework, but masks differences which offer a range of indications of the actual technological activity and what was happening at the sites.

Having said this, acknowledgement must be given to technological studies of lithic assemblages in southern Norway, which often lead to more dynamic results based on the in-depth analysis the material undergoes. One such example is the lithic material from the site of Galta 3, an Early Mesolithic locality on the Southwest coast, in Rogaland (Fuglestvedt 2007). Based on observed similarities to Ahrensburgian tools the material underwent a refitting study. A comparison of the site's technological features confirmed that the technology was identical to Ahrensburgian technology (Fuglestvedt 2007:100; 2012:8). Therefore, it could be argued that Early Mesolithic pioneers along the southwestern coast of Norway were associated with the Ahrensburg Late Palaeolithic continental complex (Fuglestvedt 2007;

2012). Other noteworthy studies generating amounts of information utilising more in-depth methods on lithic material are, amongst others, Skar and Coulson (1986), Damlien (2014) and Eigeland (2015). These are good examples of how an analytical approach may provide results that can create the foundation for interpretations. It should also be mentioned that excavation projects have in recent years begun to incorporate technological analyses on parts of their material (see for example Eigeland 2014 and Knutsson and Knutsson 2014). However, as mentioned these analyses only incorporate specific artefacts of interest, here blades and other retouched artefacts. These represent the last stages in a production sequence, thus missing out on opportunities to get a complete image of the assemblage and associated technological activities.

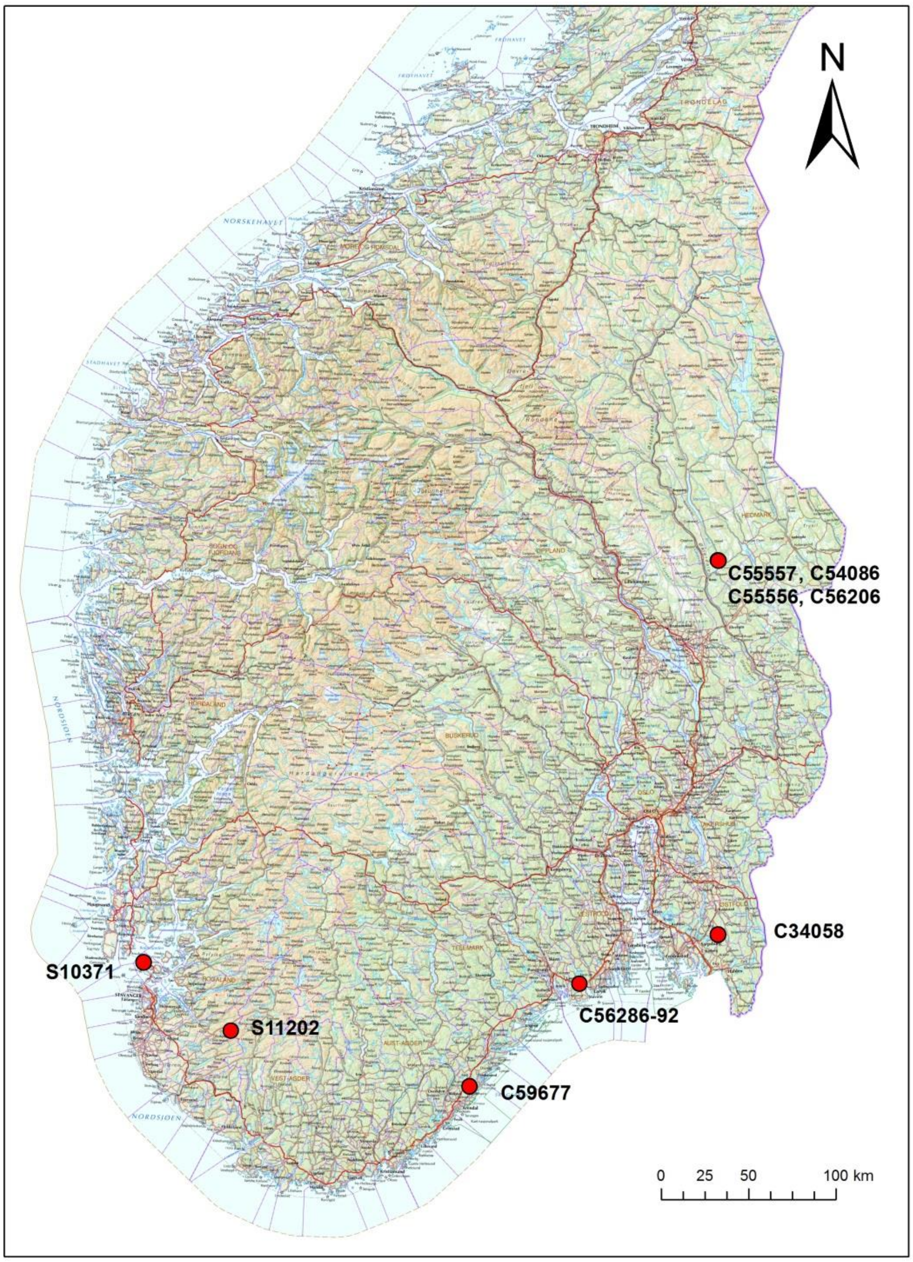
The context for the thesis is set to the Early Mesolithic in southern Norway, a period already extensively researched and discussed (e.g. Bjerck 2008; Bjerk 2017; Boaz 1999; Damlien 2014; Glørstad 2013; Åstveit 2014a). This thesis is an attempt to address the dynamic aspects in a lithic assemblage, which goes beyond rudimentary descriptions and classifications, to hopefully demonstrate that useful information can be retained, and possibly open up for new aspects to the understanding of the Early Mesolithic to be attained.

To accomplish this, the approach chosen for this thesis is refitting as the method of examination, within the framework of a *chaîne opératoire* analysis. Through refitting it is possible to reveal the processes involved in the technological activity, and utilise the distributional patterns of the material to trace movement at the locality. This type of approach provides an opportunity to reveal a more nuanced and complete image of the actions taking place at the locality. It will also provide evidence that can either confirm or refute observations and aspects in the material observed during excavation. I will attempt to discern whether it is possible to answer questions regarding technological aspects in Stone Age occupations, beyond the morphological attributes that is the present focus in today's research. In addition, by conducting a refitting examination I will be able to assess how this lithic examination compares to the initial observations by the excavators in their initial examination of the assemblage.

With this thesis, I hope to be able to contribute to the selection process for which sites receive attention, by directing the focus towards an under-represented area of research, namely demonstrating activity on a small short-term occupation from the southern Norwegian Early

Mesolithic. To this end, the present study will use the assemblage from the site of Sagene B4 as a case study. This site was excavated in 2016 within the E18 Tvedestrand – Arendal project. The assemblage in its entirety has a total of 853 finds, with only 41 registered tools (Darmark 2018, in press). The site was chosen for this study because it can be seen as a typical Early Mesolithic site, based on its location by the shoreline with easy landing points for watercraft, and for its lithic assemblage. It is characteristic for the period with a high percentage of flint, and considered diagnostic for Early Mesolithic. In addition, Sagene B4 was extensively excavated and well documented, thus providing the best possible conditions for an intensive study of the assemblage.

To put this study in perspective, a brief history of Early Mesolithic research in Southern Norway will be presented. After this, the case study will be presented before moving on to the approach of the thesis. Then, the results of the refitting examination will be given, which will be included in a discussion and conclusion chapter on what interpretations these results can provide, as well as how the site of Sagene B4 contributes to our present understanding of the Early Mesolithic in Southern Norway. Also included in this study will be an appendix, which includes a presentation of all refit groups accomplished in this study, with information on find location and classification of each artefact assigned through this study, as well as the artefacts' individual refit ID number.



S10371: Galta 3.
S11202: Myrvatn sites.
C59677: Sagene B4.
C56286-92: Pauler 1, Pauler 2, Pauler 3, Pauler 4, Pauler 5, Pauler 6 and Pauler 7.
C34058: Høgnipen sites; Rørmyr II.
C55557: Stene terrace
C54086: Stræten terrace
C55556: Bjørkeli.
C56206: Thingnæs

Figure 1. Overview of Early Mesolithic sites in southern Norway mentioned in this study. Made by author.

RESEARCH OF EARLY MESOLITHIC SOUTHERN NORWAY

This chapter will cover the climatic situation of southern Norway in Early Mesolithic, as well as give a presentation of Early Mesolithic archaeological research as a background for this study. Present day Norway underwent substantial climatic changes, which altered the flora and fauna, making the landscape more habitable and rich in recourses for humans to exploit. Therefore, a brief summary of these changed conditions is important to have covered, as they play a part in the pioneering phase of southern Norway, and also giv
e an image of the resources these early settlers exploited. Then, archaeological research of the Early Mesolithic in this region will be discussed to provide a cultural context for this thesis and how the site of Sagene B4 through the present examination fits into the existing image of this period.

The Early Mesolithic in southern Norway encompasses the pioneer phase, which is the colonization and following exploitation of the coastline and later migration towards the more mountainous inland area of the country. This will be further presented in the following pages

The period spans from 9500 – 8000 cal. BC, which corresponds to 10,020 – 8900 uncal. BP (Bjerk 2008:Table 3.1). Immediately preceding this, most of Scandinavia was uninhabitable, as it was virtually completely covered by ice from the Weichselian glacial period, which lasted from 115,000 – 10,000 BP (Bang-Andersen 2003:6; Bjerk 2008:65). It reached its peak around 22,000 BP, but at around 13,000 BP the ice began to melt and retreat, resulting in alterations in flora and fauna, as well as permitting access to some of the Norwegian coastline (Bjerk 1994:38, 2008:65). The landscape during this time would have been forest-tundra, with some occurrence of willow shrubs and open birch vegetation in sheltered areas (see Paus 1988:145f) Little is known of the terrestrial fauna during this period, except there are indications of reindeer herds dating back to 12,500 BP (Bang-Andersen 2003:6). Despite the climatic change there is, to-date, no evidence for human occupation along the Norwegian coast in the archaeological material before approximately 10,000 BP (Bang-Andersen 2012:106), thus creating a 3000 year period where parts of the coast was habitable, but not exploited by humans.

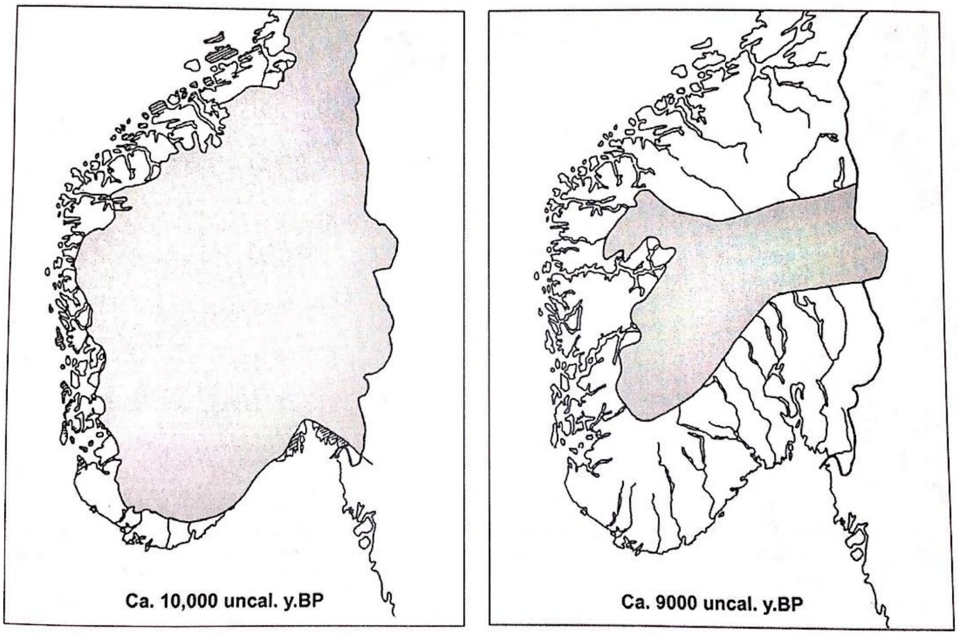


Figure 2. Southern Norway, illustrating the rapid melting of the ice sheet covering the region. After Bang-Andersen 2012, figure 5.

At the end of the ice age, there were significant climatic changes, resulting in rapid melting of the ice. This subsequently led to environmental changes due to the rise in temperature (Bjerk 2008:65). For instance, the Gulf Stream that today travels along the length of the Norwegian coast, most certainly reached this region some time during this period of climatic events (Bang-Andersen 2003:7). Marine life would have been affected by this, as it would have attracted sea mammals such as ringed, harped and bearded seals, as well as polar bears. In addition, several species of maritime birds would have migrated to this coast (Bjerk 2008:66). There would also have been a transformation in the terrestrial flora and fauna due to the rise in temperature in this period.

The natural environment underwent a transformation from an arctic to a sub-arctic state, with woodlands of birch and crowberry, and subsequently forests of pine and hazel (Bjerk 2008:66). Also, the occurrence of sea buckthorn was quite widespread, as well as juniper and willow (Gjærevoll 1992:171f). This gives an indication as to how the landscape would have been for the pioneers. Unfortunately, the faunal evidence is relatively scarce from this period, though remains of a polar bear were discovered in southwestern Norway (Blystad et al. 1983). In addition, reindeer antlers from marine sediments along the southwestern coast (Bang-Andersen 2003:7), indicate that herds of reindeer were present in the region at this time. As the ice-sheet retreated and the inland and mountain areas became accessible for habitation, it is assumed these reindeer herds migrated from the coastal zone to more highland climates, as these would have been colder and drier with less trees and scrub (Bang-Andersen 2003:8).

These improved climatic conditions, with larger parts of the coast now ice-free and habitable areas occurring in the southern highlands (see figure 2), created a more habitable landscape, with a variety of resources for humans to exploit (e.g. Bjerk 2008:65; Glørstad 2016:9). In addition to altering the environment, the rapid melting of the ice sheet covering Scandinavia brought with it a combination of rising sea levels and land uplifts due to the declining weight of the ice. Shoreline displacement is therefore used for reconstructing the prehistoric shorelines and landscape (Wieckowska-Lüth et al. 2018:840), as well as a relative dating method for prehistoric shore bound localities (Bjerck 2008:67f).

Initial colonisation of southern Norway

There have been several proposals as to the origins of the first people to inhabit what is now present-day Norway. They could have entered via the northern territories to Finnmark or further south, either by crossing the small passage of water between the Norwegian West coast and Doggerland, or the easternmost coast by people migrating westward from Sweden (e.g. Glørstad 2016; Bang-Andersen 2003:8, 2012:109). Glørstad (2016) is in favour of a route to Southeast Norway from the Swedish West coast, and argues that the reason for Norway's late occupation, despite land areas being free of ice earlier, is due to the ice sheet covering the Oslo fjord area. By assessing research regarding the melting of the ice sheet, he argues for a link between the time of the ice disappearing and the initial occupation of this region (Glørstad 2016:20).

Recent research into this field (Günther, et al. 2018) argues for a migration route both from southern and north-eastern areas based on analysis of genomes of Early Mesolithic human remains from various areas of Scandinavia. These separate migration groups would have met along the ice-free coast and created a more diverse population than contemporaneous hunter-gatherers from the European mainland (Günther, et al 2018:5ff). Given that the sample in this study was very small one should take this into consideration when assessing the work, and keep in mind that it is still a hypothesis, until more data can be analysed. Despite there being several hypotheses regarding the regional location of the first Norwegian occupation, it is a common belief that the entire coast was settled within a few hundred years (e.g. Bang-Andersen 2012:109; Bjerk 1994:45f; Glørstad 2013:77).

The landscape during this time would have been a diversity of fjords, islands and promontories, making seafaring the obvious form of transport. Thus, it is highly probable that the pioneers of Norway travelled by some sort of seagoing vessels (Fuglestvedt 2012:6; Glørstad 2013; Bjerk 2008:84). Bjerk (1994:50f) also discusses the use of watercraft, though in a different context. He argues that the late occupation of the Norwegian coast was because the continental groups planning to cross over to southern Norway needed to create watercraft stable enough to cross over the sea, as well as develop skills and knowledge in a marine-based economy (Bjerk 1994). Although there is a notion that pioneers were seafaring people, the Norwegian archaeological record lacks evidence for this (Glørstad 2013:61) as there are, as of yet, no preserved remains of watercraft. What can be used to support this notion in the remaining material, however, are flake axes which are mostly found on coastal sites (Solheim et. al. 2018:561; Bjerk 1994:47). This has led to the interpretation that these axes were connected to marine activities, and possibly for the manufacture of watercraft (Glørstad 2013:65). This suggests a maritime-based mobility amongst the pioneers, where waterways were routes of transportation.

There are several discussions regarding the nature of subsistence of the pioneers, regarding which recourses were exploited in an economic context (e.g. see debate between Åstveit, Berg-Hansen, Dugstad, Fuglestvedt and Svensen in Primitive Tider 2014:87-136; also Bjerk 2017; Bang-Andersen 2012; Fuglestvedt 2012). There is agreement that these people had a highly mobile lifestyle. However, opinions vary on whether the pioneers were experienced reindeer hunters from the European continent who followed the herds into the southern Scandinavian Peninsula, if they relied on a marine-based economy, or if it was a mix between the two involving movement. Unfortunately, there is as of yet no empirical data to support either of these claims and therefore the discussion is largely based on theoretical reasoning creating hypothetical models (Fuglestvedt 2012:11). What does exist, however, are excavated sites both along the coast and in more mountainous inland areas. Inland exploitation has been documented by highland localities such as the Myrvatn sites located approximately 600 m.a.s.l. in Southwestern Norway (Bang-Andersen 1990:215). These sites have been interpreted as being campsites for big-game hunting used by groups who were based at coastal sites (Bang-Andersen 1990:224f). This assessment is based on natural climatic conditions, thus making it a hypothetical theory. More recent evidence for inland exploitation occurred within the Gråfjell project, when localities along the Rena River were excavated (Stene 2010a). Although not Early Mesolithic, several Middle and Late Mesolithic sites were discovered, such as Stræten terrace (Melvold 2010:96), Bjørkeli (Damlien 2010a:236), Thingnæs (Damlien 2010b:265) and Stene terrace (Damlien 2010c:276). These excavations opened up for new interpretations regarding inland exploitation in the Mesolithic, as well as shedding light on the use of local raw materials. In addition to the material being initially examined by the excavators, two master theses did refitting examinations on material from a selection of these sites, yielding additional understanding of the material and the sites (see Eliassen 2015 and González 2014).

Despite there being evidence for inland exploitation, the majority of Early Mesolithic settlements are located along the coast. The Høgnipen sites are of the earliest excavated Early Mesolithic sites in Southern Norway (Johansen 1964). Material from one of the sites, Rørmyr II, underwent a refitting study. On the basis of the examination, the site was determined to be a single short-term hunter's camp, where the hunters returned with their prey for processing. In addition, several technological activities were confirmed as well as the identification of two knappers (Skar and Coulson 1986:101f). Evidence of larger sites documenting reuse are also represented in the archaeological record, see for example the Pauler sites from the E18 Brunlanes project (Jaksland 2012a; 2012b).

The archaeological record indicates that coastal occupations and settlements in the Early Mesolithic share common traits. For instance, they were mainly located in open, shore-bound areas on promontories and small islands overlooking sheltered waters, with nearby landing places suitable for watercraft, and they had sheltered conditions against weather (Bang-Andersen 2012:110; Nyland 2012:81ff; Fuglestvedt 2012:6). For examples on such shore-bound localities see, amongst others, Excavated Early Mesolithic sites from the E18 Brunlanes project (Jaksland 2012a; 2012b) and the E18 Rugtvedt-Dørdal project (Solheim 2017a). This further supports the idea of people in this area being dependent on sea vessels for moving throughout the land. The preservation of such early sites are usually poor given soil conditions and shallow deposits. There are seldom cultural layers, however, the sites are usually divided into site units, consisting of activity areas for lithic production, and hearths determined by clusters of burned flint or charcoal (Fuglestvedt 2012:5). Dwelling structures from this period are sparse. However, where they have been detected they are interpreted based on areas which have been cleared of larger stones, or circular or oval structures of stones thought to be remnants of tent rings (Fuglestvedt 2012:5; Nærøy 2018:908). These factors have resulted in the consensus that the majority of Early Mesolithic sites are single occupations occupied by mobile groups of three to five people, with recurring archaeological material such as dwelling structures, fireplaces and activity areas (Fuglestvedt 2012:5; Nyland 2009:409f).

Archaeological assemblages show a predominant use of flint in this early period, with a few notable exceptions such as the use of local lithic sources for manufacturing flake axes and limited use of local quartz and quartzite (e.g. Fossum 2014:127; Koxvold 2017:109, 129; Bang-Andersen 2003:13). This is not surprising, as the early inhabitants presumably migrated from the continent where flint was the preferred choice for manufacture. The lithic material described in recent excavation publications mainly consists of points, most often single-edged and tanged points, lanceolate microliths, microburins and flake axes. These are seen as being diagnostic for the Early Mesolithic period (Bjerk 2008:74ff). Other artefact categories in Early Mesolithic assemblages, but not chronologically specific to the period, are scrapers, knives and blade and microblade manufacture (gathered from finds tables from excavation publications in Jaksland 2012a; 2012b; Solheim 2017a and Melvold and Persson 2014). The earliest phase of the Early Mesolithic demonstrate flint assemblages and technological techniques, which resemble that of the continental Ahrensburg culture (Fuglestvedt 2007; 2010; 2012). Some time during the beginning of the 9th millennium cal. BC, a change in the technological tradition emerges, known as the conical core pressure blade technique. This is commonly seen as migrations of eastern people or knowledge into the North-western territories (Sørensen et al. 2013; Damlien 2014).

Flint does not occur naturally in the Norwegian geology. What does exist, however, is beach flint; nodules that travelled north, transported by ice. These blocks would have been of a lesser quality due to the intense temperature alterations that occurred during their embedment in the ice according to Eigeland (2007:41, 2011:128f). With this said, it has also been argued that since the flint remains in its matrix of chalk, it is protected from any damage ice would cause, thus resulting in the flint not losing its level of quality (Olaussen 1983:13). Since the archaeological material demonstrates flint of different qualities amongst Early Mesolithic sites (Fuglestvedt 1999:195), it could indicate that the early settlers of Norway utilised a number of different flint sources.

During the learning process of knapping, large amounts of flint is wasted. This was most likely not preferable for the prehistoric knappers in southern Norway, since the availability of the material was rare. A hypothesis emerged based on this and few instances of traces of differences in skill in South Norwegian lithic assemblages. It states that the transmission of skill could have been conducted on trips to areas rich in flint, where skilled knappers brought novices along so they could develop their knapping skills without wasting the locally available beach flint (Eigeland 2011). Such trips would have facilitated the abundance of resources needed to practice ones technological skills, as well as the procurement of preferable nodules for further working. This generates the impression that people settled in southern Norway were aware of other regions, with richer flint sources where the material had a more stable quality, better suited for tool manufacture (Eigeland 2011:136). Since flint does not occur naturally in Norway, it is a good marker for identifying prehistoric activity. In addition, flint material is commonly used for dating localities, as typologically diagnostic artefacts represent the different sub-periods within the Norwegian Stone Age.

Summary

To summarise, the present-day image of the Early Mesolithic in southern Norway was a hunter-gatherer society with mobile groups of people travelling along the coast, probably depending on seagoing vessels to navigate throughout the fjords, islands and promontories, which would have dominated the landscape. Colonisation most likely originated in both the North and South parts of the country, and the coast was settled quite rapidly. Hunting would have focused upon marine resources, and to some degree terrestrial game such as reindeer in inland areas. As the ice retreated inland, the reindeer migrated further into the highland areas in the interior parts of the region. This facilitated a migration between the coast and the inland where different resources were available. Flint was the predominant raw material used, with inventories consisting of tools such as scrapers, tanged points, lanceolates, and flake axes that may have been a necessary tool for manufacturing watercraft. Based on in-depth analyses of lithic assemblages, the Early Mesolithic flint technology is connected to continental Ahrensburgian groups. Around the 9th millennium BC, there occurred a migration of eastern people into the region, bringing with them a new technological technique, the conical core pressure blade technique

CASE STUDY

In the following chapter, the excavation procedure of the site chosen as a case study will be presented before moving on to the initial interpretations and conclusions made within the excavation project. The excavator's interpretations and conclusions will form the basis for the present study's further work on the material and accompanying interpretations of the site.

Excavation

The site of Sagene B4 was excavated within the excavation project E18 Tvedestrand – Arendal, conducted by the culture-historical museum in Oslo (KHM), in conjunction with the development of a new highway in Aust-Agder County along the Southeast coast of Norway. The excavation was a part of one of the museums' prioritised research areas, a project called *«Landscapes – rapid changes. Habitation and environments during 12 000 years"*. The aim of the excavation, in correlation to this prioritised project, was to gain a sense of the changing conditions of the Stone Age, as it manifested through the archaeological material, occupational organization and changes in the landscape. In addition, a focal point was to highlight the dynamics between cultural, natural and technological driving forces based on Stone Age material (Trends and Breaks in Stone Age History 2015). Excavations took place from 2014 to 2016, with 34 excavated localities from various periods throughout the Stone Age. Sagene B4 was one of 14 Early Mesolithic sites excavated, and was deemed suitable for the present study based on its small size and relatively low number of tools and debitage.

Sagene B4 was identified during the initial survey process, where indications of prehistoric activity was demonstrated by 9 worked flint artefacts retrieved from 2 of 7 test pits (Darmark 2018, in press). Based on these finds, it was decided to conduct a full archaeological investigation.

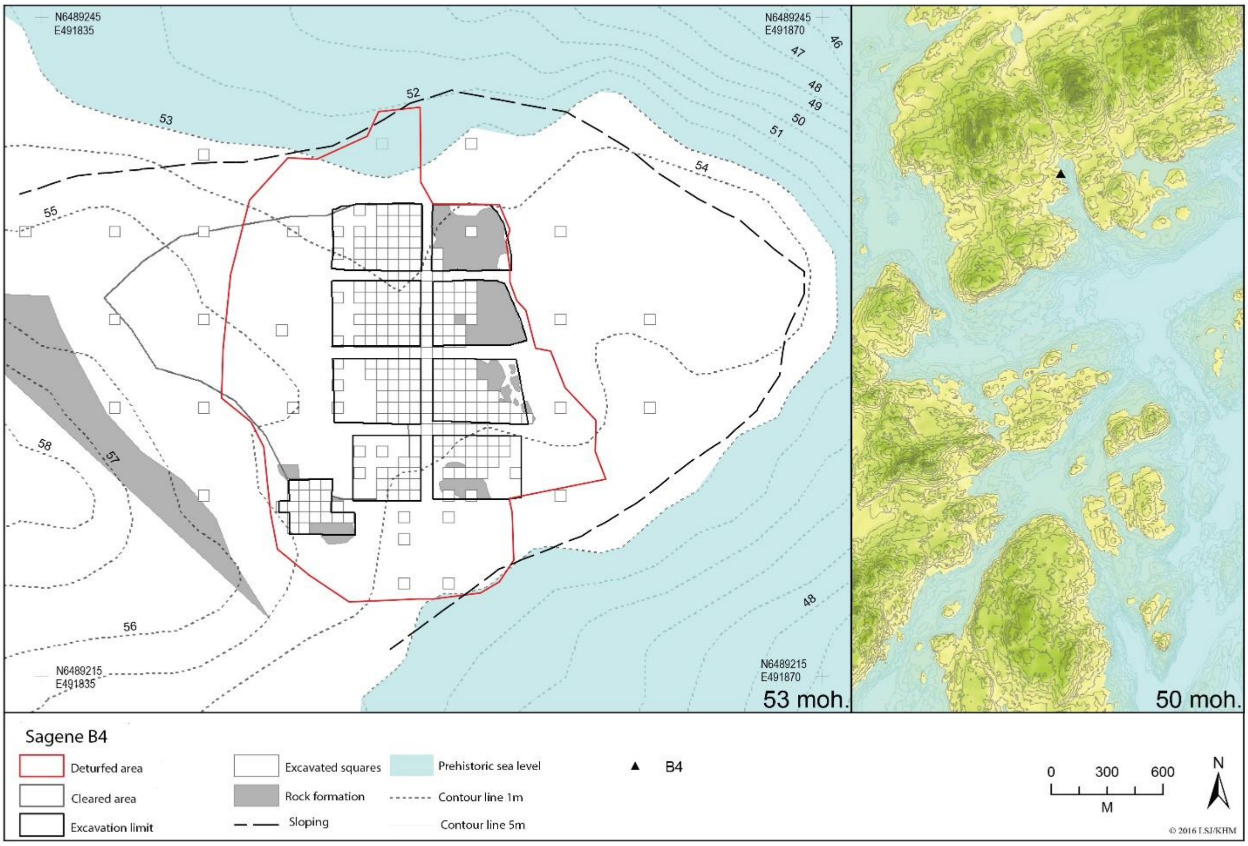


Figure 3. Location of Sagene B4 in the inner fjord area of Aust-Agder, with excavation details. Aust-Agder County, Norway. After Darmark 2018, in press.

The locality was excavated over a period of 10 weeks in 2016. Initially 31 test pits were excavated. As seen in figure 3, the test pits were evenly spread throughout large parts of the area, providing good conditions for mapping the extent of the suspected human activity. This process resulted in a total of 6 worked flint artefacts from 3 of these test pits. Based on this, it was decided not to expand any of the test pits. The small number of finds from this stage of the excavation were interpreted as being diagnostic of the Early Mesolithic, and the site was thus deemed suitable for studying change processes that occurred during this period of the Stone Age (Darmark 2018, in press).

A mechanical digger was used to de-turf the site (Darmark 2018, in press). Figure 3 depicts the de-turfed area with a red line. As illustrated, the digging of quadrants was conducted within this section. At this stage, baulks were retained with one long baulk running from South to North, with evenly spaced “side-branches” to the East and West. Baulks were retained to allow the stratigraphic layers of the site to be retained for later interpretations.

The site was excavated in 3 vertical layers of 10 cm each, with quadrants for every m2, as illustrated in figure 3. A total of 59,9m2 was excavated, 238 quadrants in the first layer, 116 in the second, and finally 12 in the third layer (Darmark 2018, in press). The rationale for the vertical decline was to decrease the possibility of time spent excavating empty quadrants. Prioritisation was to continue only in areas with the larger number of finds (Personal communication with Kim Darmark, 20.02.2018). The surface of the second layer was cleaned to determine the presence of potential structures. When the layers were deemed completely excavated, the baulks were removed, and the fill sieved for finds for retaining any potential information in the baulks. In addition, heat-altered natural stones were retained for further analysis. Unfortunately, this was not possible as the stones were too weathered (Darmark 2018, in press).

Finally, a mechanical digger was again employed to clear 129m2 of the area with the purpose of revealing any structures not previously discernible in the area (Darmark 2018, in press). This is illustrated in figure 3 by a thin black line.

Initial interpretations and conclusions from the excavation

The site, Sagene B4, has been assigned to the Early Mesolithic and dated temporarily to 9000 +- 200 BC. This designation is in part based on diagnostic factors in the material, as well as its topographical location above today's sea level, which is set to 53-54 m.a.s.l. (Darmark 2018, in press). Before the E18 Tvedestrand – Arendal project, no documentation of the shoreline displacement had been undertaken for this part of Norway. Therefore, in connection with the project, the sea level history of this region was registered and provided a relative dating of the sites excavated (Romundset 2018, in press). The locality has been designated as a shoreline occupation, positioned on a small East-West facing promontory sloping into what then would have been water, with opportunities for landing small watercraft to the North and South, (see figure 3). There is a prominent rock formation to the West of the site, as well as a similar formation to the East. During the time of occupation, these would have offered shelter from the winds (Darmark 2018, in press). This position in the landscape and topographical preferences coincide with the coastal location of other contemporaneous localities, as mentioned in the preceding chapter. (see figure 1). Sagene B4 has been interpreted as a short-term occupation, directed towards some sort of specialised activity, perhaps focused on hide preparation (Darmark 2018, in press). The designation of the site being directed towards hide preparation is primarily based on a selection of the formal tools (specifically scrapers) found during excavation. Further interpretations and conclusions from the excavation and associated material will be presented in detail in the following pages. The finds and interpretations of the site of Sagene B4 that are based on observations made during the excavation, are described in detail and presented in the publication, and will here be briefly summarised.

Very briefly, the lithic assemblage consists of 853 finds, with flint representing all but 2%. The remainder is composed of quartz and rock crystal and one whetstone of a local rock type (Darmark 2018, in press). The excavators considered the flint to mainly be of good quality, and the majority of the assemblage was uncovered in the first layer, with a total of 586 finds. The remainder of the finds were located in the second (243) and third (17) layers (Darmark 2018, in press). The following two figures show the spread of all raw material types (see figure 4) the spread of quartz and rock crystal (see figure 5), from the first layer.

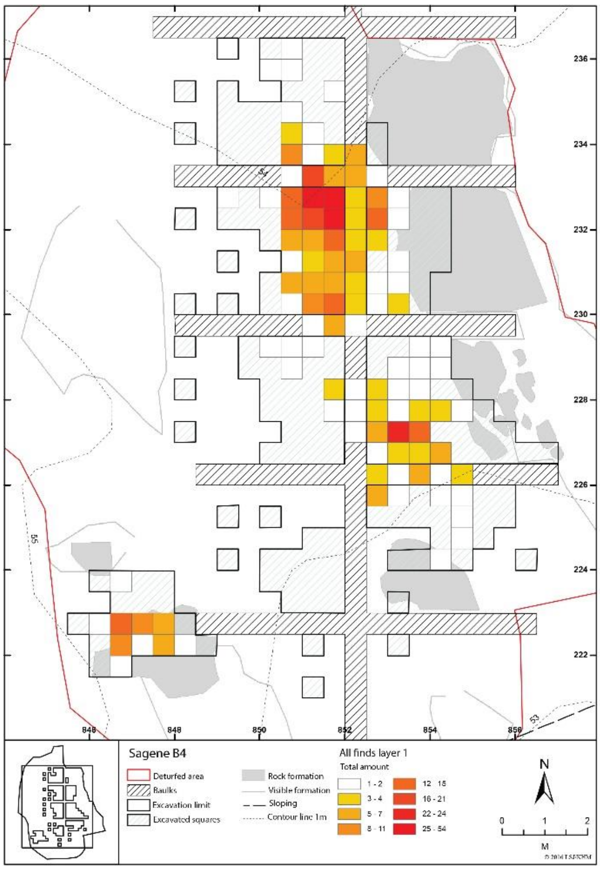


Figure 4. Spread of all excavated material in layer 1. Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

Figure 5. Spread of all excavated quartz and rock crystal. Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

As illustrated in figures 4 and 5, 3 material clusters were defined, based on the distribution of excavated material[1]. These three clusters were defined as separate concentrations and have been further interpreted as such. As illustrated in figure 6 below, the two largest concentrations, marked A and B in figure 6, are both approximately 5 x 4 m2 in size, and

[1] ***N.B.*** Be aware that the colors used in these figures are not coordinated, for example, red depicts 25 – 54 finds in figure 4, but only 3 in figure 5.

separated by ca. 1 meter stretch of few finds (Darmark 2018, in press). Each concentration is located in the North and South end of the site. The third and smallest concentration, C, is located 7 m Southwest of the southern concentration B. Here the finds were located in a block-filled gap in connection to a visible rock formation. This concentration has been considered to be different than the 2 other concentrations because of its unusual placement in the topography, and small size in terms of material, as well as the composition of raw material (Darmark 2018, in press). Whereas the 2 larger concentrations consists mainly of flint, this concentration is, in addition to flint, composed of small amounts of quartz and rock crystal of which the total amount is 17 artefacts (see figure 5). The northern concentration, A, is characterized by being the richest in finds (see figure 4), has the largest number of pieces with cortex, and has the majority of the sites' scrapers. The southern concentration, B, is characterised by fewer tools, but also has the most heat-altered pieces of the 3 concentrations (Darmark 2018, in press).

During the excavation, 3 areas were considered to be potential structures. These were on the top of layer 2, and were determined on the basis of color-alteration in the soil or different soil types, or by the placement of stones on the surface (Darmark 2018, in press). See figure 6 for the location of two of these three features. However, after further examination, the excavators re-considered these potential structures and determined they could not be argued as being man-made (Darmark 2018, in press). Despite this, the excavators determined they did not want to abandon them completely, as structures dated to this early period could have lost any observable features.

Based on the spread of the flint material, the excavators determined that the site has not been subject to post-depositional processes. The 3 concentrations are areas of human activity during the period of occupation of the locality (Darmark 2018, in press). The excavators made efforts to find connections between concentration A and B, but the results were negative. Having said this, they did observe several characteristic types of flint, which were recovered from both A and B concentrations (Darmark 2018, in press). Regarding concentration C, the excavators factored in its separation from the other concentrations and concluded that there was no correlation between this cluster of finds and the two other concentrations based in part on the difference in raw material. However they also noted that the topography would make a naturally occurring transport to this location highly unlikely (Darmark 2018, in press).

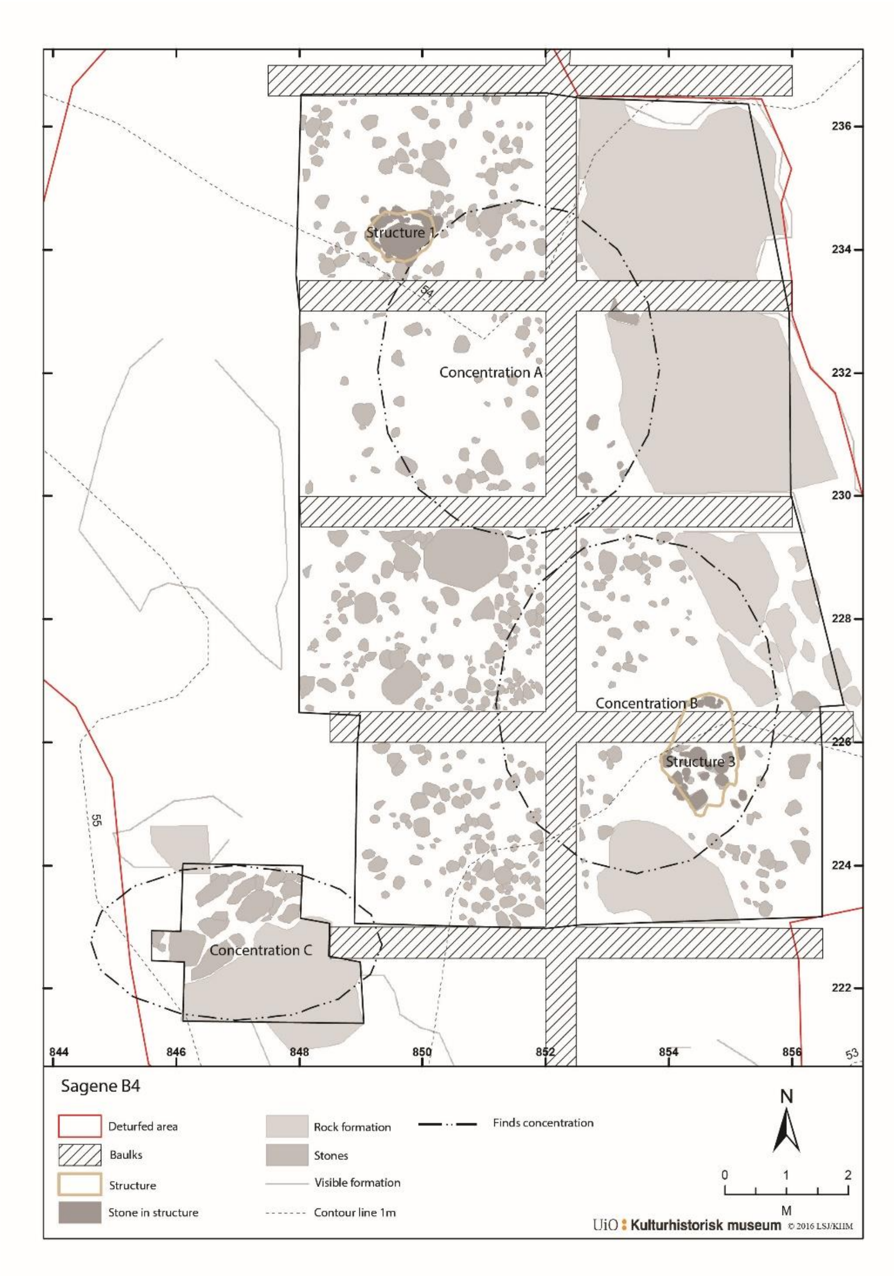


Figure 6. Location of the three concentrations as determined by the excavators and two of the three potential structures. Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

In compliance with the requirements of the project, the lithic assemblage only underwent a morphological examination. Artefacts were classified into different categories based on their morphological attributes. However, the artefacts classified as blades received extra attention. According to the excavators (Darmark 2018, in press), the technology at the site has been interpreted as being towards blade production, as 105 pieces were categorized as blades, and 49 as microblades, all raw materials included (see table 1). All cores and core fragments have been classified as blade cores diagnostic of the Early Mesolithic. These cores and fragments were interpreted to be terminated because they were exhausted, as they show signs of having hinges or plunges.

Table 1. Finds table from excavation. Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

U.nr.	Main category	Quantity	%	Subcategory/comment	Quantity
Secondary working of flint					
1	Arrowhead	1	0,1	Høgnipen?	1
4	Burin	1	0,1		1
2	Microlith	5	0,6	Lanceolate	5
3	Mikroburin	4	0,5		4
5	Blade	6	0,7	With retouch	6
7	Microblade	2	0,2	With retouch	2
9	Flake	8	1,0	With retouch	8
11	Fragment	12	1,4	With retouch	12
13	Chips	2	0,2	With retouch	2
Sum secondary working of flint		**41**	4,9		
Primary working of flint					
6	Blade	103	12,3		103
8	Microblade	47	5,6		47
10	Flake	155	18,6		155
12	Fragment	207	24,8		207
14	Chips	276	33,1		276
15	Core	6	0,7	Platform core	3
16				Core fragment	3
Sum primary working of flint		**794**	95,1		
Sum, flint		**835**	100		
Heat altered flint		*202*	24,2		
Flint with cortex		*151*	18,1		
Prosentage of all lithic finds			*97,9*		
Primary working of rock crystal					
17	Blade	2	14,3		2
18	Microblade	1	7,1		1
19	Fragment	5	35,7		5
20	Chips	6	42,9		6
Sum primary working of rock crystal		**14**	**100**		
Sum, rock crystal		**14**	**100**		
Rock crystal with natural exterior		*0*	*0*		
Prosentage of all lithic finds			*1,6*		
Primary working of quartz					
21	Flake	1	33,3		1
22	Fragment	2	66,6		2
Sum primary working of quartz		**3**	**100**		
Sum, kvarts		**3**	**100**		
Quartz with natural exterior		*0*	*0*		
Prosentage of all lithic finds			*0,4*		
Secondary working of local rock					
23	Whetstone	1	100		1
Sum secondary working of local rock		**1**	**100**		
Sum, local rock		**1**	**100**		
Local rock with natural exterior		*0*	*0*		
Prosentage of all lithic finds			*0,1*		
SUM, ALL LITHIC FINDS		*853*	*100*		

The number of observed tools at the site, 5% of the assemblage, has been classified as being a normal amount for Early Mesolithic sites, which varies between 2 – 7% (Darmark 2018, in press). Though arrowheads are poorly represented in the material, aside from 1 possible Høgnipen point, 4 artefacts have been defined as microburins, which are associated with the manufacture of lanceolate microliths, of which there are 5. However, the excavators did not find any correlations between the microburins and microliths at the site (Darmark 2018, in press). The largest tool category (10) seems to be scrapers or "flakes/blades with retouch" which they have been assigned in table 1 (Darmark 2018, in press). In addition to these, 3 artefacts have been categorised as knives, and one as a burin with a refitted burin spall (Darmark 2018, in press).

To assess the blade technology at the locality, the excavators identified blades by first dividing them up into macro-, narrow (translation of the Norwegian term "smal"), and microblades (Darmark 2018, in press). The dominant category were the macroblades, while narrow blades (delimited as 1- 1,1cm width in Darmark 2018, in press) were under-represented at the site. Thus, narrow blades were considered the focus for production, and were interpreted as having been removed from the site for further use. In addition, the microliths were observed to be manufactured from such narrow blades (Darmark 2018, in press). According to the excavators (Darmark 2018, in press), these various aspects indicate the use of a direct, medium-hard hammer (and instances of soft hammer) knapping technique.

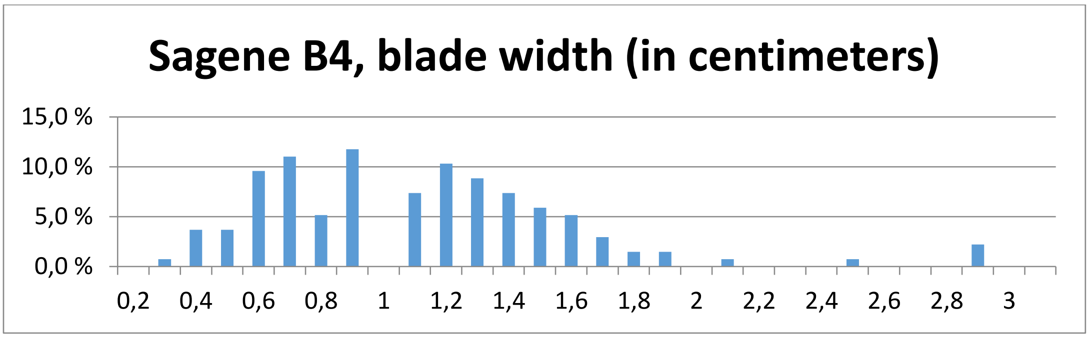


Figure 7. Depiction of the width of excavated blades from Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

It was mentioned briefly above that an attempt was made to study the heat-altered natural stones, but their weathered condition made this rather difficult. The excavators did, however, create a distributional map of their location in relation to the burned flint. As illustrated in the figure below, there is little correlation as the burned flint is concentrated towards the centre of both A and B concentrations[2].

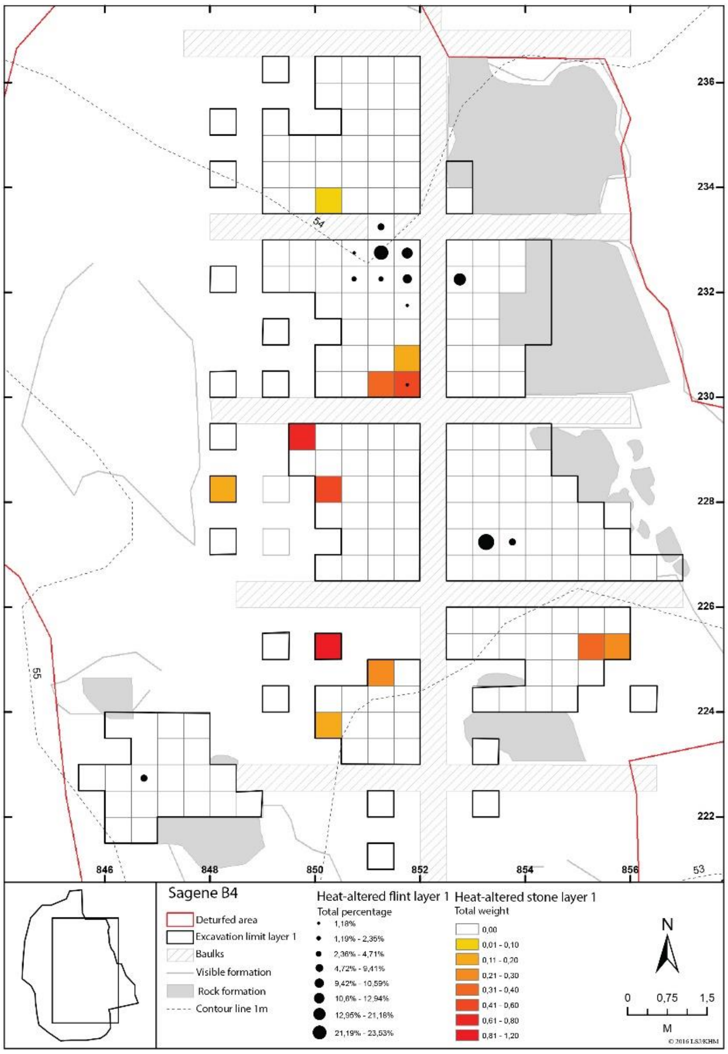


Figure 8. Distribution of heat altered flint and natural stones. Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

On the basis of these initial interpretations of the material made in connection to the excavation, the site has been designated as a short-term specialised locality, with blade manufacture as the main technological industry based on the number of blades and microblades observed. The designation of the site being focused towards a specialised activity was largely based on the 10 scrapers identified, which make up the preponderant of the formal tools found at Sagene B4 (Darmark 2018, in press). Figure 9 shows a selection of these scrapers recovered from the site with dotted lines marking where retouch has been identified.

[2] **NB!** Note that the markers for flint and natural stone represent different values. For the flint, the distribution is marked by total percent, while the natural stone is marked by total weight.

Figure 9. A selection of the scrapers recovered form Sagene B4, Aust-Agder County, Norway. After Darmark 2018, in press.

No individual finds number were assigned to the artefacts. Therefore, it was necessary to rely on the excavators finds table and information written on the finds bags (example, these were labelled as "scraper" or "flake/fragment with retouch") to identify all artefacts they deemed to be scrapers. Figure 10 depicts the total amount of artefacts classified by the excavators as scrapers, identified in the present study, based on the information available.

Figure 10. The 10 assumed classified scrapers from Sagene B4, Aust-Agder County, Norway. Photo by author.

With these interpretations as a point of departure, the focus of the present study will encompass an intensive refitting examination within the framework of a *chaîne opératoire* analysis, to investigate outstanding questions regarding this Early Mesolithic site of Sagene B4. Further, the results from the examination will be included in a discussion surrounding how the findings from this study can contribute to the existing image of Early Mesolithic we have today, and hopefully how smaller sites can provide additional perspectives in Stone Age research, as noted previously (see introduction).

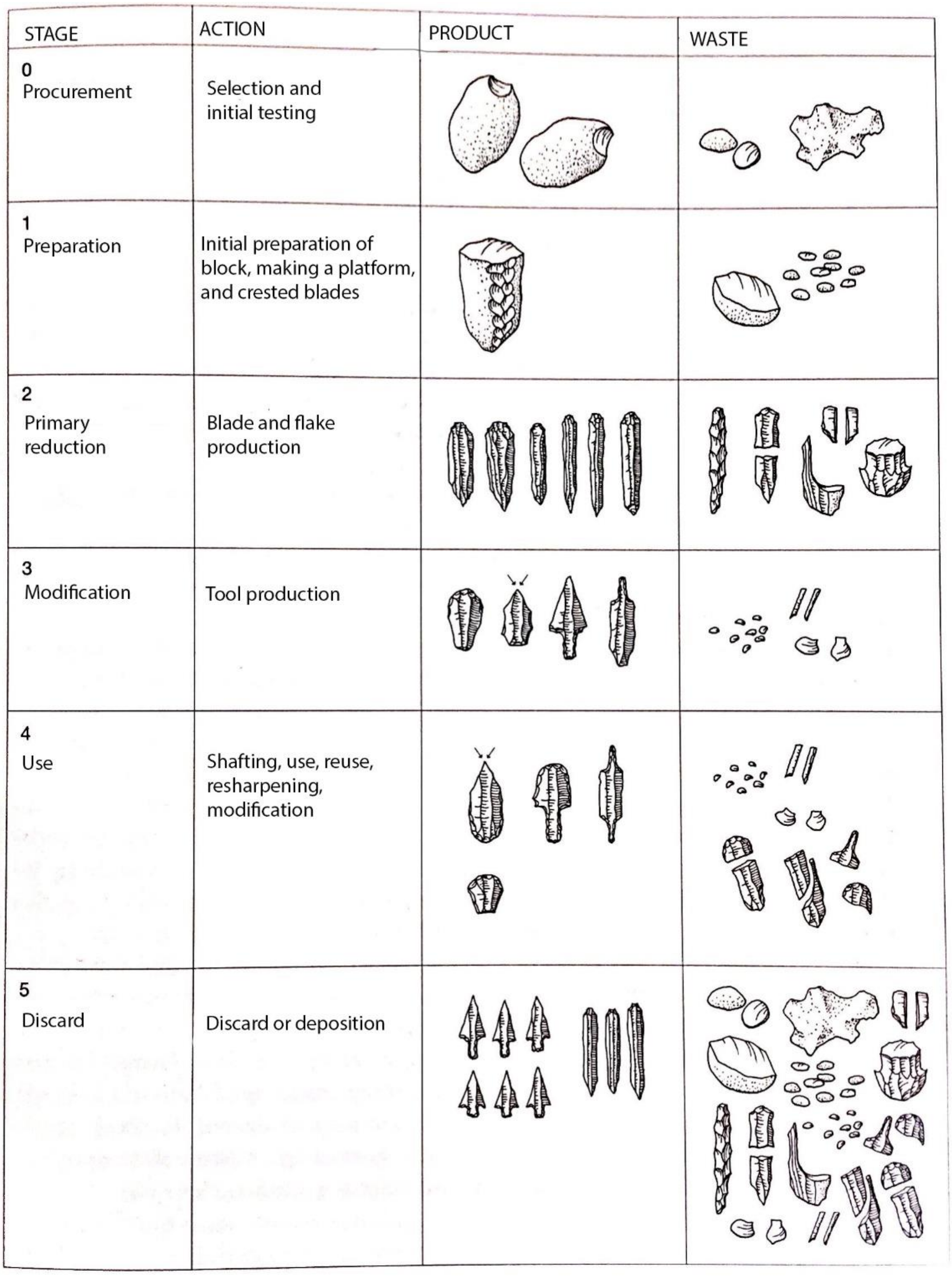
ANALYSIS OF SAGENE B4

A *chaîne opératoire* analysis, specifically utilising refitting as a means of tracing prehistoric behaviour, will be employed in this investigation. The intent of this study was to recapture as complete as possible an understanding of the lithic technology and the activities occurring on the site of Sagene B4. The intent is to demonstrate that by using this approach a great deal more information can be gleaned by conducting a technological analysis of the finds, even from a small site, which usually receive less attention within large projects.

Chaîne opératoire

An initial definition of the term can be said to be the operational chain raw material undergoes in the process of being transformed from a block of stone into a cultural product. This process includes all stages from procurement, manufacture, use and discard of material (Schlanger 2006:25; Inizan et al. 1999:14).

There are 6 separated stages to follow, and each of these has distinct artefacts for identifying which stage is present. The first stage is 0) procurement. This entails the localising of desired raw material, either local or exotic material, as well as the initial testing of nodules. Local material is when the source is in close proximity of the knapper, and exotic is raw material gained through social networks between groups. The material remains of this stage is represented by unused nodules and corticated flakes, where the entire outer surface is covered by cortex (Eriksen 2000:80). This stage is followed by 1) preparation. This is the shaping out of a core as well as the making of a platform for the production of desired products. The material remains after this stage is often prepared blocks and flakes with parts of the outer surface covered in cortex (Eriksen 2000:80). The third stage is 2) primary reduction, where the production of blanks such as blades of flakes for tool production, is carried out. Crested blades, platform flakes, blanks as well as exhausted cores represent material remains from this stage (Eriksen 2000:80ff). After this comes 3) modification. This is the stage where tools are fabricated. The remains from this stage entails amongst others retouch chips, microburins, partially modified or broken blanks (Eriksen 2000:82). This stage is followed by 4) use. This is the use of artefacts and entails hafting of tools, reshaping, and the reuse of tools. It is represented by several of the same artefact as the previous stage, but with more modification flakes from tools (Eriksen 2000:82). The final stage is 5) discard. This stage is where the material is considered not further usable and therefore discarded. The material remains is represented by a fair share of the abovementioned representations, such as exhausted cores, broken blanks and tools, etc. (see figure 11).



STAGE	ACTION	PRODUCT	WASTE
0 Procurement	Selection and initial testing		
1 Preparation	Initial preparation of block, making a platform, and crested blades		
2 Primary reduction	Blade and flake production		
3 Modification	Tool production		
4 Use	Shafting, use, reuse, resharpening, modification		
5 Discard	Discard or deposition		

Figure 11. Chaîne opératoire stages. Own translation from Eriksen's model, 2000: fig. 1.

Thereby, a *chaîne opératoire* analysis is applied to the study of lithic assemblages with the intention of structuring these successive steps in a socially embedded technical context (Inizan et al. 1999:14), thus gaining a better understanding of the use of material and the technological approach at the site. The approach incorporates the human aspect in the production and use of artefacts (Andrefsky 2008:68), for example, the choices and actions within manufacture, and level of skill of the manufacturer and/or user. The knapper must take into consideration the nature of the lithic material, such as size, shape and quality. Therefore, a plan of execution and a vision of the finished product is an important part of the production process (Eriksen 2000:75). As a methodological framework it is efficient for tracing and reconstructing the production and use of prehistoric artefacts, as well as being a perspective where one can gain an understanding of the technical activities' role in past human societies (Schlanger 2006:26). It provides detailed and quantifiable data on an artefacts' life-history, as well as on the series of technical operations raw material goes through in the process of being transformed into cultural products (Dobres 2000:167). This definition shows how such an approach differs from the initial examinations used in large projects today, in that it strives to explain and understand the archaeological material beyond aiming at observing and describing attributes and typological features.

Within an analysis of an artefacts' life-history, the *chaîne opératoire* is a tool for identifying and describing actions and choices made in the course of production, use and repair activities (Dobres 2000:164). In the view that technology is a culturally embedded activity, as it is done in a peopled context, and therefore entails social relationships (Dobres 2000:165, 167), it encourages to view the operational sequences as part of the social reality (Martinón-Torres 2002:34).

With this as a foundation, *chaîne opératoire* will be used in the present investigation as a perspective on how the material is viewed and investigated during the analysis. It will be utilised as a tool for providing the material and technology with a socially grounded context, as it offers a chance to view the material in a dynamic way, as well as the choices and actions involved in its transformation from a natural resource to a cultural product.

Refitting

To achieve these goals refitting will be applied. Refitting can be described as the process of fitting together knapped pieces of a lithic assemblage to reconstruct the operation steps of a reduction sequence of a given material (e.g. Eriksen 2000:84; Karlin, Bodu and Ploux 1987:144; Inizan et. al. 1999:96). Refitting has altered the perception of stone artefacts and lithic industries from being immobile, static materials to being viewed as evidence of human behaviour, since refitting artefacts is exactly the inverse of the prehistoric technicians' actions

(Cahen 1983:1). In other words, by refitting artefacts that were knapped, actual accounts of actions that took place in the past are being reconstructed. Going from a collection of artefacts where the artefacts can only be viewed individually to groups of refitted artefacts provides a much better understanding of the what the original knappers were attempting to accomplish. Methods and technological choices become evident when artefacts are refitted, as the successive operational steps are now visible. Thus allowing one to use the evidence made discernible through the refitting for interpretations of the material as well as the process it undergoes from being transformed within a technicians envisioned context. In this way, a more confirming view of what the material can portray of actions taking place at a locality is made possible.

The benefits of the approach has shown to provide information on sites and the human activity happening there otherwise lost for us today. For other similar studies carried out on material from southern Norway see Skar and Coulson (1986), Fuglestvedt (2007), as well as other Masters theses (e.g. Eliassen 2015; Gonzáles 2014). A key factor for revealing the information is to be as methodical and meticulous as possible. The way an excavation documents the finds, largely affects a refitting study. As mentioned above, the use of excavated materials from this project provided detailed information, facilitating a thorough examination of this assemblage.

The method is valuable particularly when studying lithic technology. A common practice within refitting studies is to illustrate the distributional patterns and overall spread of the material with the purpose of highlighting movement of the material. By doing this, one can connect the refitted artefacts and discover any potential spatial organisation at a locality, specific activity areas and trace where knapping took place (Ballin 2000:107, 115). This in turn can be used to interpret how a group organised their occupation, for example, where the different steps of production took place, where they had a fire and where they put up shelter, as well as shed light on potential post depositional disturbances (e.g. Baales 2001:135ff; Vaquero et. al. 2017:266-278). Refitting has also resulted in the identification of individual knappers based on idiosyncratic traces revealed through applying the method to the material (e.g. Cahen and Keely 1980; Skar and Coulson 1986; Karlin, Bodu and Ploux 1987).

By conducting the refitting analysis within a framework of a *chaîne opératoire* analysis, the results from the examination can be viewed and interpreted beyond descriptions of tools and typology. It is a way of reconstructing what the occupants of the site were actually doing at the site by assessing the refitting in a social perspective. The study will utilise the abovementioned model (figure 11) of *chaîne opératoire* stages to identify which of the different stages are present in the material. It is anticipated that the results generated from this study will contribute to increase our understanding of the behaviours of the early inhabitants of the Mesolithic as illustrated at the site of Sagene B4. In addition to this, facilitate an assessment of how lithic analyses can benefit the study of excavated assemblages, as well as contribute to the knowledge of Sagene B4 and its associated technology.

Material selection

The selection of material for this thesis are the lithics gathered from the excavation of Sagene B4. The main focus is on the flint material as this consists of 98% of the entire collection. In addition, the rock crystal received a cursory overview. The entire flint assemblage was not, however, a part of the analysis. Excluded from the material were the artefacts classified as “chips” (own translation form the Norwegian term “splint”) from the excavation, as these are very small in size, no larger than 10mm. The reason for excluding these artefacts was based on the time limitations of the study, as these make up a total of 289 pieces (34%) of the flint material. Instead the focus was on the larger artefacts, where the possibility for finding refits and acquiring additional understanding of the knappers intentions is much higher. However, two of the chips did have retouch and were thus examined, which resulted in a refit. In total 568 lithic artefacts were included in the refitting analysis, which make up 66,5% of the 853 excavated artefacts. With this said, the chips were examined for gaining exact numbers of corticated and burned artefacts. For the purpose of consistency when defining the material from Sagene B4, the study will follow the definitions of technology and terminology of knapped artefacts determined by Inizan et al. (1999).

Procedure

The refitting analysis took place over a 12 week period. This included preparation stages such as creating a database, and assigning an ID number to each artefact. Before the actual refitting examination could take place, it was important to conduct some preparatory work. This stage consisted of constructing a digital database for the material. This entailed documenting all relevant information from the excavated finds, as well as assigning the contents from each finds bag an individual ID number. The excavation at Sagene B4 gave a very detailed documentation of the material, including the museum catalogue number of the excavation, classification number, coordinates for the quadrant as well as which layer the finds were found. In addition, the raw material and what classification the artefacts were assigned were on the bags. For the purpose of the present study, the individual ID number was also written on the artefacts. In addition to this, the artefacts where photo documented, with a purpose of having an extra back-up, in case the marking on the artefacts partially or completely vanished during the course of this investigation.

An initial step in the examination was to place the collection onto A4 sized sheets of cardboard, oriented according to the direction of removal, proximal end upwards and always the same face facing up. This was done for easy access and sorting of the various groups between refitting sessions, as well as permitting related materials to be viewed from different angles. Then the collection was separated into fragmentary and complete artefacts to facilitate the mending of broken artefacts. The fragmentary artefacts were laid out with the broken ends facing each other. These fragmentations can be the result of post-depositional disturbances such as trampling, breaks occurring during the excavation, or they can be intentional breaks made by the knapper. Starting a study with this initial "mending" stage provides larger surfaces to work with during the refitting, by beginning with more complete artefacts. During this step, I had a chance to get an initial impression of the attributes and characteristics of the material as a whole, which in turn laid the foundation for how the examination proceeded.

To assure the entire collection received equal attention and was given a range of possibilities to refit, the collection was sorted and rearranged in the following ways. Firstly, the collection as separated into different groups based on similar hand specimen characteristics, which later were deemed as separated flint groups. Any artefacts not fitting into any one of the groups were placed together initially as a miscellaneous group, which could be referred to or re-examined later, if needed. Then the material was reorganised according to their find location. The material was spread out based on the horizontal spread of where the artefacts were recovered, with the purpose of observing any refits based on proximity between the artefacts. After this, the material was again reorganised, this time focusing on similar attributes, such as cortex and inclusions. Up until now, the material had been examined with the dorsal face facing up, but the final step of the examination was to turn artefacts over so that the ventral face was now facing up. This gave an entirely new perspective for further observations and possible refits. Within this step, artefacts with visible butts were placed together, as similar butts can indicate that artefacts originate from the same core and knapping sequence.

When, after twelve weeks, the number of refits per day drastically decreased, and the material had undergone all abovementioned strategies, it was decided to end the examination and focus on the results it had yielded. It should be mentioned here that despite formally ending the examination, some refits were made after this, since the material was still handled after the examination in connection to among other things photographing the refits. I also found it hard to not investigate when I suspected possible refits.

This chapter has presented the approach of the analysis of this thesis. The focus has mainly been on the flint material at the site, examined for refits within the framework of *chaîne opératoire.* The goal has been to achieve as many refits as possible between the artefacts included in the study. By approaching the material in this manner, the aim was to gather as much additional information inherent in the material that goes beyond morphological attributes and typologies. The entire assemblage was initially examined, and out of the 853 excavated artefacts, 586 were chosen to be a part of this study, excluding primarily artefacts smaller than 10 mm, as well as other raw materials than flint. The refitting examination took 12 weeks, and resulted in 65 refit groups, as well as other observations and assessments of the collection, which will be used to interpret Sagene B4 and discuss how the site compares to other excavated Early Mesolithic sites in southern Norway.

RESULTS FROM *CHAÎNE OPÉRATOIRE* ANALYSIS

This chapter will cover the results of the refitting analysis. The results will be presented in a way so that each flint group (here defined as groups of lithics that share similar hand specimen characteristics) is separately covered, before moving on to the refit groups (a group of lithics that refit together). The presentation of the refit groups is divided up into different categories of what they represent, which will be discussed in the next chapter. Each category will be exemplified by a specific refit group that I consider to be the best example of the given category it represents. The presented refit groups will be incorporated in a discussion in the next chapter, where interpretations will be drawn regarding the activity at Sagene B4, before discussing how these findings fit into the current perception of the Early Mesolithic in southern Norway

The separate flint groups were distinguished in the initial stages of the examination as a means to get an overview of how many different blocks were brought and worked at Sagene B4. A total of 7 distinguishable flint groups were determined based on hand specimen characteristics (colour, texture, grain size, translucency and inclusions), as well as taking into account their finds location. These conditions, especially colour and texture, made the separation significantly easier. However, since flint is seldom homogenous when it comes to these hand specimen characteristics, it is likely that some of the flint groups could have come from the same block. Having said this, the groups are separated on the strictest basis of the previously mentioned conditions. They may be able to be joined together, but for the purposes of this analysis it is thought wise to leave them separated and potentially combine them at a later point. The refitting examination worked with these separated flint groups as a starting foundation to allow this material to be given the best possible chance for successful refits.

The analysis resulted in refits of 187 of the 568 artefacts, which amounts to approximately 33% of the chosen material, or roughly 22% of the entire excavated assemblage. A total of 65 refit groups were established, varying from 2 to 11 artefacts in each group. 3 different types of refits were distinguished: reduction sequence, breakage and thermal fracturing. By preliminary impressions of the assemblage, the knapping debitage can be described as mainly consisting of flakes and flake fragments based on general morphology of the assemblage, with inclusions of blades and tools. As the material was studied through a technological analysis as well, this resulted in new classifications of the assemblage (see table 2).

Table 2. Finds table from this study. Sagene B4, Aust-Agder County, Norway. Table by author.

Main category	Quantity	%	Subcategory/comment	Quantity
Primary working of flint				
Blade	34	3,9	With refits: 28	
Microblade	9	1,0	With refits: 7	
Flake	194	22,7		
Fragment	301	35,2		
Chips	269	31,5		
Core	3	0,3		
Core fragment	2	0,2		
Sum, primary working of flint	810	94,8		
Secondary working of flint				
Burin	1	0,1		
Point	2	0,2		
Microlith	6	0,7	Lanceolate	6
Flake	2	0,2		
Fragment	2	0,2		
Scraper	5	0,5		
Knife	2	0,2		
Chips	2	0,2		
Sum, secondary working of flint	23	2,3		
Sum, all flint	**835**	100		
Flint with cortex	121	14,4		
Heat altered flint	123	14,7		
Primary working of rock crystal				
Blade fragment	2	0,2	With refits: 1	
Fragment	5	0,5		
chips	7	0,8		
Sum, primary working of rock crystal	14	1,6		
Sum, all rock crystal	**14**	100		
Rock crystal with natural exterior	-			
Primary working of quartz				
Flake	1	0,1		
Fragment	2	0,2		
Sum, primary working of quartz	3	0,3		
Sum, all quartz	**3**	100		
Quartz with natural exterior	-	-		
Secondary working of local rock				
Whetstone	1	0,1		
Sum, secondary working of local rock	1	0,1		
Sum, all local rock	**1**	100		
Local rock with natural exterior	-	-		
SUM, ALL LITHICS	**853**	100		

Flint groups

Flint group 1: This group consists 81 artefacts (see figure 12). It is a grey, fine-grained flint, with different inclusions in parts of the material. On some, there is a stripe of red going across the surface, while other artefacts have inclusions of chert. The material is overall opaque with a smooth surface. The cortex in this group has weathered to a uniform smooth nature, in addition several artefacts are patinated. In this group, 15 refit groups were made with 48 artefacts, where the majority of refits were between heat-fractured artefacts with cortex. There was some difficulty initially assigning some of the artefacts, as there are several with color alteration, as well as some artefacts having intricate inclusions. As seen in figure 13, this material is mainly located in the North end of the site, in concentration A, with a few artefacts scattered elsewhere.

Figure 12. Flint group 1, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

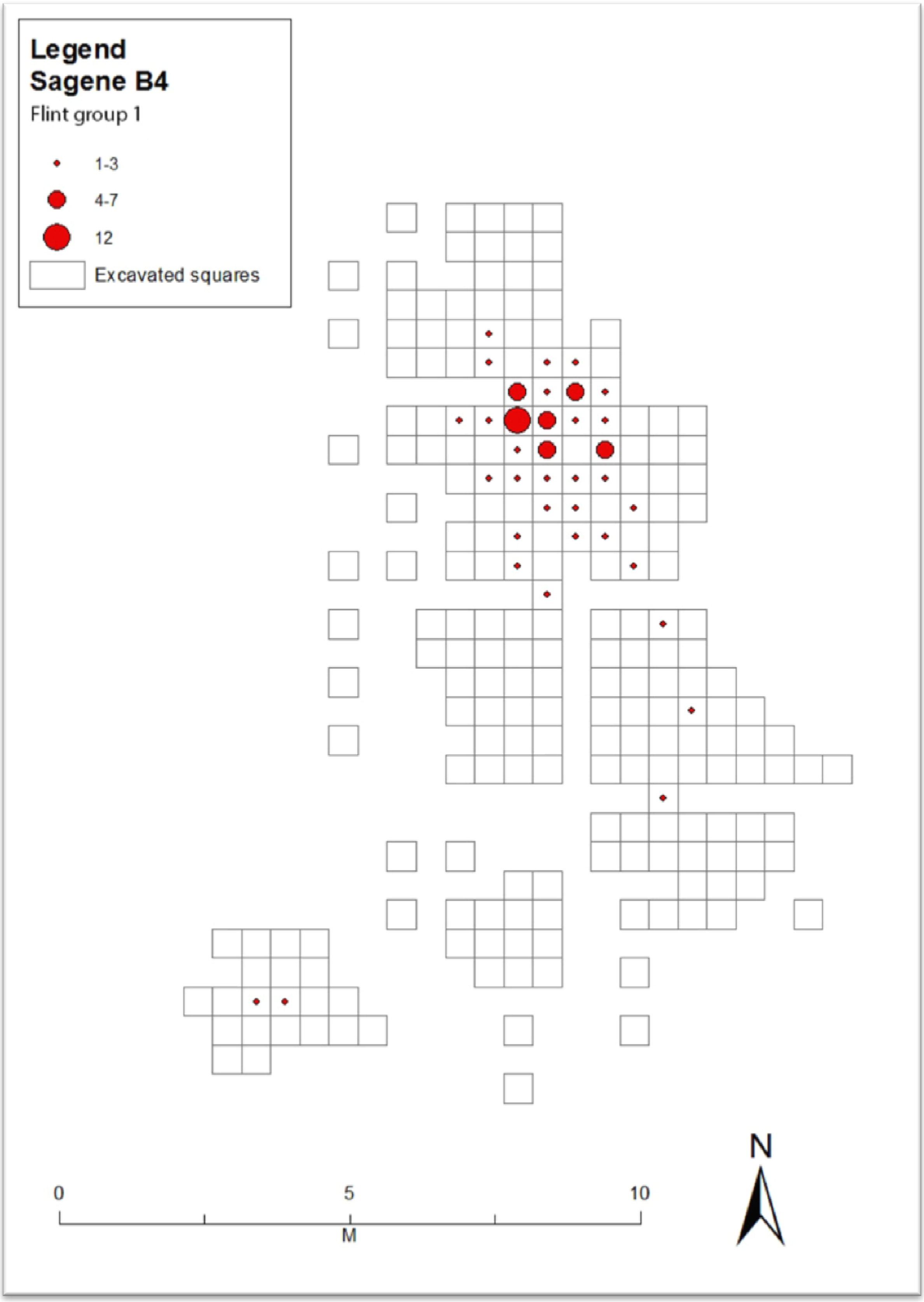


Figure 13. Spread of flint group 1 at *Sagene B4, Aust-Agder County, Norway*. Illustration by author.

Flint group 2: There are 92 artefacts in this group (see figure 14), making it the largest flint group in the study. The material consists of artefacts in dark grey to black raw material, with some inclusions of lighter specks throughout. The texture is smooth as the material is of fine-grained flint, with a translucent characteristic. In addition, the cortex in this group is of a coarse nature. The total amount of refit groups here was also 15, with 40 artefacts. There was greater ease determining which artefacts belong in this group, since the artefacts are mostly consistent in colour and texture, and the remaining material does not display as dark a color as this group. This material is mainly divided between the 2 larger concentrations, with some artefacts in concentration C, although the majority is located in concentration A (see figure 15).

Figure 14. Flint group 2, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

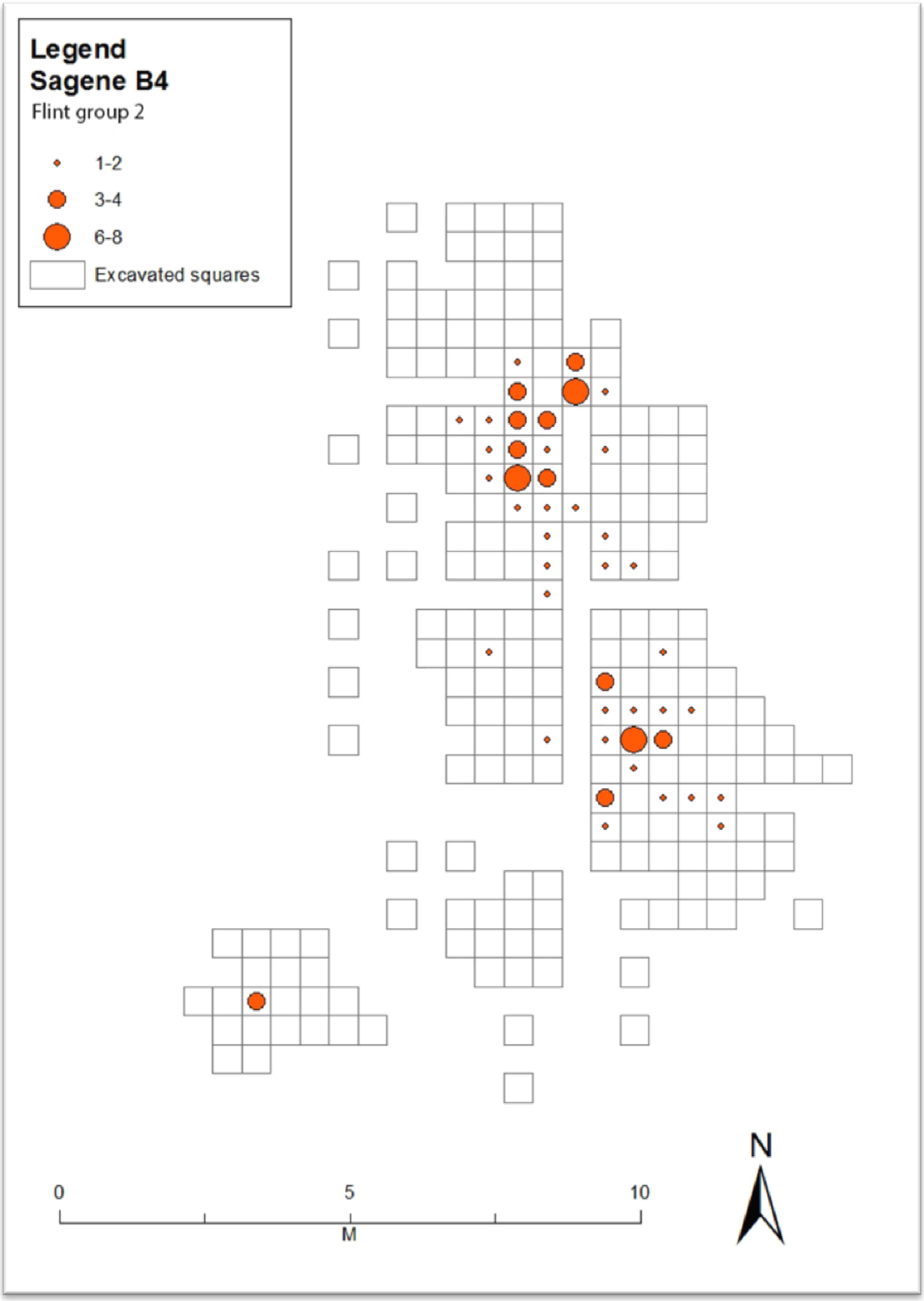


Figure 15. Spread of flint group 2 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Flint group 3: This group consist of 73 artefacts. As seen in figure 16, this flint group is grey in colour with no visible inclusions. It is a large grained material of an opaque character. This group has very few artefacts with cortex, but from the ones that do the cortex is of a smooth type. A total of 11 refit groups were made in this group, with 32 artefacts. Most of the refits were made between fractures due to heat alteration, indicating that parts of the material in this group was at some point in contact with a heat source. This group was largely separated based on its opaque, large grained nature, and was easy to determine. The material is mostly located in concentration B, but also present to some extent in concentration C. There are also individual artefacts towards the North of the site (see figure 17).

Figure 16. Flint group 3, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

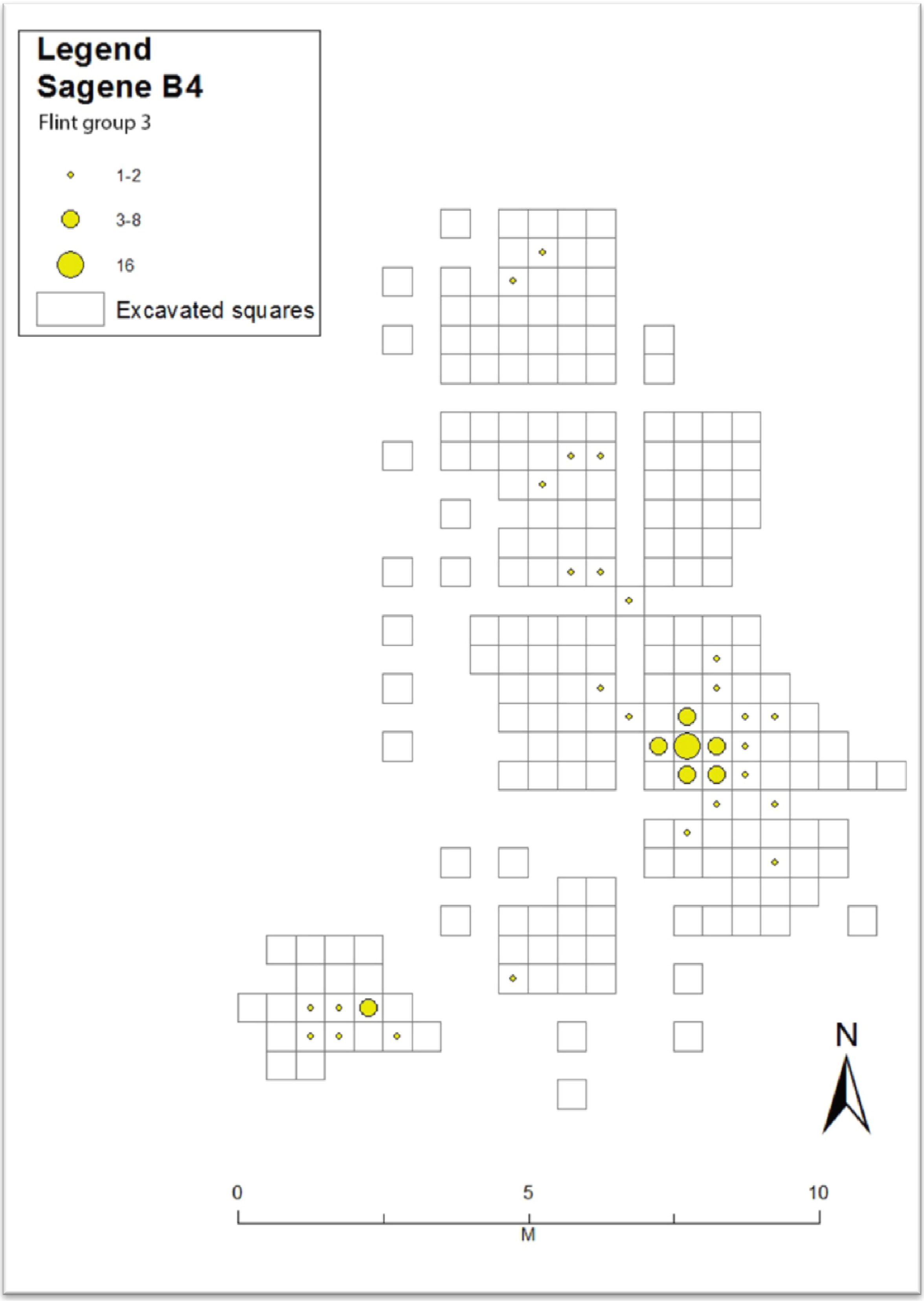


Figure 17. Spread of flint group 3 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Flint group 4: There are 75 artefacts in this group (see figure 18). The material has a very light grey/blue colour, with an opaque character. The inclusions mostly consist of larger patches of chert and cream-colored to white specks. The texture is a smooth, fine-grained material. As with flint group 3, this material has little cortex to go by, but also here it seems to be of a smoother type. In this group, a total of 8 refit groups were made with 22 artefacts. It was overall easy to determine the artefacts belonging to this group because of their light color, but some were added later as they were more closely examined. The material is located in both concentrations A and B, with the largest amount in the South end of concentration A. No artefacts in this group were found in concentration C (see figure 19).

Figure 18. Flint group 4, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

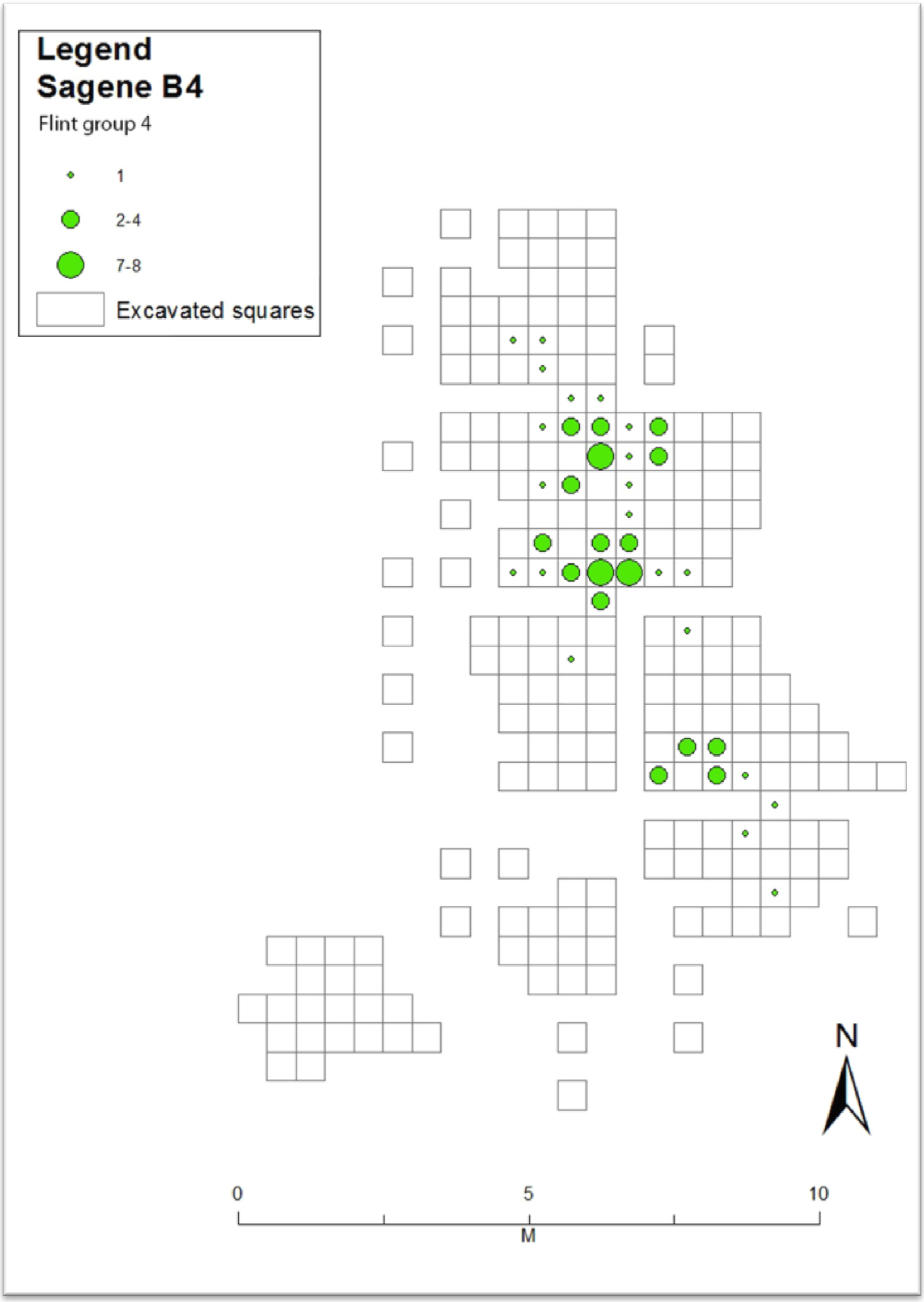


Figure 19. Spread of flint group 4 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Flint group 5: There are a total of 31 artefacts in this group (see figure 20). The material is sandy beige in colour. It is a fine-grained flint with a smooth texture. There are few inclusions apart from a distinctive white stripe on some of the artefacts and others displaying patches of white. The material is of a semi-translucent character. None of the artefacts in this groups have cortex. Four refit groups were made, with 12 artefacts. There was some trouble discerning the difference between some of the artefacts in this group and flint group 6, as they display similarities in hand specimen characteristics, so the final separation was based on the differences in grain size. This flint group is mainly located in concentration A, with a few artefacts in concentration B, and a single artefact in concentration C (see figure 21).

Figure 20. Flint group 5, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

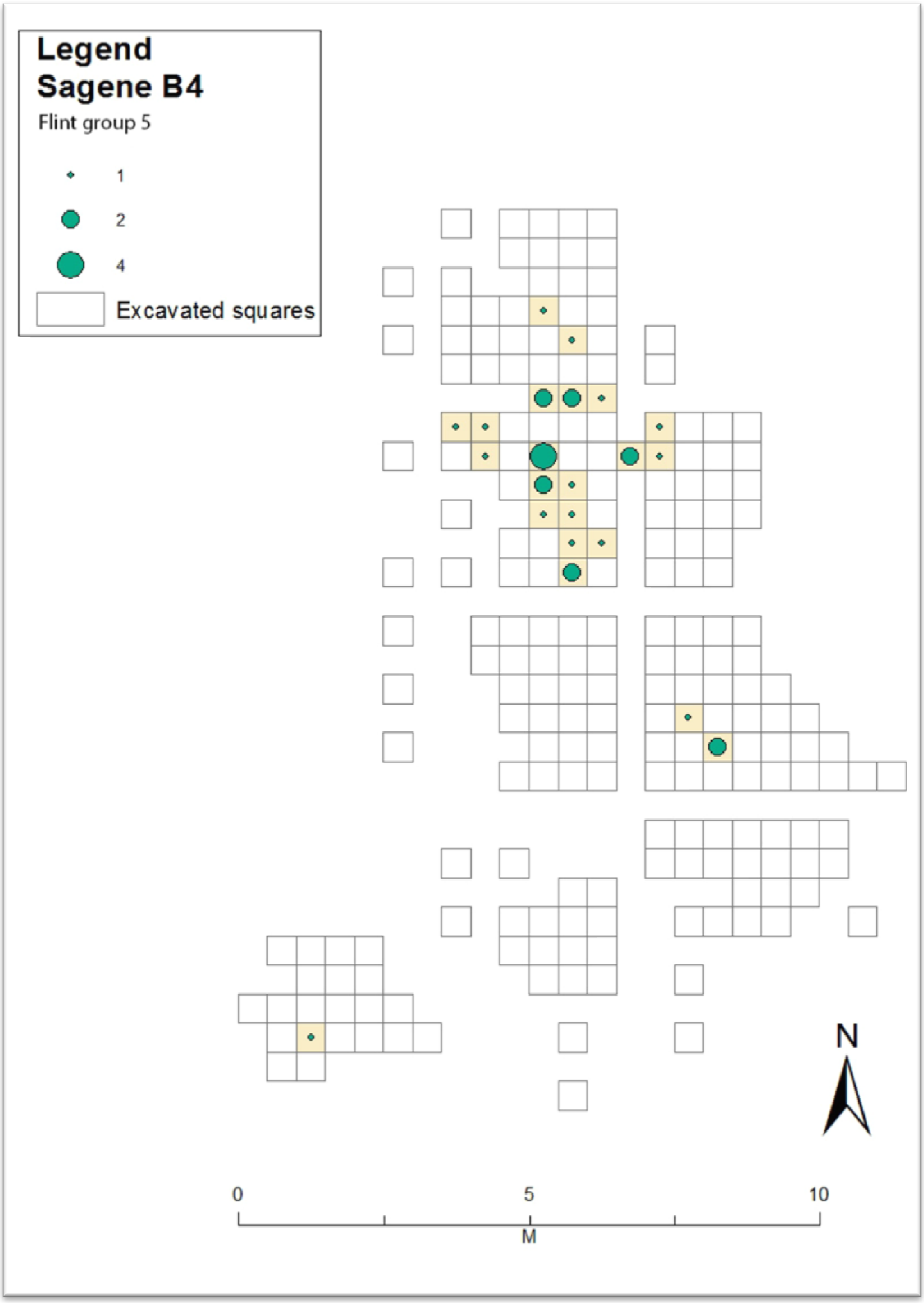


Figure 21. Spread of flint group 5 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Flint group 6: There are 40 artefacts in this group (see figure 22). This flint group is similar to flint group 5 as mentioned, although what sets them most apart is the texture. Both groups are sandy beige in colour, but the material texture is coarser where this is more large-grained than the latter group. Also, there are some patches of chert on some of the artefacts, as well as other inclusions which consists of lighter specks and small stripes. It is of an opaque character, with what seems to be a coarse type of cortex based on the few instances where there is cortex. It is possible that this group and flint group 5 originate from the same core, but for the time being these groups will be viewed separately. This flint group had 13 refits divided in 2 sets of artefacts. The artefacts in this group are mostly located in concentration A, with some additional artefacts in concentration B. One artefact was excavated in concentration C (see figure 23).

Figure 22. Flint group 6, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

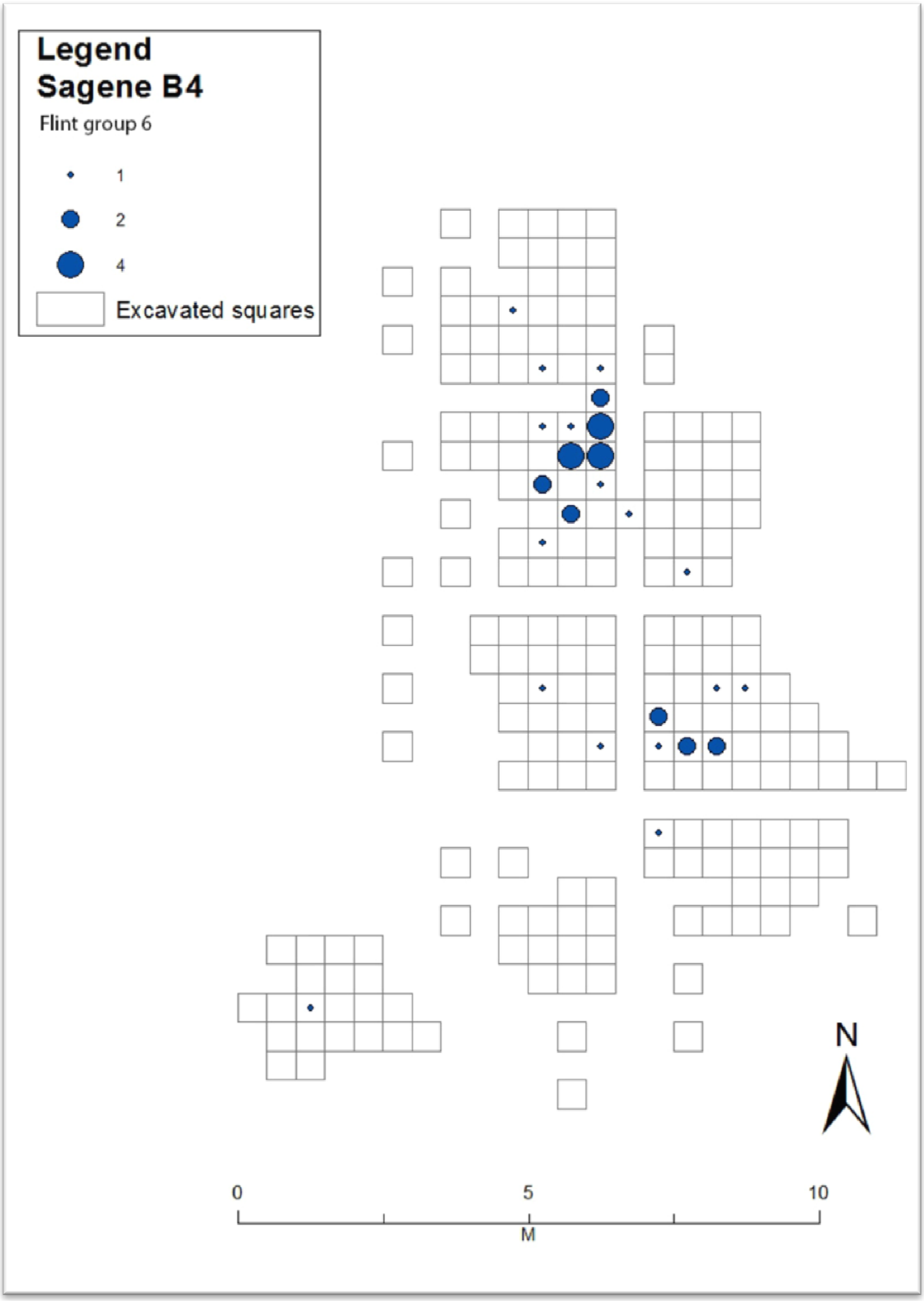


Figure 23. Spread of flint group 6 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Flint group 7: This group has 37 artefacts (see figure 24). The material is dark in colour; more brown and grey than black. It is of a fine-grained material, smooth in texture. There are inclusions, lighter specks on some of the artefacts. The flint is of a translucent character. Few artefacts have cortex, but from what is there this cortex seems to be of a smooth type. This material has similarities to core group 2, but for the purposes of this study these groups will remain separated based on the differences in hand specimen characteristics described here. This group has 4 refit groups, with a total of 13 artefacts. It was relatively difficult to separate this group from flint group 2, but during the study these artefacts were deemed as different mainly based on the difference in colour. There are also several artefacts displaying evidence of being exposed to a heat source. The artefacts in this group are divided between the two larger concentrations A and B, with more material in concentration A (see figure 25).

Figure 24. Flint group 7, with refits at Sagene B4, Aust-Agder County, Norway. Photo by author.

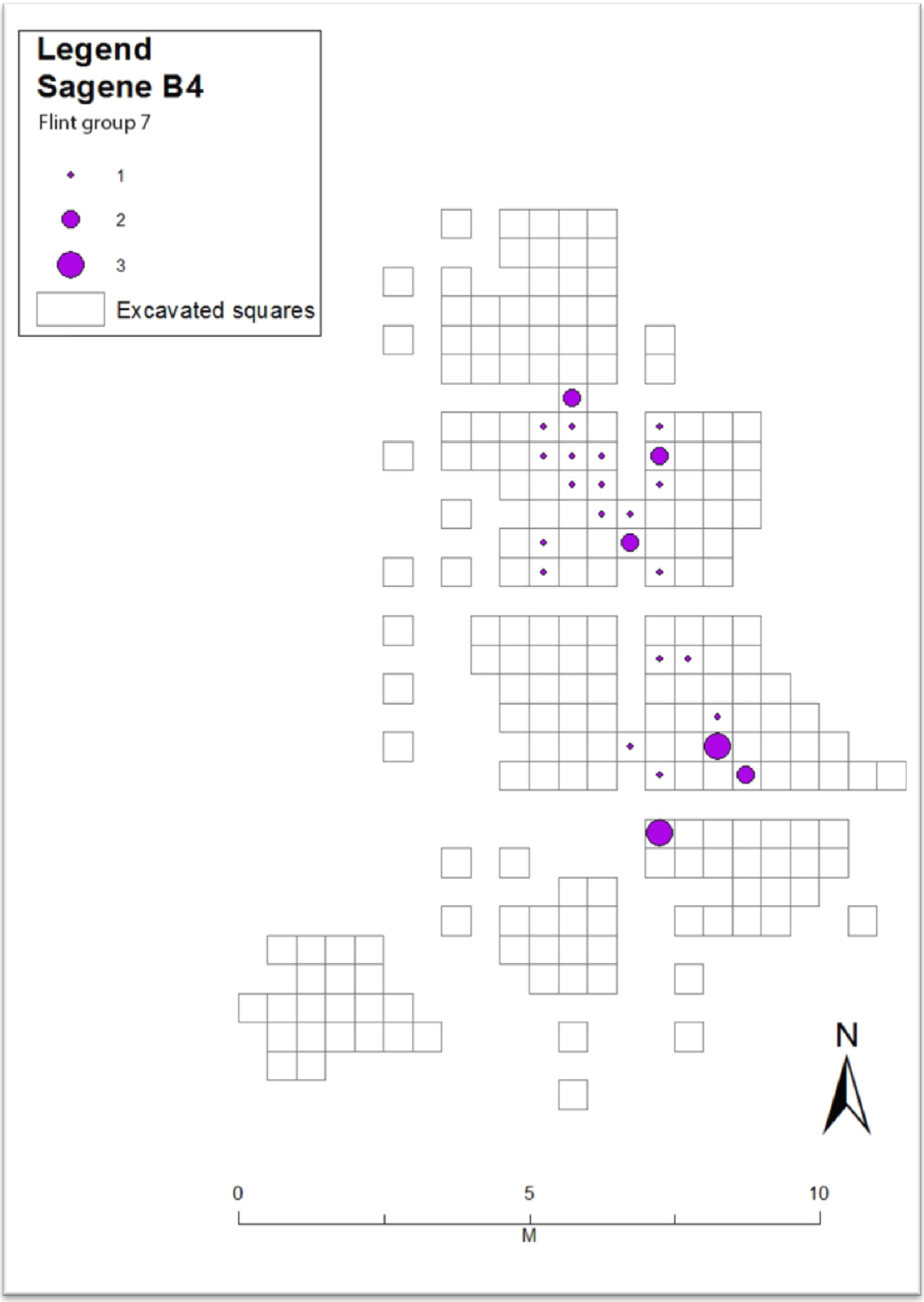


Figure 25. Spread of flint group 7 at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Refit groups

A selection of the refit groups, the ones that are relevant concerning the activities and occupation at Sagene B4, will now be presented in different categories. Not all refit groups will be presented here as there is overlap as to the results, so only the best examples will be given. However, for a presentation of all refit groups with associated find information and ID number, see the appendix. Each refit group is named after the flint group in which it belongs, in addition each refit group within a flint group has an individually designated number. For example, the first refit group on flint group 2 received the number 2.1. Also, from this point onward, when referring to specific artefacts that were a part of the refitting examination they will be referred to as "ID [number]". This will be done because every artefact presented will have the given ID number on the figures in the text. This way, it is easier for the reader to know specifically which artefact is being discussed.

Core and refitted debitage - Refit group 6.1

Refit group 6.1 is the largest refit group from this study and consists of 11 artefacts; blade fragments, shatter fragments and 2 core fragments (see figure 26). By morphological attributes and the sequencing demonstrated by the refitting, this group has been designated to be blade debitage through this analysis. Besides shatter fragments refitted in this group, the artefacts conjoined to the core fragments were all fragments of blades, mostly the proximal sections (ID: 41, 117, 147, 536, 70, and 114), struck from the same direction. These blade fragments have parallel sides, and either parallel or subparallel dorsal ridges. Based on the negative scars left on the core fragments by the removals, the fragments also seem to be at least twice as long as they are wide. ID 464 could be a fragment of a severely plunged flake, potentially the distal section to ID 114, but since no medial section was refitted this remains a speculation. If it is, then ID 114 is not a blade fragment. This is a single platform core as the refitting shows that all removals are from the same direction. The refitting between the two core fragments ID 561 and ID 564 demonstrates that the original core was larger when this sequence started, and that the discard of the core was most likely due to a plunge removal leading the core to exhaustion.

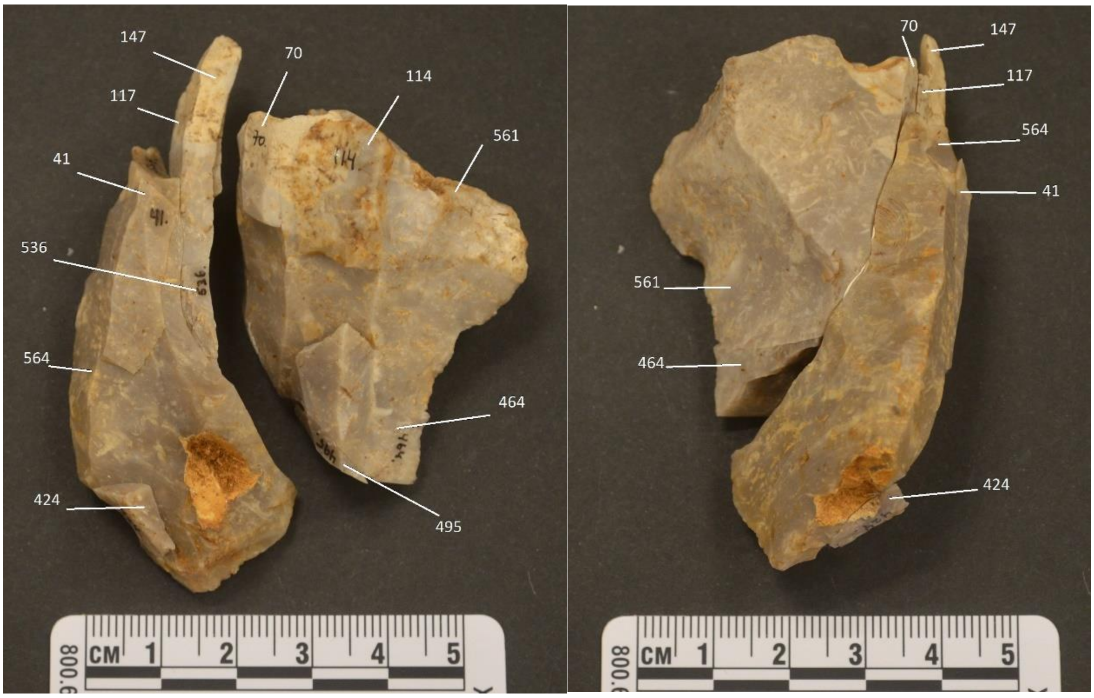


Figure 26. Refit group 6.1 seen from 2 different sides. Sagene B4, Aust-Agder County, Norway. Photo by author.

This is only 1 of 2 refit groups where cores could be refitted with adjoining flakes. The second one had two refits, both with waste products which were small in size (see refit group 4.1 in appendix). Therefore, it was deemed unnecessary to illustrate that group further here.

The spread of the artefacts in refit group 6.1 indicates that all artefacts were knapped within 3m² of concentration A, all located towards the Southwest except ID 70, (see figure 28) indicating that the sequence was conducted at this end of the locality.

Flaking sequences - Refit group 5.1

This group consists of 6 artefacts from core group 5, all of which have been classified as flakes with or without retouch in the course of the present examination (see figure 27). Three of the artefacts were classified as tools by the excavators; 2 scrapers (ID 343 and ID 345) and a knife (ID 179). The remainder were classified as blades (ID 111, ID 67 and ID 68). Through refitting, it became evident that the artefacts were struck from different directions from the core, indicating that these were not a part of blade production, but a flake sequence. As illustrated in figure 27, the artefacts were all struck from a different direction, although ID 67 (refitted with ID 68) and ID 345 (refitted with ID 343) seem to have been struck from the same direction. In addition, this analysis revealed that the 2 scrapers were in fact 1 scraper which had sustained a break. Also, the interpretation of these removals as blades must be questioned based on the striking direction.

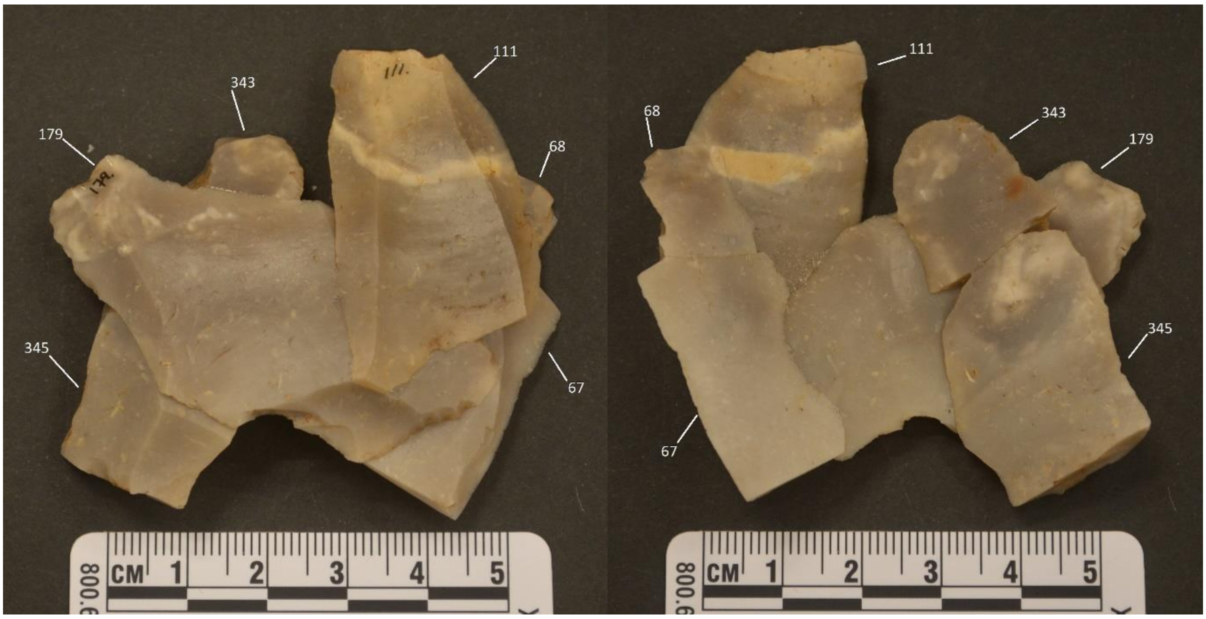


Figure 27. Refit group 5.1. Left: dorsal face. Right: ventral face. Sagene B4, Aust-Agder County, Norway. Photo by author.

The artefacts in this refit group were all excavated within concentration A (see figure 28), towards the Southwest, the same location as refit group 6.1. This suggests that this finds concentration could have been a designated knapping area at the site during occupation, which will be discussed further in the next chapter.

For other groups representing a flake sequence, see refit groups 4.8 and 5.2 in the appendix.

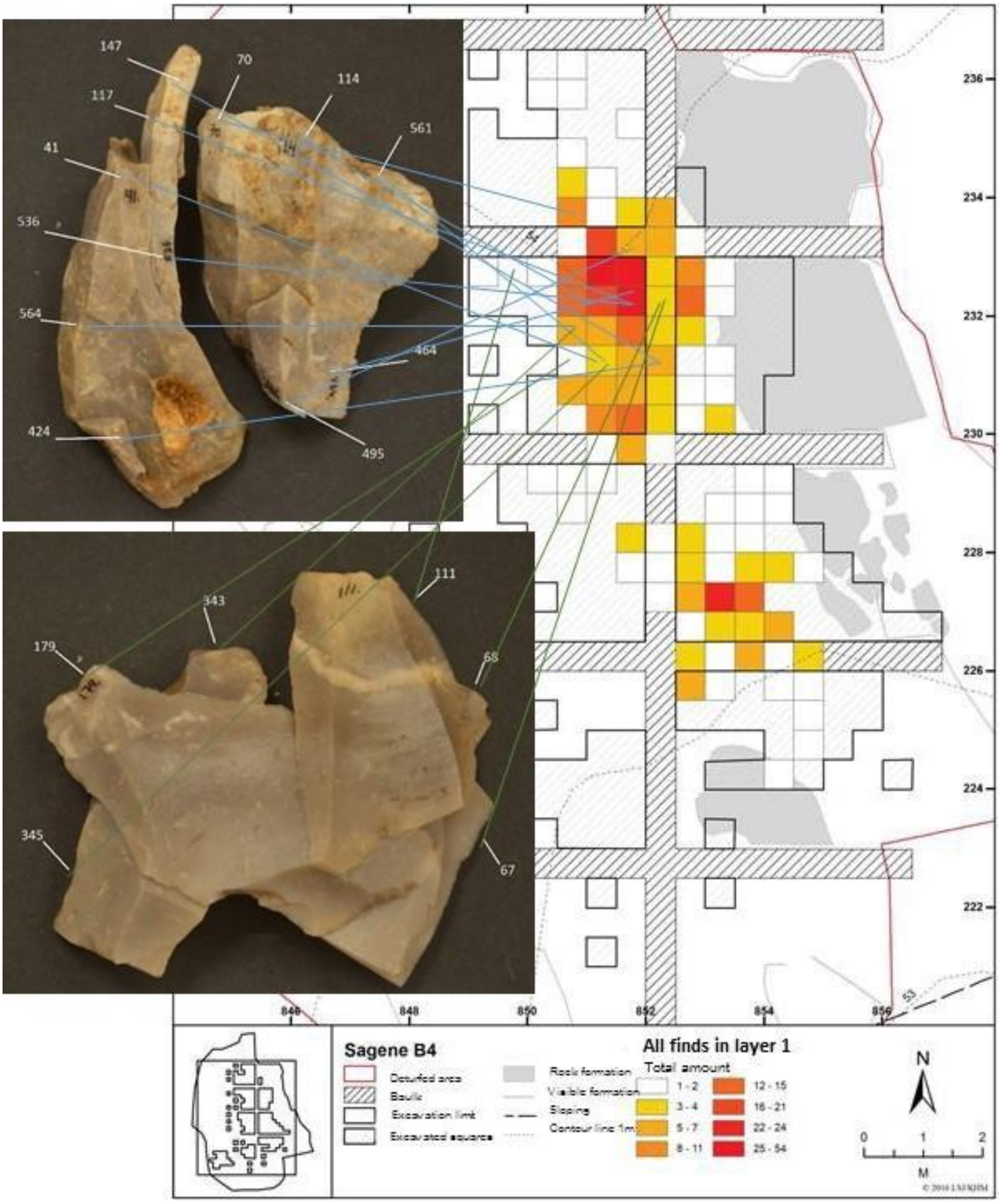


Figure 28. Spread of refit groups 6.1 (top) and 5.1 (bottom) at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Procurement and preparation - Refit group 1.5

This group consists of 5 individual artefacts from flint group 1, all with some cortex (see figure 29). This implies that the group represents an initial stage of a *chaîne opératoire*, possibly the testing of the block and/or primary shaping of the core. During the excavation, artefacts number ID 76 and ID 106 were classified as blades and ID 167 as a microblade, while the remaining 2 (ID 214 and ID 235) were classified as flakes based on morphological attributes. However, after being examined and refitted it is more likely that all artefacts in this refit group are primary flakes, and not intended for further modifications, because they were struck during the shaping process of the core. Further, ID 106 and ID 167 were excavated in the same quadrant, which indicates that ID 167 is more likely a shatter-fragment which occurred while reducing the core, rather than a microblade. Other refit groups and individual artefacts from flint group 1 also have retained cortex on the dorsal surfaces which strengthens the notion that this is the representation of the initial working of a block. Their connection to this refit group will be dealt with in the next chapter.

Figure 29. Refit group 1.5. Left: Ventral face. Right: Dorsal face. Sagene B4, Aust-Agder County, Norway. Photo by author.

As figure 32 illustrates, the artefacts in refit group 1.5 were all excavated within concentration A. The other artefacts with cortex from the same flint group, briefly mentioned above, were also excavated from this concentration. They were not included in this figure as too many lines would make the figure confusing. For their finds location, however, see the appendix.

Burned refits - Refit group 2.1

Refit group 2.1 consists of 5 burned artefacts from flint group 2, 3 severely burned and 2 which are only lightly altered by high temperatures (see figure 30). The 3 severely burned artefacts (ID 510, ID 514 and ID 398) were the first to be refitted, and were originally not a part of any flint group due to their surface alteration. The refit between these 3 and the other 2 (ID 204 and ID 555) was made because of the distinct heat fracture on the ventral face of ID 510, ID 514 and ID 398, and the dorsal face of ID 204. This refit could confirm that the 3 artefacts belonged to flint group 2, since ID 204 and ID 555 was from this group. It is a very good example to show how flint transforms in the process of being heated. Not only does the surface change colour drastically if heated enough, as can be seen in figure 31, where the artefacts now light grey and opaque were originally black and semi translucent, flint also shrinks when exposed to high temperatures. This can clearly be observed in this refit group, where there are gaps in the points of refit between ID 510, ID 514 and ID 398, and between these three and ID 555 and ID 204. Such alterations in shape can make refits between burned artefacts more challenging.

Another refit group representing this, is refit group 2.3 (see the appendix).

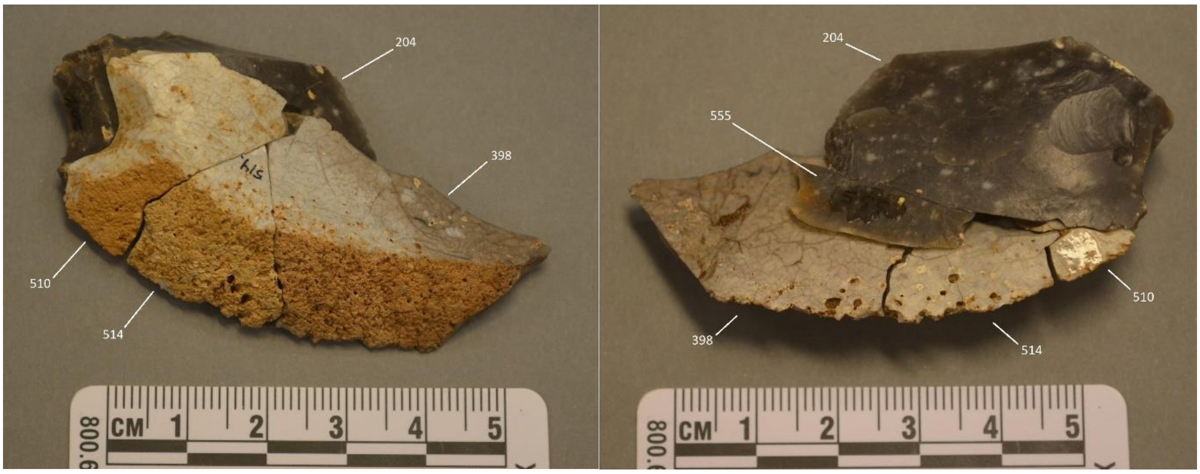


Figure 30. Refit group 2.1. Left: dorsal face. Right: ventral face. Sagene B4, Aust-Agder County, Norway. Photo by author.

The 3 severely burned artefacts were located with a maximum separation of 2 m in concentration B, as illustrated in figure 32, suggesting that they were disturbed post-deposition, meaning that they were most likely not excavated at the same place they were heat-altered.

The refitted artefacts represent a quite large artefact with cortex, suggesting that the block from which this was struck was brought to the site only slightly modified, and more preparation was needed before the production of tool blanks could take place. Another refit group from flint group 2, refit group 2.2 (see figure 31), which demonstrates similar characteristics, strengthens this notion.

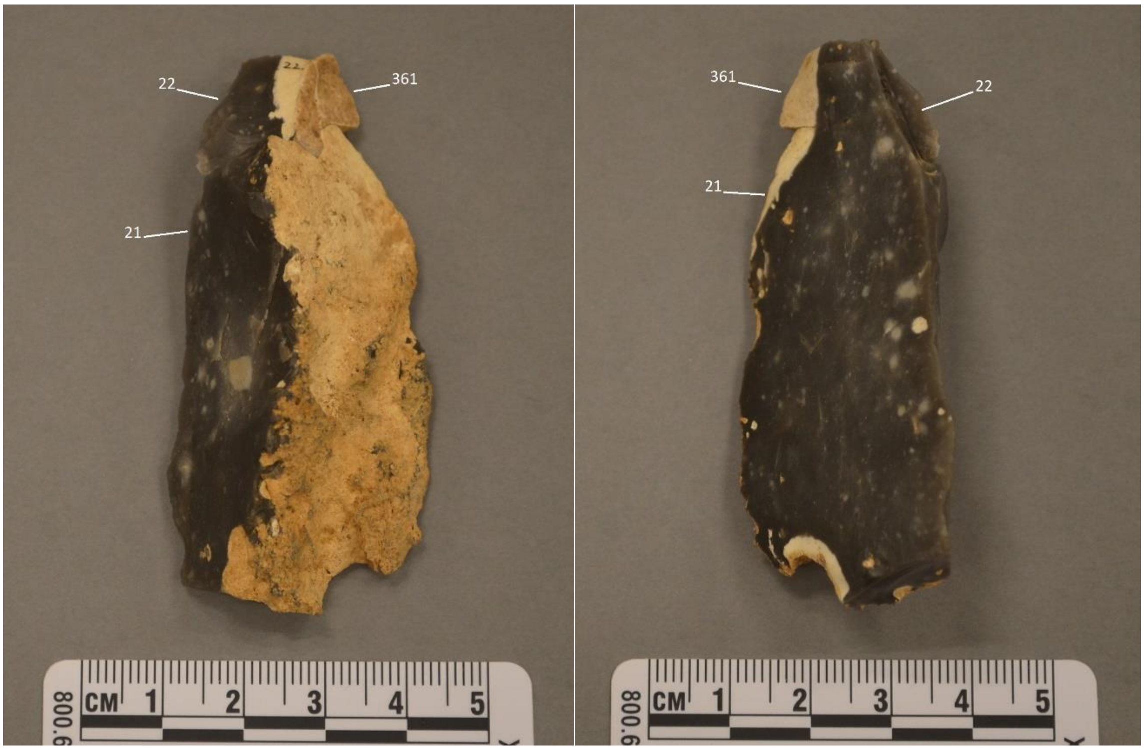


Figure 31. Refit group 2.2. Left: dorsal face. Right: ventral face. Sagene B4, Aust-Agder County, Norway. Photo by author.

As illustrated in figure 31 above, the cortex goes along the entire lateral edge of the flake similar to refit group 2.1, furthering the notion that the block for flint group 2 was brought to the site only slightly prepared. The two mentioned refit groups (2.1 and 2.2) were attempted refitted, but with no success. ID 21 was classified as a blade by the excavators, but after the refitting examination and comparing it to refit group 2.1, there is justification for reassigning it to elongated flake, struck off in the initial stage of the preparation of a core. The artefacts in this refit group were also excavated in the same area as refit group 2.1, in concentration B (see figure 32).

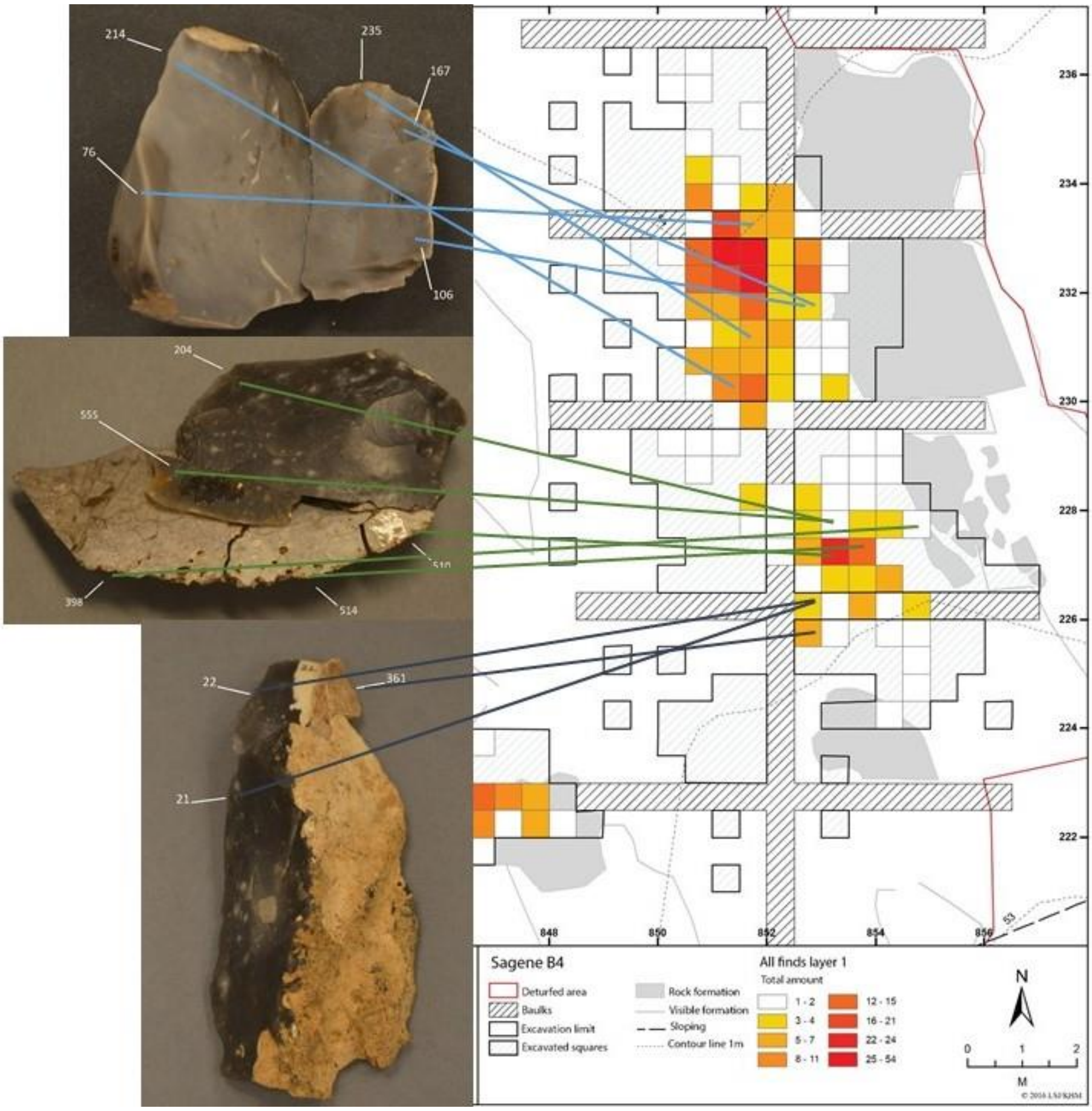


Figure 32. Spread of refit groups 1.5 (top), 2.1 (mid) and 2.2 (bottom) at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Tool identification

Refit group 2.8

This refit group consists of 2 individual artefacts from flint group 2, classified as a microburin (ID 9) and a microblade (ID 170) by the excavators (see figure 33). This implies that the microburin technique was part of the technological activity at Sagene B4. The notion that ID 9 represents this technique is presumably because of the notch along the lateral edge of the flake, which is a part of the process. 3 other artefacts, ID 7, ID 8 and ID 10, were also classified as microburins during the excavation (see figure 35). The discussion regarding this classification will be dealt with in the next chapter. The artefacts in refit group 2.8 were excavated in concentration A, in two quadrants connected in a diagonal. This implies that the original piece was struck off its core in this area; same as above mentioned refit groups in this chapter that display a reduction sequence.

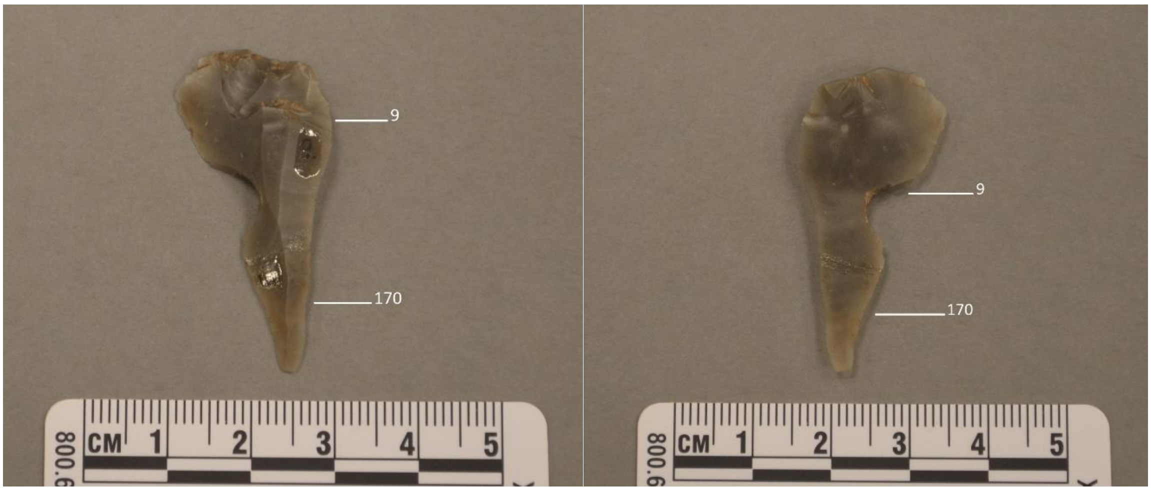


Figure 33. Refit group 2.8. Left: dorsal face. Right: ventral face. Sagene B4, Aust-Agder County, Norway. Photo by author.

One of the other artefacts classified as a microburin, ID 10, was also refitted (refit group 2.14, see figure 35, and the appendix) in the course of the analysis, with what seems to be a platform rejuvenation flake, (ID 354). The 2 artefacts were excavated in different concentrations, A and C. ID 354 was in fact the only artefact from concentration C to be refitted with an artefact from another area at the site, thus confirming the contemporaneity between concentration C and the other two. Since concentration C is located in a crack in the rock formation, it is likely this find spot indicates human intervention.

ID 1

Artefact ID 1 was not refitted, but during the present examination process it was assessed (see figure 34). The excavators classified this artefact as a Høgnipen point. During the present examination the material chosen for this study underwent a *chaîne opératoire* analysis, regardless of whether it was refitted or not. This artefact was further assessed in a technological perspective and re-classified as a fragment. There is no visible retouch along the edges, however, the edges show signs of being damaged, which could account for the interpretation of it being retouched.

Figure 34. ID 1 from Sagene B4, Aust-Agder County, Norway. Photo by author.

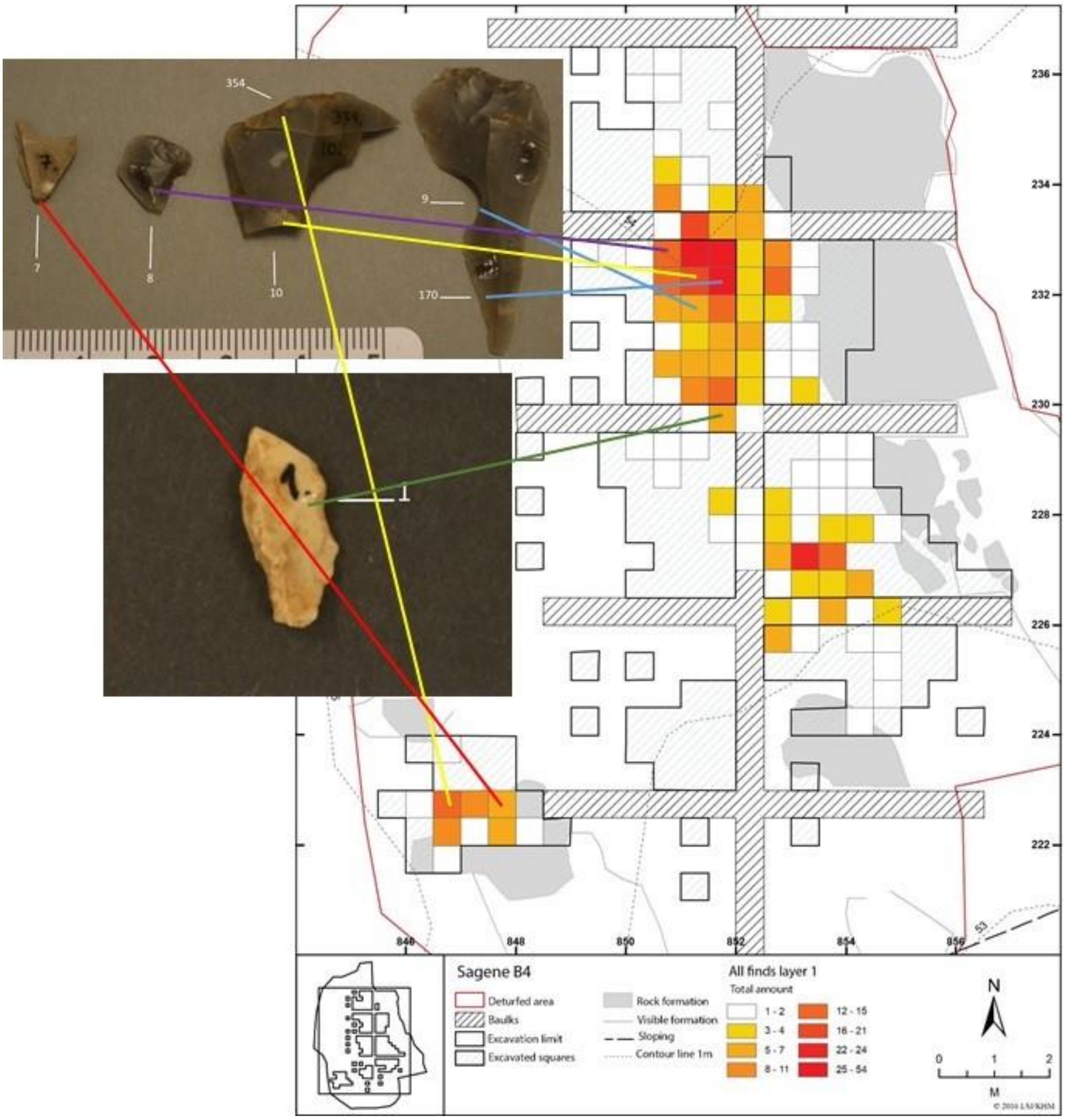


Figure 35. Spread of ID 7, ID 8 and refit groups 2.8 and 2.14 (top), and ID 1 (bottom) at Sagene B4, Aust-Agder County, Norway. Illustration by author.

Anomalous refits - Refit group 2.10

During the present study, it became evident that the intention of the knapper was not always clear or obvious on the basis of several refit groups, exemplified here with refit group 2.10 (see figure 36). For similar anomalous refits see refit groups M.5 and 3.6 in appendix. These groups do not fall under any discernible knapping methods where an intended end-result is visible. They do not follow conventional blade or flake debitage and are thus classified as anomalous refits within this study.

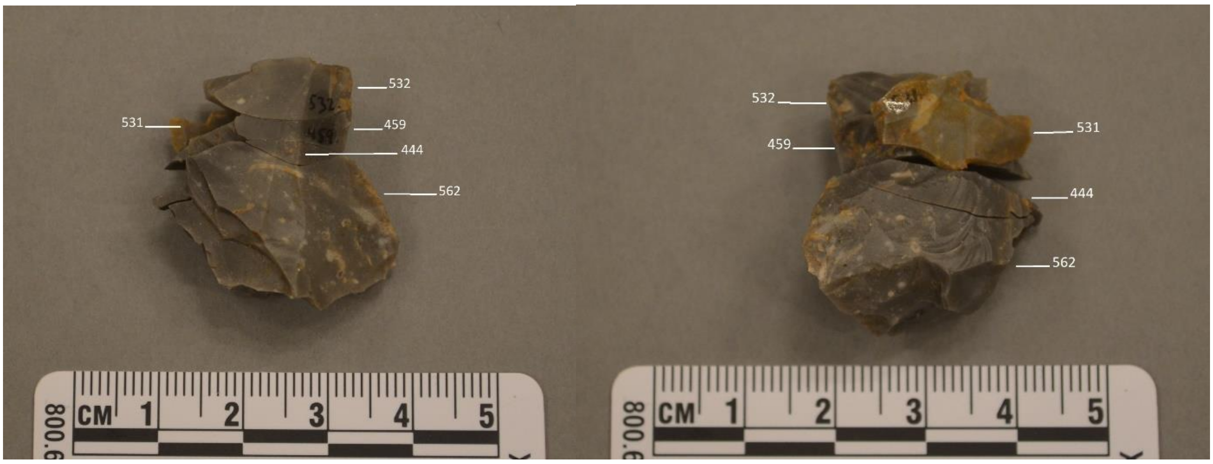


Figure 36. Refit group 2.10 seen from 2 different sides. Sagene B4, Aust-Agder County, Norway. Photo by author.

This refit group consists of 5 artefacts from flint group 2. All artefacts have been classified as fragments or flakes through this study. ID 562 was originally deemed to be a core fragment by the excavators, but after refitting this classification has been altered. The refitting showed that the artefacts fit together as if stacked on top of each other (as illustrated in figure 36 above). It is not clear what the intended vision was for this sequence, but the presence of a bulb on the ventral surface on ID 444, ID 459 and ID 532 suggests these were struck off, not fractured due to heat exposure or post-depositional disturbance processes.

The artefacts were all excavated within concentration A, as illustrated in figure 38 below. The distance between the artefacts also indicates that these are not fragmented post-deposition, as they would most likely be located closer together if that was the case.

Reconstructions – refit group 4.5

As mentioned, not all refits in this study were dorsal to ventral surface refits. There were also heat-fracture refits, and in addition a fair amount of mending of breakage between blade or flake fragments, thus reconstructing the original artefact. This will be exemplified by refit group 4.5 (see figure 37).

Figure 37. Refit group 4.5. Left: dorsal face. Right: ventral face. Sagene B4, Aust-Agder County, Norway. Photo by author.

In figure 37 above, it is clear that this artefact has broken in 2 through the middle. The 2 fragments were recovered from the same quadrant (see figure 38), which is also the case with several other artefacts with the same type of break from the site (see among others refit groups 1.9, 1.12, 2.11, 3.2, 7.1 and M.1 in the appendix). Other similarly fractured fragments that have been reconstructed were recovered in close proximity to one another (see amongst others refit groups 1.4, 4.2, 5.3 and 5.4 in the appendix). The number of mended blades or blade-like flakes contradict the excavators' assessment of the amount of blades in the assemblage, which will be discussed in the next chapter.

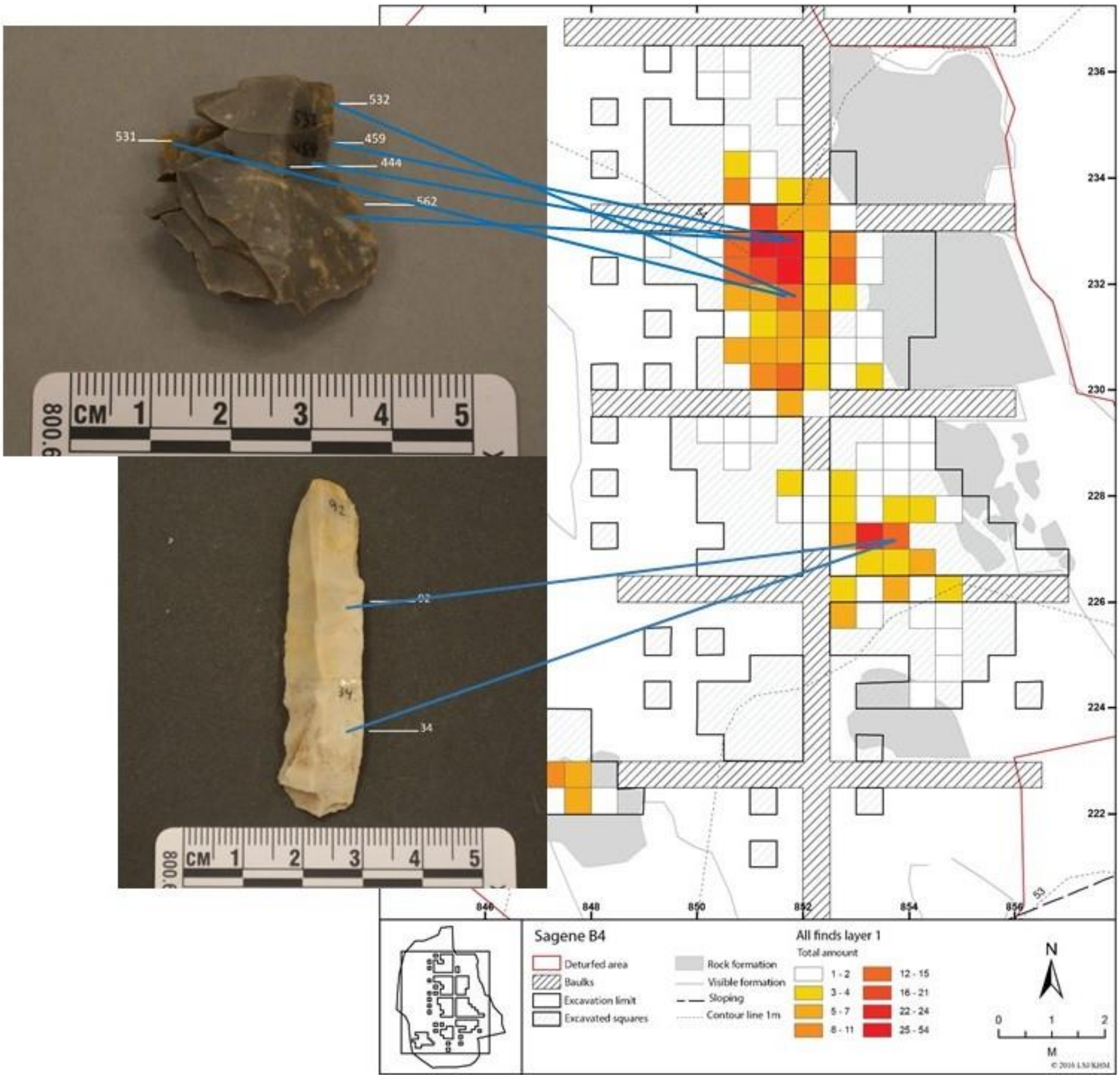


Figure 38. Spread of refit group 2.10 (top) and refit group 4.5 (bottom). Sagene B4, Aust-Agder County, Norway. Illustration by author.

<u>DISCUSSION AND CONCLUSIONS</u>

In this chapter, the findings of the present study will be included in a discussion that incorporates the interpretation of these findings and initial conclusions. The chapter is divided into sub-sections of what the findings demonstrate, and I will discuss them individually. Firstly the stages of *chaîne opératoire* present at Sagene B4 will be covered, before moving on to a discussion regarding the excavators' interpretations of the site, particularly their focus on blade production. Then, the findings demonstrating spatial organisation will be discussed. After this, the burned material and the amount of breakage in the material will be dealt with, followed by a sub-section discussing how Sagene B4 contributes to the Early Mesolithic in southern Norway.

Evidence for partial or complete *chaîne opératoire*?

Here the evidence of different stages of *chaîne opératoire* present at Sagene B4 will be discussed using the examples presented and described in the previous chapter. As shown in the previous chapter corticated blocks, a number of worked cores, tool use and breakage and abandonment of artefacts are among the material recovered and refitted from Sagene B4, thereby indicating that various stages of *chaîne opératoire* occurred at this locality.

At the site of Sagene B4, a number of worked cores were excavated. The excavators classified 6 artefacts as cores or core fragments, but through this analysis, one core fragment (ID 562) has been reclassified as a fragment (see figure 36). In all, 5 cores or core fragments have been identified through this study. 4 of the flint groups (1, 3, 5 and 7) do not have cores, which can be the result of the core not being excavated, it being tossed outside the excavation limits, or the core was taken away from the locality to be further worked elsewhere. The 5 identified cores demonstrate that several cores were worked on site to the point of abandonment during occupation, although 3 of them did not have any refits. This further supports the interpretation that several artefacts are missing from the collection. This could be the result of them not being recovered during excavation, or that substantial parts of the knapping products were taken away from the site, either as finished products or as blanks to be further modified. This is based on the fact that there are gaps in the refitting, cores without conjoined flakes, and that several artefacts could potentially have occurred from the same knapping operation, but cannot be refitted. The artefacts that would fit in between refits are now gone from the site.

This notion is based on the size and assumed shape of the artefacts. On the other hand, this does indicate that the materials brought to the site were heavily worked in the time they spent at Sagene B4 and that the majority of what where deemed to be useable flakes or blanks were taken away when the knappers left the site. Given that the excavators' observations denote this as a short-term occupation based on the limited number of finds, and the absence of any structures, it cannot be an area that was assigned as a specialised manufacture site within a groups' mobile lifestyle. If it were, one would anticipate a far greater amount of lithic material would have been recovered. In summary, this site is likely to represent a single occupation and not a location people returned to.

The overall size of the knapping products in the assemblage, all flint groups included, gives the impression that the original size of the flint nodules were quite small (<10cm), suggesting that the group occupying Sagene B4 primarily had access to or preferred smaller nodules. Another explanation could be that the locality was one of the last stops for the use of these cores before they were considered to be exhausted. These cores must have started out larger than what they appear at the locality. For example, this is demonstrated through flint group 6 with a large blade (ID 28), and the 2 core fragments (ID 561 and ID 564) of what was originally a larger core (see figure 22).

Corticated blocks brought to the site

Initial stages of the *chaîne opératoire* have been represented by refit group 1.5 (see previous chapter for full description). The refitted artefacts all have retained cortex, to various degrees, although ID 214 and ID 235 have cortex on the entire or large parts of the dorsal surface, while the other three have cortex to a lesser degree (see figure 29). This supports the interpretation of this reduction sequence being testing of the block or perhaps primary shaping of a core at the site, as these types of flakes are indicative of a block being brought to a site unworked or only having 1 or 2 flakes removed (see Inizan et. al. 1999:27). What further strengthens this interpretation of refit group 1.5 representing the initial stage of a *chaîne opératoire*, is other refit groups and individual artefacts in flint group 1 (see figure 39) that display cortex on entire or large parts of the dorsal surface.

Figure 39. Refit groups and individual artefacts with cortex in flint group 1. For more info on each refit group, see the appendix. Photo by author.

The figure above (figure 39) illustrates the selection of refit groups with corticated surfaces from flint group 1 (1.1, 1.2, 1.4, 1.5, 1.7 and 1.8), as well as 2 individual artefacts (ID 283 and ID 254) which demonstrate primary working of a block similar to refit group 1.5. As illustrated in figure 39 most of the refits were accomplished between heat-fractured fragments, thus reconstructing the original artefact as complete as possible to how it was when it was struck. It was through this process that the image of this being initial stages of a *chaîne opératoire* became evident. ID 254 is the distinctive first flake struck off a block, done in order to assess a blocks' quality and suitability for further reduction and manufacture (see Eriksen 2000:80f). This implies that the block was transported to the site unworked. This in turn further provides a strong indication of the knappers' procurement strategies for at least this flint group. The presence of these types of artefacts can indicate that the range from the location of procurement to the locality of Sagene B4 was not far. It is thought that this type of testing is normally accomplished in the vicinity of the procurement site (see Eriksen 2000:80). As stone is heavy, the reason for such testing of a block being conducted at the site of procurement could be to eliminate transporting an internally fractured block back to the knapping area. Therefore, one could argue that the people occupying Sagene B4 used beach flint as part of their technological raw material, and that such flint deposits were not far from the site. Flint group 1 did not yield any core, which also strengthens the notion that the block underwent initial and secondary production stages, but when the site was abandoned the core was taken away for further knapping.

Based on the morphological attributes of the artefacts, such as the texture of cortex on the artefacts, it is highly probable that these refit groups and artefacts from flint group 1 can be given the term “associated” refit groups. The term is applied here to this particular material on the basis that they share enough similarities to place them in a single hypothetical group, although they are not refitted to an actual refit group. Although, it is expected that the material could possibly be refitted if additional artefacts were present in the collection. However, I personally prefer to work with the assumption that a piece is either refitted or it is not, therefore such terms will be kept to a minimum in this study. Given that these artefacts are from the same flint group, and they all represent the initial shaping out of a core, which in turn suggests that they are from the same knapping operation, I am inclined to place them in such an associated refit group. Efforts were made to adjoin these refit groups, but no further success was achieved.

Reduction sequence

Refit group 6.1 represents the final stages of the reduction of a core before the core was exhausted (see figure 26). The refitting shows a series of blade removals. The identification of the removals as blades was also the excavators’ assessment, and even though all artefacts underwent a new technological analysis through this study, and by following the criteria described by Inizan et. al. (1999) for what constitutes a blade, the findings of the present study are in agreement with this classification. The description states that the flake must have parallel edges and arrises which tends to be rectilinear; a constant thickness, including the medial section; no obvious ripples on the ventral face; and lastly, the butt is always narrower than the maximum width of the flake, which is very rapidly reached (Inizan et. al. 1999:79). The removals interpreted as blades within refit group 6.1 have parallel edges as well as parallel dorsal ridges. In addition to this, the refitting shows the removals were done in a sequential manner from the same platform. These factors strongly indicate that blade manufacture was present at Sagene B4, although perhaps not the prioritised method of debitage, when seen in context with the rest of the collection. This refit group is the only one where blades were refitted to reconstruct the production sequence. The remaining blades (n=28) in the examined material could not be refitted in such a manner.

Discard

Another result of refit group 6.1 is the probable cause of abandonment of this core, which demonstrates the final stage of the *chaîne opératoire* at Sagene B4. There was a knapping accident from a large plunge removal resulting in the core splitting in 2 (ID 561 and ID 564), which is a common mode of termination (see Cotterell and Kamminga 1987:701). This could have resulted in the abandonment of the remaining core (ID 561). However, it appears that the knapper pursued further reduction on the remaining sections of the core, as several blade fragments could be refitted between the two core fragments (see figure 26). This endeavour was terminated, however, when further knapping resulted in yet another plunging flake (ID 464). As illustrated in the right hand photo in figure 26, both these flakes removed the entire bottom section of the core. These findings demonstrate an attempt to save the core, but with no success, leading the knapper to choose to abandon the core rather than continue in their attempts. This further supports an interpretation that the same individual worked this core, as the striking accidents are of a very similar nature, and it would be unlikely that another knapper would have taken over at this late stage in the reduction sequence. On this basis, one can propose the conclusion that at least one individual has been identified at Sagene B4, based on this idiosyncratic knapping trait.

The third and fourth stages of the *chaîne opératoire*, modification and use, are also present at Sagene B4 through ID 343 and ID 345. However, this will be discussed under the subsection "Tool identification" later in this chapter.

Evidence of blades and microblades

During the course of the excavation, Sagene B4 was interpreted as being a site with blade production (Darmark 2018, in press). This was based on the large number of blades and microblades recovered and identified from the site, as well as the designation that all recovered cores/core fragments were blade cores. These categories were identified by the excavators, however, the results of the refitting indicate a different outcome.

Flake sequence

As mentioned in the preceding chapter, the artefacts in refit group 5.1 were struck from different directions. Without refitting, one could be inclined to believe that these artefacts were struck from the same direction. However, given that the artefacts were not struck from the same direction means that these removals were not from a blade core, but rather an amorphous core for manufacturing flakes for further modification and tool production. The interpretations yielded by this refit group therefore do not confirm the excavators' assessment that the technological focus at Sagene B4 was blade manufacture. An amorphous core has no specific morphology, it is simply a modified block suitable for striking flakes from any surface point leaving no preferred platform (see Inizan et al. 1999:61). As the core within flint group 5 is missing, this cannot be further proven beyond the knapping features of refit group 5.1. In addition, this argument can be based on the artefacts' overall irregular shape, which is more in line with what the assemblage as a whole demonstrates; namely a flake industry, rather than a blade industry.

Reassigning artefacts

What further strengthens the contradiction that Sagene B4 was a site for blade production are several artefacts that have been reclassified during this study when interpreting the refits while following the formal definition of what classifies a blade. As mentioned above, in this study artefacts ID 111 and ID 68 in refit group 5.1 were reclassified from blades to flakes based on morphology. It became evident that these artefacts were not part of a blade manufacturing sequence, but rather a flake sequence. Similar results were reached with refit group 1.5, where artefacts were refitted so that the original classification as blades was no longer applicable. It shows that the artefacts (ID 167, ID 106 and ID 76) originated from an initial working of a block. The artefacts have therefore been reassigned as elongated flakes (for a clearer visibility of ID 167, ID 106 and ID 76 see appendix). A further example of how refitting has caused an alternative interpretation of this site is from a flake in the associated refit groups presented above in connection with refit group 1.5. After refitting ID 63 in refit group 1.7, it was reassigned as a flake fragment as it was originally part of a larger flake which has most probably been fragmented post-deposition, and not struck off in a blade sequence (see the appendix). In addition, this flake does not demonstrate the criteria of what classifies a blade.

However, there are blades and blade fragments in this assemblage, although the original assessment of there being 154 blades, including microblades, at Sagene B4 has decreased in the course of this study. The first reduction was due to the mending of artefacts early in the examination. A total of 17 blades or flakes were reconstructed in this process, with 34 fragments. During this procedure as well as throughout the examination, the artefacts also received more attention, with the result that several artefacts were reclassified from blades and microblades to flakes, often with an elongated shape, or simply shatter-fragments (mostly for the microblades). This re-assessment was done in order to only include artefacts that fit firmly within the formal attributes of a blade (see Inizan et. al. 1999:79). In total, the number of blades at Sagene B4 was reduced to 34 (originally 105), while 9 are classified as microblades (originally 47). These numbers represent both full blades as well as blade fragments that have been refitted. If the refitted fragments are counted as 1, then the total amounts to 28 blades and 7 microblades. This reduction in the number of blades at Sagene B4, contradicts the interpretation of the site being attributed blade production. In line with this, several of the tools at Sagene B4 were modified from flakes, not blades, strengthening the interpretation that this site is attributed flake production.

Tool identification

A broken scraper

2 artefacts from refit group 5.1, ID 343 and ID 345 (see figure 40), classified through this study as a single scraper, is a good example for discussing the identification of tools, as well as the manufacture and use of tools on site. During the excavation, these artefacts were classified as 2 separate scrapers, but after refitting it rather seemed that this was originally 1 scraper that has sustained a break, possibly during use as the fracture is along a common central point of stress.

Figure 40. Break between ID 343 and ID 345. Scraper from Sagene B4, Aust-Agder County, Norway. Photo by author.

Figure 41. ID 345, hafting end of scraper at Sagene B4, Aust-Agder County, Norway. Photo by author.

The nature of the break between ID 343 and ID 345 suggests that pressure was applied to the dorsal surface, which lead the tool to break in 2, leaving a distinct fracture (Cotterell and Kamminga 1987:691) with a dorsal lip on ID 343, and lip negative on ID 345 (see figure 40). Therefore, it is most likely that ID 345 was not the distal end of a scraper, but the hafting end of a scraper, and that ID 343 was the distal end of this tool. What also strengthens this interpretation is the presence of retouch on the distal end of ID 343, something that does not occur on ID 345. The excavators identified retouch in the distal end and left side of ID 345, but during this examination the left side retouch has been reclassified as edge damage because of it being uneven and barely visible, while the alleged distal end retouch has been ascribed as damage due to the break (see figure 41). The break is likely to account for why the artefact was discarded, as it might have been deemed unfit for further use. This break does, however, strengthen the interpretation of this tool being in use and then abandoned at the site of Sagene B4. Based solely on its morphological attributes, ID 345 could have been used further as a scraper, despite it not being retouched. Although, with what the information yielded by the refitting demonstrates, this is purely conjecture.

Similar results were found in refit group 7.3 (see appendix), where the distal end of a scraper was refitted with its hafting end. Also here, the break suggests pressure was applied to the dorsal surface.

Further, ID 343 and ID 345 was a part of refit group 5.1, a flake sequence happening at the site in concentration A. This confirms that it was both manufactured and used at the site, placing stages 3) modification and 4) use at Sagene B4. Therefore, there is confirmed evidence that all stages of the *chaîne opératoire* occurred at this short-term occupation.

The occurrence of Høgnipen?

As mentioned in the previous chapter, the excavators classified a single artefact as a Høgnipen point. An initial observation could potentially lead to this classification based on the morphological shape of the artefact, but when given a closer examination, the attributes that cover the criteria for what makes a Høgnipen point are not, in my opinion, present in this case. For an artefact to be classified as a Høgnipen point, there has to be retouch on the full length of both lateral edges. Furthermore, these points are manufactured from blade or flake fragments, and are relatively small (see Nordqvist 2000: fig. 146, 8-23 and Jaksland 2012c: fig. 6, a-f) (Nordqvist 2000:166). By shape alone, ID 1 could resemble such a point, but there is no retouch on this artefact. There is, however, a great deal of edge damage. It is suspected that this, along with the artefacts' shape has lead the excavators to interpret this artefact as a Høgnipen point. As there is limited opportunities for excavators to go through excavated material, quick and initial assessments are bound to happen. However, if such initial assessments are not corrected they can lead to misrepresentations of the historical period, where material is assigned a certain classification, thereby facilitating interpretations that do not necessarily portray an accurate demonstration of the past.

The microburin technique

It was stated by the excavators that the microburin technique was represented in the material by 4 artefacts, ID 7, ID 8, ID 9 and ID 10 (see figure 43). Although this is a technique and not a tool type, it is mentioned here since it is used in connection with manufacturing tools. Based on this examination, that assessment has been questioned based on the lack of convincing representations in the material of what constitutes this technique. The microburin technique is applied to suitable flakes (here used as a term for any artefact struck off a core) for the purpose of manufacturing microliths. It is a method for dividing the flake into desired fragments, which are then further worked by retouch. The technique is carried out by placing the flake on a surface with a sharp edge, such as an anvil, as seen in the figure below (see figure 42: 1-3), while light blows are applied repeatedly with a small hammer to the side edge of the flake not in contact with the anvil (Inizan et al 1999:82). This creates the distinct notch, which is deepened when a twist or snap fracture is created. This facet is oblique both to the axis and the faces of the flake (see figure 42) (Inizan et al. 1999:83). At this point, one is left with 2 fragments (see figure 42: 4a and b); the desired product, and the waste fragment, namely the microburin (Inizan et al.1999:83), which is how ID 9 has been classified.

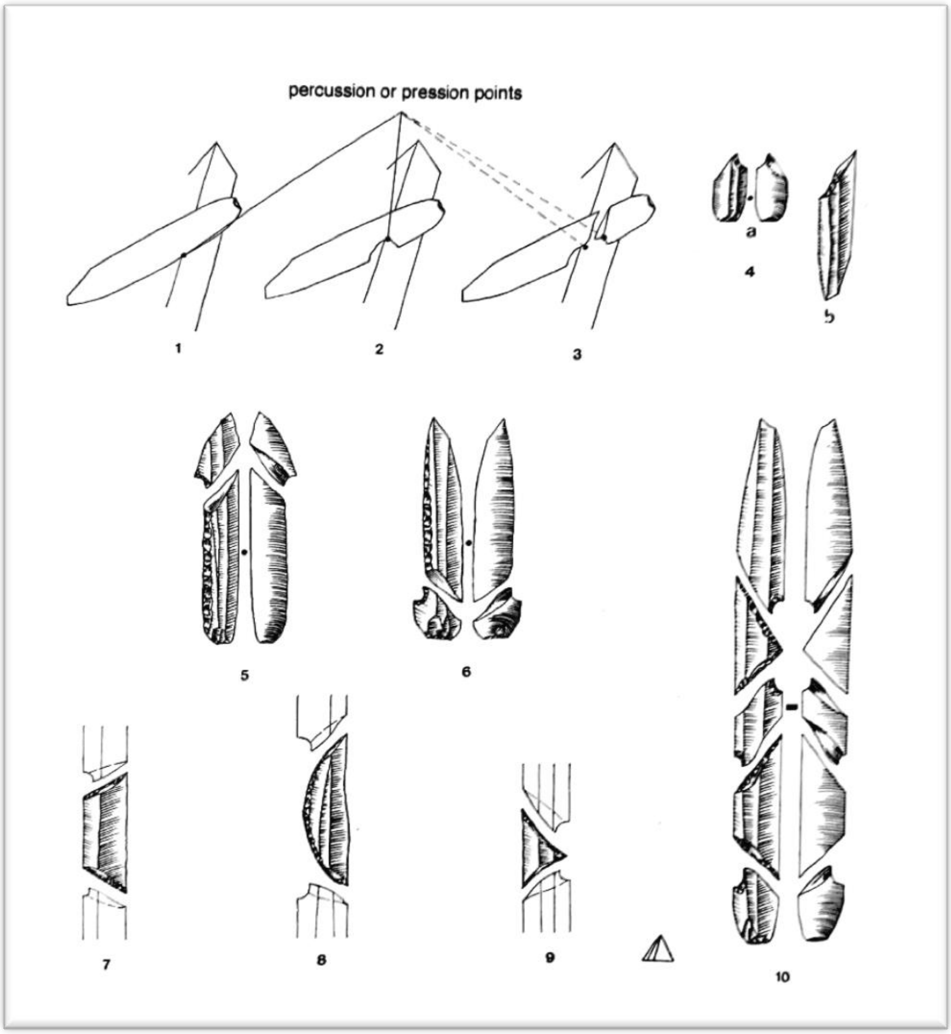


Figure 42. The Microburin technique. After Inizan et al. 1999:83.

This technique leaves characteristic attributes. The fracture facet, as mentioned, is not perpendicular to either the axis or faces of the flake and is often twisted (see figure 42 above). In addition, the facet is slightly hinged towards the dorsal face of the fragment (Inizan 1999:84). Besides the diagnostic fracture facet, another characteristic attribute used for determining the presence of this technique is the distinctive notch on the fragments. This will then be visible as fine retouch directly connected to the fracture facet (see figure 42 above) (Inizan et al. 1999:84).

Returning to the discussion of refit group 2.8, and comparing it to the description of the microburin technique, the notion of ID 9 being a microburin is weakened. The notch is present, yes, but there is no evidence for it being produced to carry out the technique. If it were a microburin, the fracture would be where the notch is and not 5mm below. In addition, the fracture facet between the artefacts ID 9 and ID 170 does not have the distinctive twisting in the break. Rather it is a clean break, perpendicular to the flake. Further, this gives some implications of the excavators' criteria for the classification of artefact ID 170 as a microblade. The nature of the break as well as the distance from where it was found to ID 9, suggests that originally ID 9 and 170 was simply an elongated flake which later broke in 2. The 2 artefacts were found in 2 quadrants, which were connected diagonally (see figure 34). The fracture of the flake was thus more likely to be caused unintentionally after it was discarded.

Three other artefacts in the assemblage were also classified as microburins (ID 7, ID 8 and ID 10), but none of them show the necessary characteristics for what denotes a microburin (see figure 43), besides perhaps ID 8 which will be dealt with shortly.

Figure 43. Artefacts classified as microburins by the excavation, from left to right: ID 7, ID 8, ID 9 and ID 10. Sagene B4, Aust-Agder County, Norway. Photo by author.

Artefact ID 10 is very similar to ID 9 in terms of overall shape and attributes that resemble those of the microburin technique. As with ID 9, the original classification of this artefact was probably due to the notch along the lateral edges of the flake. Here, the fracture is also positioned below the notch, which suggests that the break was not caused by the microburin technique. In addition, the fracture facet is clean and perpendicular to the faces, thus strengthening this reinterpretation. The distal section of artefact ID 10 was not observed in the assemblage in the present study, suggesting that it might have been taken away from the site for further use. This could be interpreted as the break being a part of an intentional technological action, but not by applying the microburin technique, or simply that the distal end of the artefact was not recovered during the excavation.

The 2 remaining artefacts, ID 7 and ID 8, are considerably smaller in size. Artefact ID 7 does not demonstrate any features resembling the microburin technique, and has been re-assigned as a fragment. Artefact ID 8 (figure 44) on the other hand, has the strongest resemblance to actually being a microburin. It is just under 1 cm wide, and has a fracture facet that could be interpreted as being twisted just below the bulb, similar to the examples above in figure 42: 4a and 6. However, the presence of an intended notch is harder to confirm.

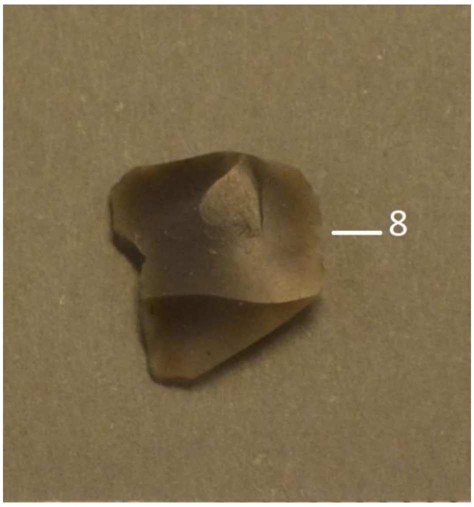


Figure 44. Ventral face of ID 8. 9 mm width. Sagene B4, Aust-Agder County, Norway. Photo by author.

Having said this, there is a hollow on one of the lateral edges, as seen in figure 44 above. It could resemble a notch, although it is very shallow. The fact that it is unclear if this is a notch, however, can be used to argue that this is not a microburin. To conclude, out of the 4 originally classified microburins, artefact ID 8 is the only one that actually resembles a microburin. With this said, one unlikely example is a poor foundation to confirm that this technique was applied to the material in my opinion. This does not exclude the possibility that the group occupying the site had this as part of their technological industry, but rather that it was not done at Sagene B4.

Spatial organisation

Activity area

Through the course of this examination, it has become clear that the reduction sequences presented all occurred in the North end of the site, within concentration A. This provides a basis for interpreting this part of the site as a knapping area during occupation. Almost all artefacts in refit group 6.1 were excavated in a semi-circle towards the Southwest of this concentration suggesting an individual was seated towards the Northeast of this area during this reduction sequence. A similar spread is found in refit groups 5.1 and 1.5 as well as the associated refit groups to 1.5, which strengthens the interpretation of this being a designated knapping area where several cores were worked. Further, the fact that these were all knapped in the same area seems to indicate the same individual knapped several cores, or alternatively that there were several knappers occupying the same area at different times during their stay at the locality.

In addition, artefacts ID 343 and ID 345 were also excavated from concentration A, located in close proximity to one another, in 2 adjacent quadrants. This can be interpreted as both knapping and tool use being present in this area. They are a part of a reduction sequence happening at the site (refit group 5.1), suggesting the scraper was both manufactured and used in this area. The other broken scraper (refit group 7.3) briefly mentioned above was also located here, strengthening the notion that scrapers were used in concentration A. Since scrapers are thought to be tools used for, among other things, preparing animal hides with a scraping motion (e.g. Jensen 2000:215f), perhaps this activity also occurred at Sagene B4, although this is pure conjecture. In this way, an activity area has been positively identified at the site, attributed mainly to knapping, but perhaps use of tools also took place as well. Through refitting, this area is not simply a cluster of finds, but is also a representation of human activity in the Early Mesolithic.

Burning – concentrated?

At Sagene B4, a total of 123 artefacts were identified as being burned, based on alterations in the material. Based on the spread of the burned artefacts, it can be argued that there are 2 main concentrations of burned artefacts, 1 in concentration A, and 1 in concentration B. In concentration A there are 59 burned artefacts. Most of the burned artefacts are located in squares 232x 851y and 232x 852y with 16 and 17 artefacts in each, with the remaining 26 artefacts spread out to some degree from this concentrated area. In other words, not a confirming amount or concentrated spread to be able to argue that a heat structure was located here. However, in concentration B, there is a total of 61 burned artefacts, with the largest concentration of burning within a single m², 227x 853y, consisting of 40 artefacts. Both these distributional patterns of burning in concentrations A and B also coincide with the excavators assessment of the distribution of burned artefacts at the site (see figure 8). The distributional patterns do not, however, shed additional light of the questionable structures interpreted by the excavators (see figure 6), and the burned concentrations are not seen as part of any of those 3 structures. Having said this, there is enough material to argue that concentration B did have a heat source, possibly a fireplace, based on how concentrated the location of the burned artefacts are. This will, however, remain conjecture, as there is no other data, such as charcoal, to confirm that there in fact was a structure in this specific area.

Breakage at Sagene B4

As noted above, several flakes and blades were reconstructed. This gave implications for the excavators' assessment of there being a large amount of blades at the site. Through these reconstructions the amount of blades was reduced, in addition to several artefacts originally classified as blades were through this study re-classified as flakes or elongated flakes. The high number of reconstructions tells us that a large number of artefacts sustained breaks in some way post deposition. Several of these reconstructions were between artefacts located close to one another, or in the same quadrant. This in turn, gives some indications of the cause. As stated in the case study chapter, the excavation used a mechanical digger for the initial de-turfing of the site. Several of these reconstructed artefacts (both blades and flakes) were located in layer 1, meaning that they were just beneath the turf at the site (see refit groups 1.9, 1.10, 1.12, 2.2, 2.11, 3.1, 3.2, 3.5, 3.6, 4.6, 7.1 and M.1 in the appendix). Other reconstructions were done between artefacts located in both layer 1 and 2, or adjoining quadrants in layer 1 (see refit groups 1.4, 1.7, 2.2, 4.2, 4.5, 5.3 and 5.4 in the appendix). The immense weight of this machine driving over the site is destructive for the material, which can cause breaks, and is potentially the cause for the breakage in the material mentioned here. This can in turn lead to misinterpretations regarding the material, since modern disruptions has caused a change in the material. Therefore, when factoring in the potential damage this method is for the archaeological remains, it is a relatively destructive method. However, it is a very effective means to ready an area for manual excavation, and saves a lot of time for an excavation.

Sagene B4 in Early Mesolithic in southern Norway

Early Mesolithic sites in southern Norway are represented in the archaeological record as mainly being single occupations visited by small, mobile groups of people. The sites are considered to be shore-bound, positioned along the coast on promontories and islands with sheltered conditions from the weather. They had landing places suitable for watercraft and it is assumed the people were dependent on sea vessels, and that waterways were the preferred routes for transportation. Structures such as dwelling areas and fireplaces are sometimes identified based on cleared areas or circular stone structures, and charcoal or clusters of burned flint. Activity areas are usually determined on the basis of distributional patterns in the lithic material and certain activity-related artefacts such as scrapers. Excavation projects mainly focus on interpreting lithic assemblages based on morphological and typological observations and assessments, providing an overview of the tool inventories at these early settlements. Typical Early Mesolithic assemblages include diagnostic tools such as tanged and single-edged points, lanceolate microliths, Høgnipen points, flake axes and microburins, as well as other tools such as scrapers, knives, and burins.

Together with such initial examinations of lithics, main concerns of excavators are to get a sense of the subsistence strategies and regional chronologies. This approach was also employed in the investigation of Sagene B4, a small short-term Early Mesolithic site, dated based on diagnostic tools and the shoreline displacement curve for this region. Based on the low number of finds, large number of blades (n=154) and scrapers (n=10), the excavators concluded that the site was a short-term occupation directed towards blade production and some specialised activity involving scrapers. The excavators also identified a tool inventory at Sagene B4 similar to other Early Mesolithic sites in southern Norway, with the identification of lanceolates, the use of the microburin technique, and an identified Høgnipen point. These initial observations and interpretations largely fits with how other sites from the Early Mesolithic are assessed and interpreted. Most often, the material is categorised after Helskog et. al 1976, as mentioned in the introduction, and morphological attributes and typology is assessed. By approaching the interpretation of sites in the same way, and focusing on the same aspects of each site, there is a great possibility for ending up with similar results based on the same preconditions. This excludes any other type of information inherent in the material to be observed and investigated, thereby creating a bias in how we understand the prehistoric conditions in southern Norway.

The aim of this study has been to assess how Sagene B4 fits into the current understanding of the Early Mesolithic in southern Norway. This was done by deploying a different approach when analysing the lithic material than what is the main methodological approach in today's excavation projects, to show how smaller sites with small lithic assemblages can provide additional information. This is done to contribute to the selection process of which sites receive attention. The entire assemblage (with the exception of chips) has undergone an intensive refitting examination within the framework of *chaîne opératoire,* where the artefacts also received a technological analysis, with the means of getting a better understanding of the technological activity that occurred at Sagene B4.

Through this study, the original interpretations of the site and the material has been substantially altered by exposing the material to the previously mentioned approach. The excavators assessment of Sagene B4 being a blade production site has been refuted based on the decline in blades and microblades through mending of artefacts, as well as the re-assigning of several blades to flakes, by following the formal criteria by Inizan et. al. 1999 of what constitutes a blade. A reduction of the production of blades was confirmed, through refit group 6.1 (see figure 26) with refits consisting of a core and adjoining artefacts. However, this was the only representation of a blade reduction occurring at the site, with 5 blades. The remainder of the blades at the site amounts to 29. Further, refit group 5.1 (see figure 27) demonstrates a flake sequence including artefacts that were classified as blades by the excavators, but through this examination were reclassified as flakes. Based on refit group 5.1 and the reclassification of several blades to flakes in the assemblage, the site has been designated as a flake production site, with some occurrences of blades.

As stated, typical inventories of tools from this period usually consists of microliths, often lanceolates, tanged and single-edged points, Høgnipen points, flake axes and microburins, as well as other non-diagnostic tools such as knives and scrapers. Initial examinations carried out by the excavators concluded that all these categories were also present in the Sagene B4 material (see table 1). Throughout the examination in this study, it became evident that some of these classifications were no longer applicable. Refit group 2.8 (see figure 33) could confirm that the 2 artefacts formerly classified as a microburin (ID 9) and a microblade (ID 170) were originally 1 flake. However, while there is a notch on ID 9, there is no evidence suggesting this was made to carry out the microburin technique. The break between the 2 artefacts was clean and perpendicular to the faces of the fragments, and positioned 5mm below the notch. These factors suggest this was more likely a flake that sustained a post-deposition break. In line with this, the other 3 artefacts labelled microburins were examined with reference to Inizan et. al. 1999, and were concluded not to be microburins. Based on this, the presence of microburins at Sagene B4 has been contested. In addition, after examining the Høgnipen point (see figure 35), this artefact showed no evidence of being retouched, and therefore it was reclassified as a fragment. There was, however, a total of 6 lanceolates at the site, which coincides with other Early Mesolithic sites in southern Norway.

The interpretation of specialised activity occurring at Sagene B4 based on the large amount of scrapers, has also been questioned through this study. The excavators classified 10 artefacts as scrapers, however, through refitting 1 of these (ID 345) was confirmed to be the hafting end of another scraper (ID343), and other scrapers were reclassified as fragments with edge damage. The revised number of scrapers is now 5 (see table 2). There is evidence of use represented by the break between ID 343 and ID 345, but what this activity was remains conjecture.

These new findings alter the tool inventory at Sagene B4, demonstrating missing chronologically diagnostic categories such as microburins and Høgnipen points. This does not challenge the dating of the site, however, I am more inclined to ascribe the cause to Sagene B4 being a short-term occupation, and therefore not all traits of Early Mesolithic technology can be expected to be represented in the lithic remains.

This study has confirmed the presence of specific technological activities and all stages of the *chaîne opératoire* at the site as concluded in the previous chapter. Such dynamic aspects of lithic material can rarely be confirmed solely based on morphological and typological assessments, and will mostly remain conjecture until a *chaîne opératoire* analysis is applied. Refit group 1.5 (see figure 29) with associated material represents the initial stages of the *chaîne opératoire*, 0) procurement and 1) preparation, occurring at Sagene B4. This further allowed for an interpretation that the knappers utilised locally available beach flint as part of their technological material. The number of corticated flakes (n=121) supports this interpretation. Further, reduction sequences shown in refit groups 5.1 and 6.1 demonstrate stage 2) primary reduction, both for the manufacture of blades and flakes. Also present are stages 3) modification and 4) use, exemplified by the broken scraper from refit group 5.1, and finally stage 5) discard, represented by refit group 6.1, where the core was considered exhausted after two plunged accidents. This shows that all the *chaîne opératoire* stages occurred at Sagene B4 and that the material was extensively worked, even though it is a small short-term site.

Assessing the distribution of the material in connection to the refit groups, a knapping area was identified in concentration A. The refitted artefacts (refit groups 1.5, 5.1.and 6.1) were all recovered towards the Southwest of the concentration, while the Northeast end did not yield any refits. Therefore, an interpretation suggesting a knapper was seated in the northeast end occurred. In addition, the use of tools in this area is represented on the basis of the presented scraper (ID 343 and ID 345) and the similar refit group 7.3 with fractures, suggesting they were broken during use. With an examination of the distributional pattern of burned artefacts from the site, there is basis to argue that there was a fireplace in concentration B, with a large cluster of burned artefacts centred in square 227x 853y (see figure 8).

Concluding remarks

The results have shown the site of Sagene B4 to be a short-term single occupation, most likely inhabited by a small group. This assessment is conclusive with how other Early Mesolithic sites in southern Norway have been interpreted, as mentioned earlier (e.g. Bang-Andersen 2003:13; 2012:110; Nyland 2012:81ff; Fuglestvedt 2012:5). In addition to this, the present study has revealed new information about the material and technological activity occurring at Sagene B4, that otherwise would not have been able to investigate, and has thus contributed to confirm specific actions taking place, as well as a revised classification of the recovered material based on refitting and a technological analysis. A knapper has been identified to have been seated in the North end of the site, while perhaps another individual carried out some activity involving at least 2 scrapers. The group utilised locally available beach flint, which they brought to the site for production, as well as bringing other already worked cores form elsewhere. They brought some cores with them as they abandoned the site, while others were considered exhausted and discarded on site. The group mainly focused on flake production, although blades were also manufactured.

These results cannot, however, be used to determine generalised tendencies for the Early Mesolithic in this region, as they are only representative for the site of Sagene B4. That being said, a more widespread application of this approach when interpreting sites can be argued based on the results from this study. For larger sites with abundances of material, this approach can be time consuming and resource draining. With smaller sites with limited assemblages on the other hand, the possibility to apply this approach on the entire assemblage is greater, providing a chance to confirm or refute initial observations, thus gaining a better understanding of the sites and the activities occurring, as has been done here. Therefore, it is suggested here that more attention should be directed towards smaller short-term sites that will not necessarily yield large amounts of lithic material. Additional information can be retrieved to create a more nuanced perspective of the Early Mesolithic, where *chaîne opératoire* analyses are applied to more excavated material. This goes beyond initial examinations of morphology and typology, and by applying refitting to an entire assemblage, a more accurate image of what the material represents is achieved. By applying a *chaîne opératoire* analysis, an understanding of the material and how it was utilised at a site is better understood, where the choices and actions of the people are revealed, thus presenting researchers with new ways of interpreting sites, and the Stone Age in southern Norway.

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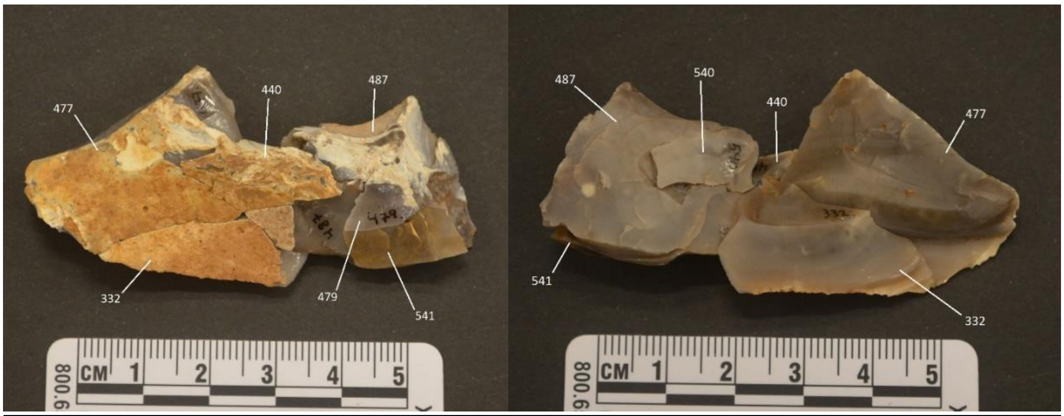
<u>APPENDIX</u>

Here all refit groups made during the examination are listed, with both dorsal and ventral face. Each refit group is accompanied with all artefact ID numbers, find location and classification ascribed through this study.

Refit group 1.1

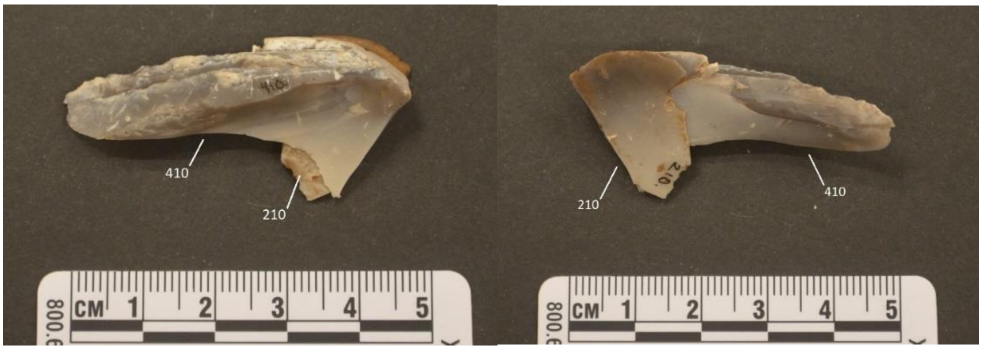


REFIT ID	LOCATION	CLASSIFICATION
477	232x 852y, NE, layer 1	Flake fragment
440	232x 851, NW, layer 1	Flake fragment
487	232x 852y, SE, layer 1	Flake fragment
541	232x 852y, SE, layer2	Flake fragment
479	232x 852y, NE, layer 1	Flake fragment
332	232x 852y, NW, layer 2	Flake fragment
540	232x 852y, SE, layer 2	Flake fragment

Refit group 1.2

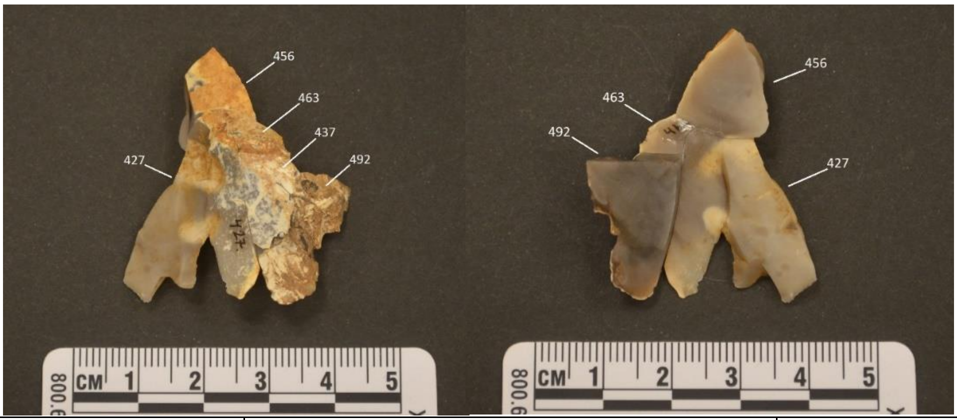
REFIT ID	LOCATION	CLASSIFICATION
549	233x 852, SW, layer 2	Fragment
481	232x 852y, SE, layer 1	Fragment

Refit group 1.3



REFIT ID	LOCATION	CLASSIFICATION
410	233x 852y, SW, layer 2	Fragment
210	232x 852y, SE, layer 1	Fragment

Refit group 1.4



REFIT ID	LOCATION	CLASSIFICATION
427	231x 852y, NE, layer 1	Flake fragment
456	232x 851y, NE, layer 1	Flake fragment
463	232x 851y, SE, layer 1	Flake fragment
437	232x 851y, NW, layer 1	Flake fragment
492	233x 851y, SW, layer 1	Flake fragment

Refit group 1.5

REFIT ID	LOCATION	CLASSIFICATION
214	230x 851y, SW, layer 1	Flake
235	231x 851y, SE, layer 1	Flake
76	233x 851y, SE, layer 1	Flake
106	231x 852y, NW, layer 2	Flake
167	231x 852y NW, layer 2	Flake

Refit group 1.6

REFIT ID	LOCATION	CLASSIFICATION
247	232x 851y, NW, layer 1	Flake
450	232x 851y, NE, layer 1	Fragment

Refit group 1.7

REFIT ID	LOCATION	CLASSIFICATION
490	233x 851y, SW, layer 1	Flake fragment
474	232x 851y, SE, layer 1	Flake
451	232x 851y, NE, layer 1	Flake fragment
63	232x 851y, NE, layer 1	Flake

Refit group 1.8

REFT ID	LOCATION	CLASSIFICATION
408	229x 853y, SE, layer 1	Flake
528	230x 853y, SW, layer 2	Fragment

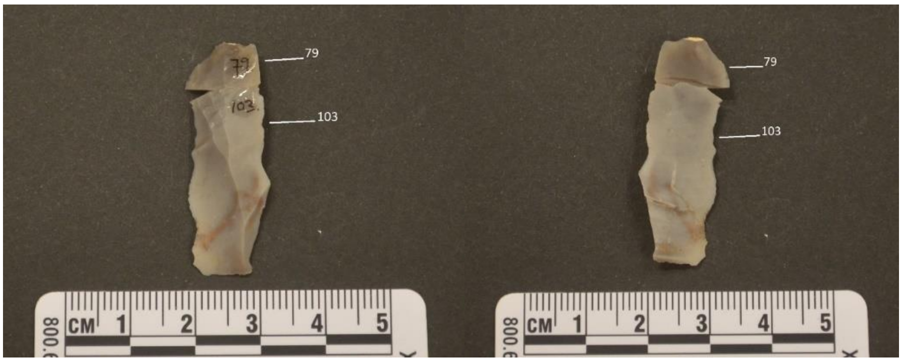
Refit group 1.9

REFIT ID	LOCATION	CLASSIFICATION
433	232x 851y, NW, layer 1	Flake fragment
152	232x 851y, NW, layer 1	Flake fragment
50	232x 851y, NW, layer 1	Flake fragment
52	232x 851y, NW, layer 1	Flake fragment

Refit group 1.10

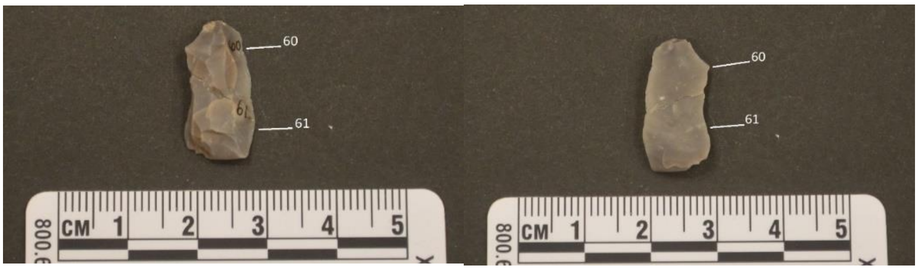
REFIT ID	LOCATION	CLASSIFICATION
43	231x 851y, NE, layer 1	Flake
45	232x 850y, NW, layer 1	Flake
335	233x 850y, NE, layer 2	Flake fragment
430	232x 850y, NE, layer 1	Fragment

Refit group 1.11



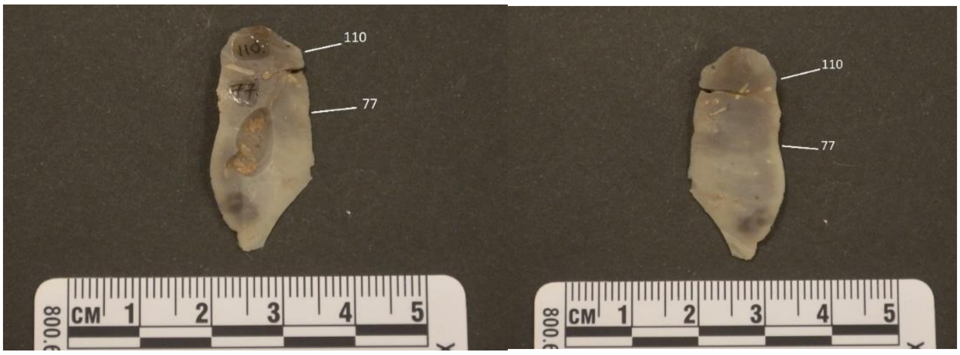
REFIT ID	LOCATION	CLASSIFICATION
79	234x 850y, SE, layer 1	Blade fragment
103	231x 850y, NE, layer 2	Blade Fragment

Refit group 1.12



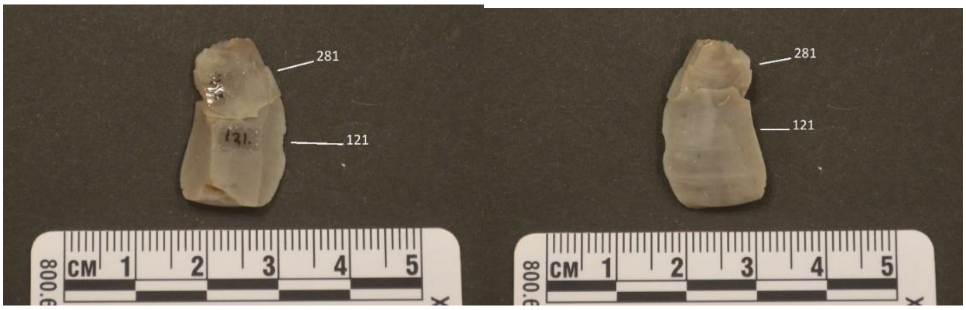
REFIT ID	LOCATION	CLASSIFICATION
60	232x 851y, NE, layer 1	Flake fragment
61	232x 851y, NE, layer 1	Flake fragment

Refit group 1.13



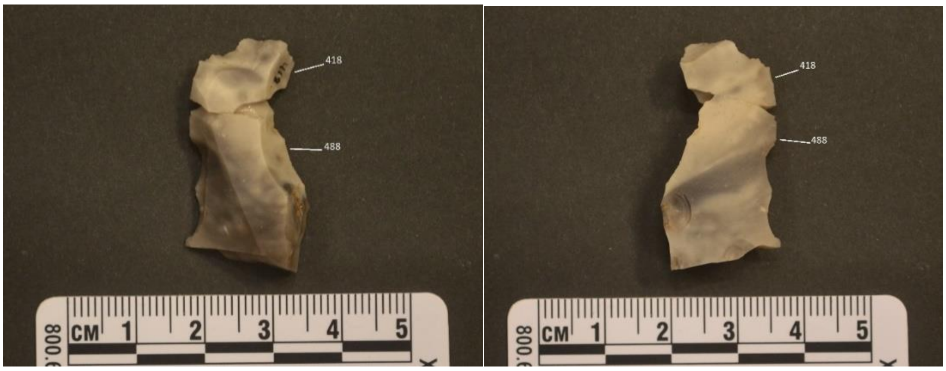
REFIT ID	LOCATION	CLASSIFICATION
77	233x 852y, SW, layer 1	Flake fragment
110	231x 852y, SW, layer 2	Flake fragment

Refit group 1.14



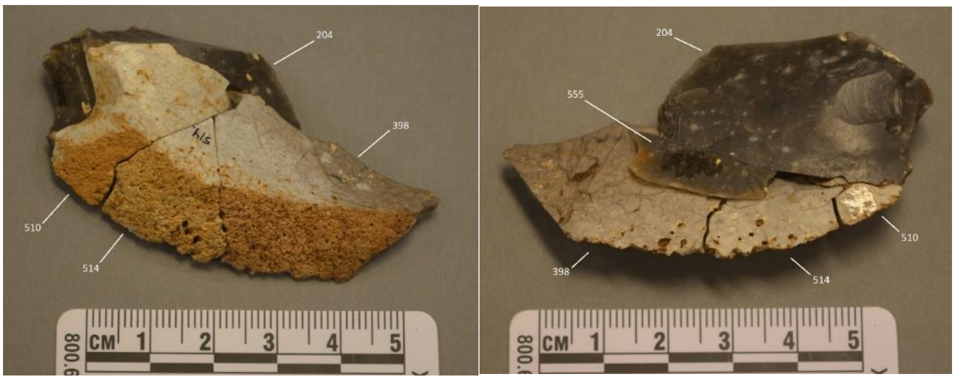
REFIT ID	LOCATION	CLASSIFICATION
121	233x 852y, SW, layer 2	Flake fragment
281	233x 852y, SW, layer 1	Flake fragment

Refit group 1.15



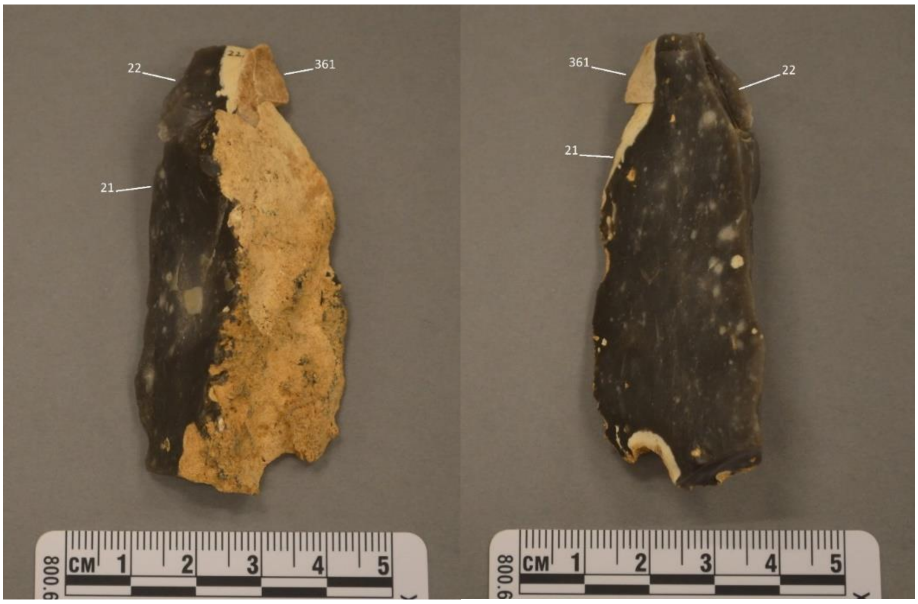
REFIT ID	LOCATION	CALSSIFICATION
488	233x 850y, NE, layer 1	Flake fragment
418	231x 850y, NE, layer 1	Flake fragment

Refit group 2.1



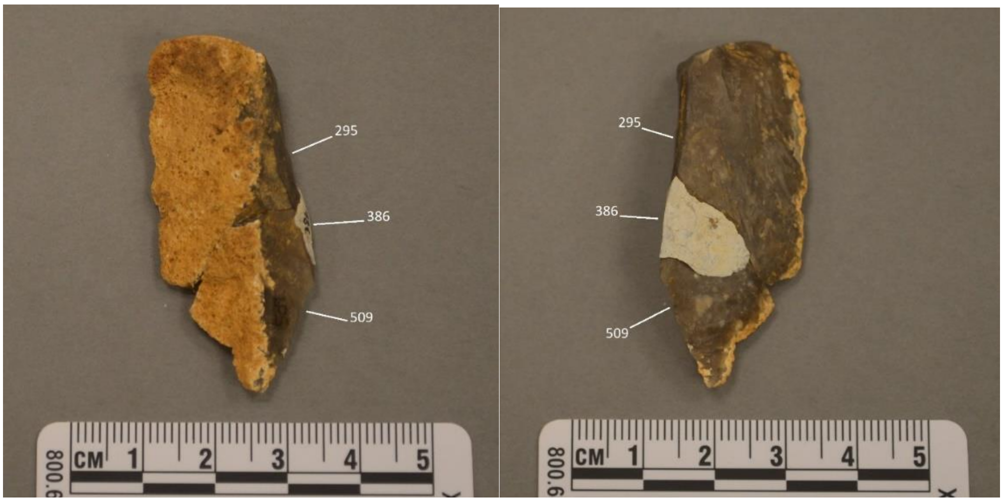
REFIT ID	LOCATION	CLASSIFICATION
398	227x 854y, NW, layer 1	Fake fragment
510	227x 853y, SW, layer 2	Flake fragment
514	227x 853y, SE, layer 2	Flake fragment
555	227x 853y, NE, layer 3	Flake fragment
204	227x 853, NE, layer 1	Flake

Refit group 2.2



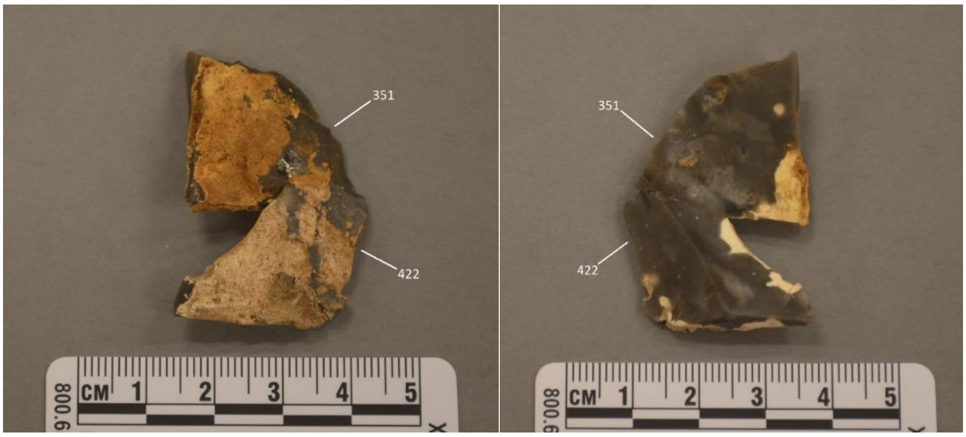
REFIT ID	LOCATION	CLASSIFICATION
21	226x 852y, SE, layer 1	Flake fragment
22	226x 852y, SE, layer 1	Flake fragment
361	225x 852y, NE, layer 1	Flake fragment

Refit group 2.3



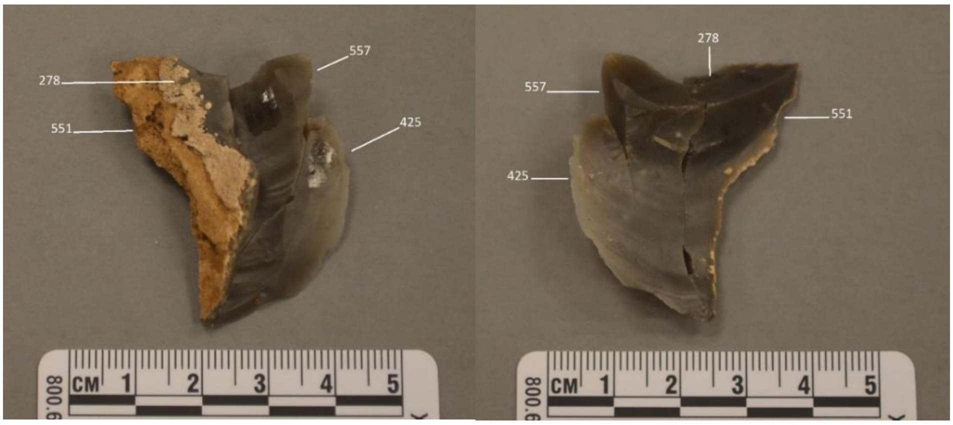
REFIT ID	LOCATION	CLASSIFICATION
295	227x 853y, SW, layer 2	Flake
509	227x 853y, SW, layer 2	Flake fragment
386	227x 853y, SW, layer 1	Flake fragment

Refit group 2.4



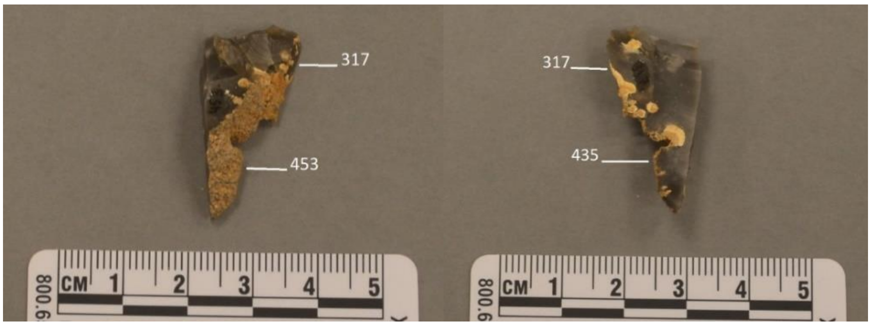
REFIT ID	LOCATION	CLASSIFICATION
351	232x 850y, NW, layer 2	Fragment
422	231x 851y, NE, layer 1	Fragment

Refit group 2.5



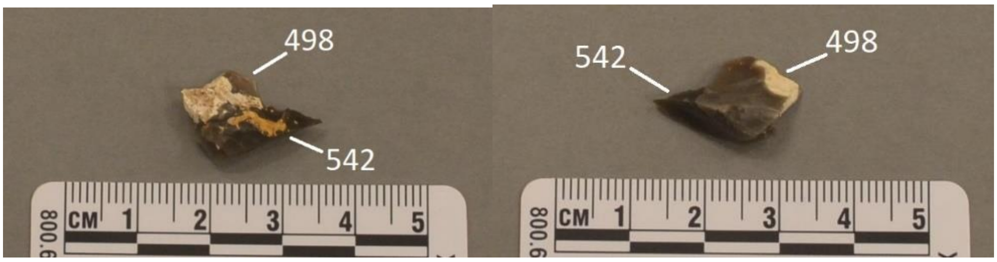
REFIT ID	LOCATION	CLASSIFICATION
278	233x 852y, NW, layer 1	Fragment
551	233x 852y, SW, layer 2	Flake fragment
557	231x 851y, NE, layer 3	Flake fragment
425	231x 852y, SW, layer 1	Fragment

Refit group 2.6



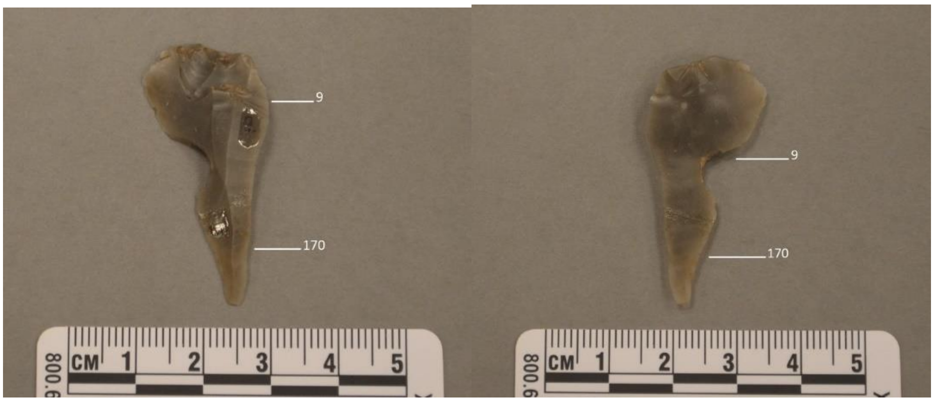
REFIT ID	LOCATION	CLASSIFICATION
453	232x 851y, NE, layer 1	Fragment
317	231x 851y, NW, layer 2	Fragment

Refit group 2.7



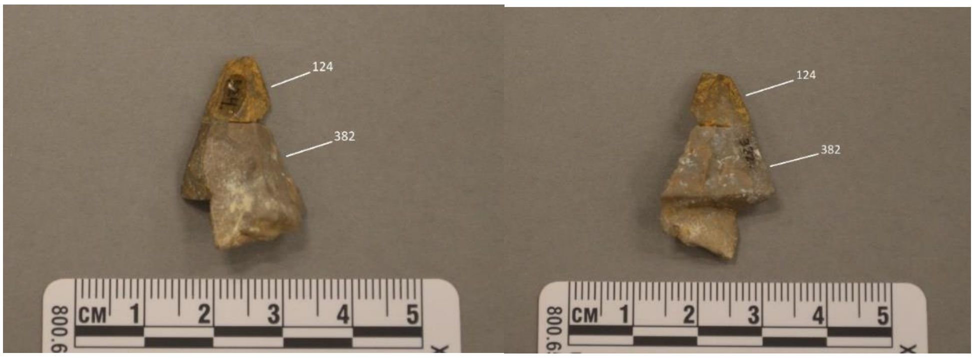
REFIT ID	LOCATION	CLASSIFICATION
498	233x 852y, SW, layer 1	Fragment
542	232x 852y, SE, layer 2	Fragment

Refit group 2.8



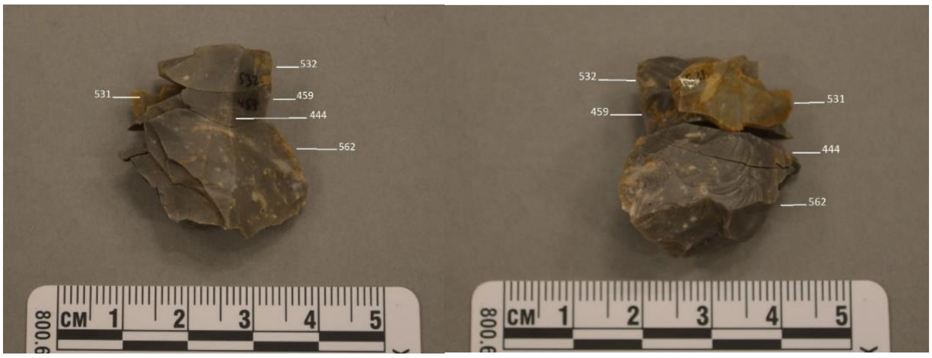
REFIT ID	LOCATION	CLASSIFICATION
9	231x 851y, NE, layer 1	Flake
170	232x 851y, SW, layer 2	Flake fragment

Refit group 2.9



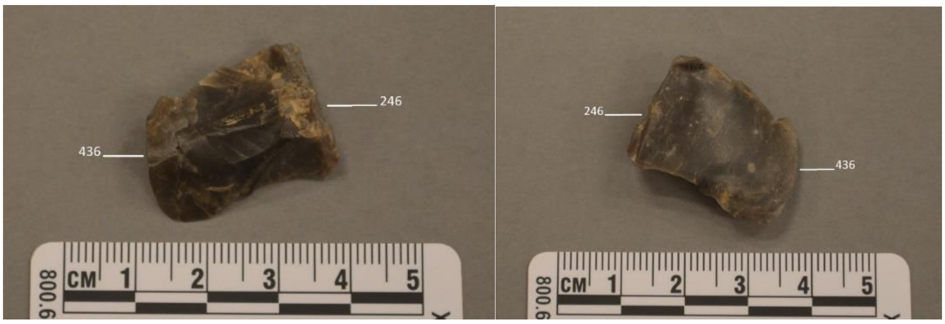
REFIT ID	LOCATION	CLASSIFICATION
124	227x 853y, SW, layer 3	Flake
382	227x 853y, SW, layer 1	Flake fragment

Refit group 2.10



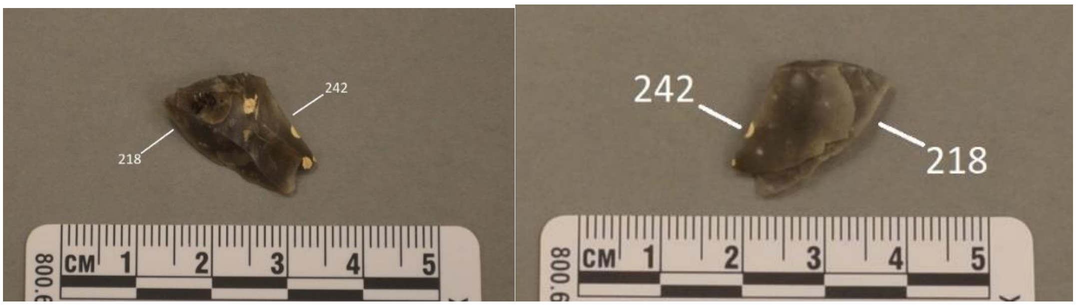
REFIT ID	LOCATION	CLASSIFICATION
562	232x 851y, NE, layer 1	Fragment
444	232x 851y, NW, layer 1	Flake
459	232x 851y, NE, layer 1	Flake
531	231x 851y, NW, layer 2	Fragment
532	231x 851y, NW, layer 2	Flake

Refit group 2.11



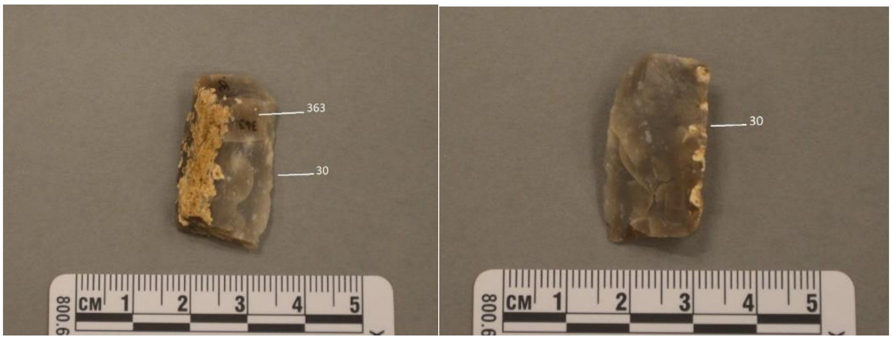
REFIT ID	LOCATION	CLASSIFICATION
436	232x 851y, NW, layer 1	Flake fragment
246	232x 851y, NW, layer 1	Flake

Refit group 2.12



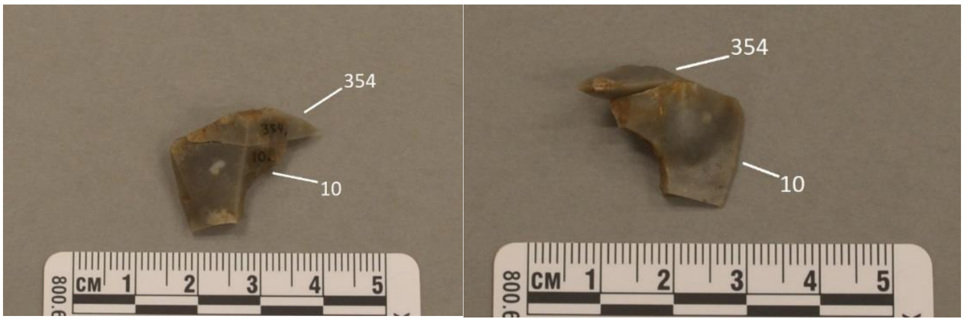
REFIT ID	LOCATION	CLASSIFICATION
218	230x 851y, SE, layer 1	Flake
242	232x 851y, NW, layer 1	Flake

Refit group 2.13



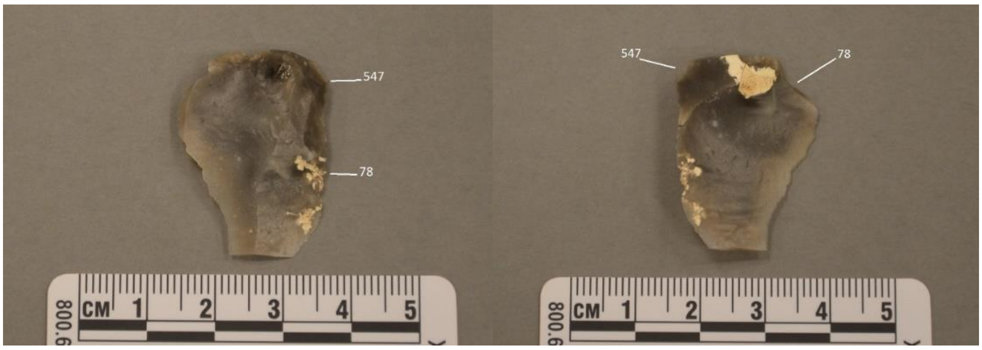
REFIT ID	LOCATION	CLASSIFICATION
30	227x 853y, SE, layer 1|	Flake
363	225x 854y, NE, layer 1	Fragment

Refit group 2.14



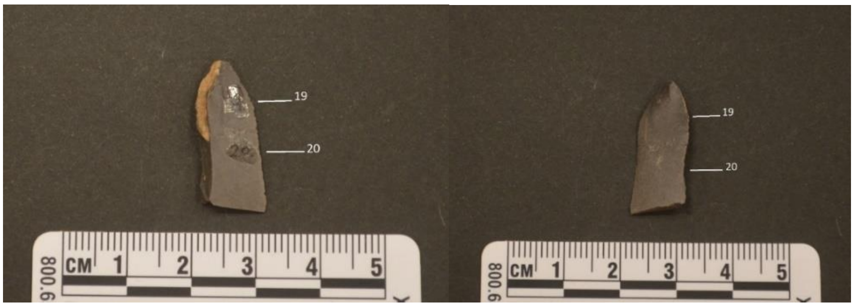
REFIT ID	LOCATION	CLASSIFICATION
10	232x 851y, SW, layer 2	Flake
354	222x 846y, NE, layer 1	Flake

Refit group 2.15



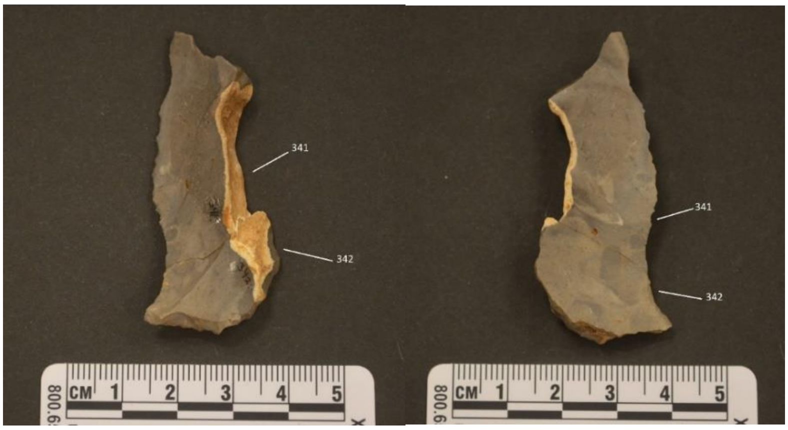
REFIT ID	LOCATION	CLASSIFICATION
78	233x 852y, SW, layer 1	Flake
547	233x 852y SW, layer 2	Fragment

Refit group 3.1



REFIT ID	LOCATION	CLASSIFICATION
19	225x 854y, SE, layer 1	Blade fragment
20	225x 854y, SE, layer 1	Blade fragment

Refit group 3.2

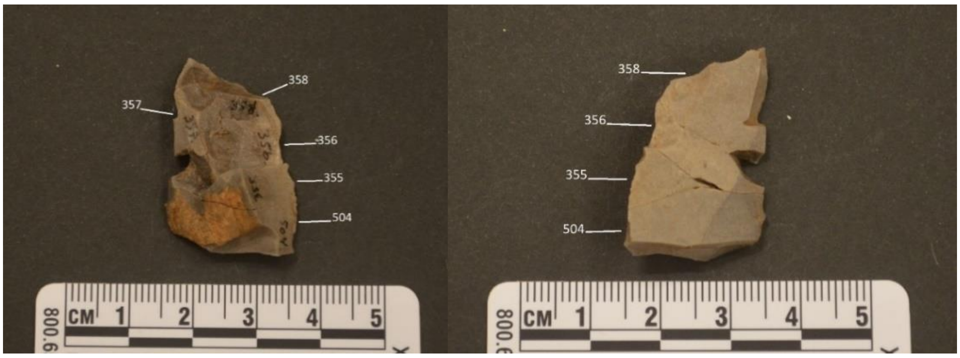


REFIT ID	LOCATION	CLASSFICATION
341	230x 851y, SW, layer 1	Flake fragment
342	230x 851y, SW, layer 1	Flake fragment

Refit group 3.3

REFIT ID	LOCATION	CLASSIFICATION
516	227x 853y, SE, layer 2	Fragment
378	227x 853y, SW, layer 1	Fragment
380	227x 853y, SW, layer 1	Fragment
384	227x 853y, SW, layer 1	Fragment
553	227x 853y, NW, layer 3	Fragment
511	227x 853y, SW, layer 2	Fragment

Refit group 3.4



REFIT ID	LOCATION	CLASSIFICATION
355	222x 847y, NW, layer 1	Fragment
356	222x 847y, NE, layer 1	Fragment
357	222x 847y, NE, layer 1	Fragment
358	222x 848y, SW, layer 1	Fragment
504	222x 847y, SW, layer 2	Fragment

Refit group 3.5

REFIT ID	LOCATION	CLASSIFICATION
383	227x 853y, SW, layer 1	Fragment
385	227x 853y, SW, layer 1	Fragment

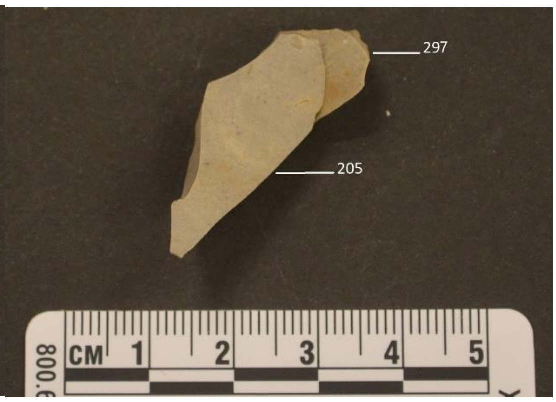
Refit group 3.6

REFIT ID	LOCATION	CLASSIFICATION
372	226x 854y, NW, layer 1	Flake
397	227x 854y, NW, layer 1	Flake fragment
513	227x 853y, NE, layer 2	Flake fragment
393	227x 853y, SE, layer 1	Flake fragment
558	277x 854y, SW, -	Flake fragment

Refit group 3.7

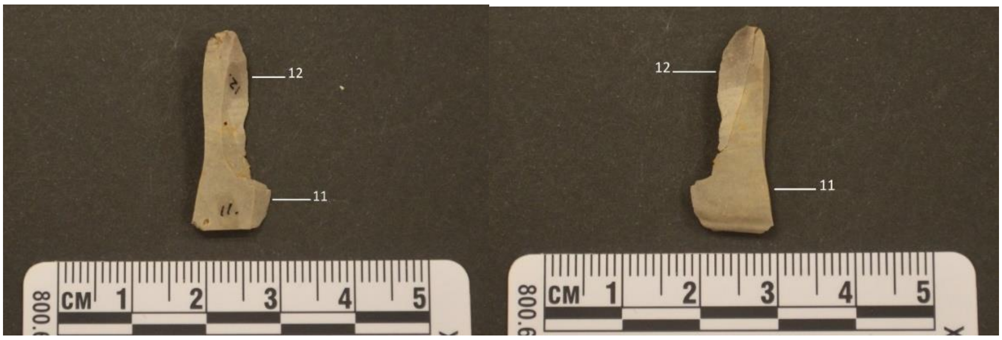
REFIT ID	LOCATION	CLASSIFICATION
377	227x 853y, SW, layer 1	Fragment
387	227x 853y, SW, layer 1	Fragment

Refit group 3.8



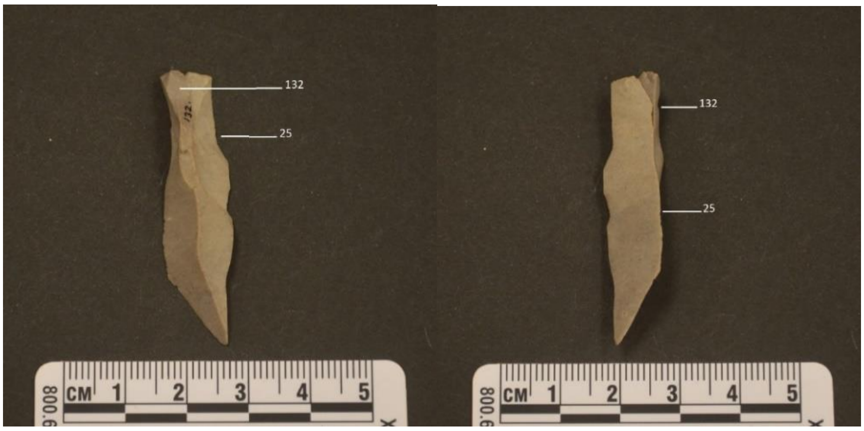
REFIT ID	LOCATION	CLASSIFICATION
297	227x 853y, SE, layer 2	Fragment
205	227x 853y, SE, layer 1	Flake

Refit group 3.9



REFIT ID	LOCATION	CLASSIFICATION
11	226x 853y, NE, layer 1	Flake
12	226x 853y, NE, layer 1	Fragment

Refit group 3.10

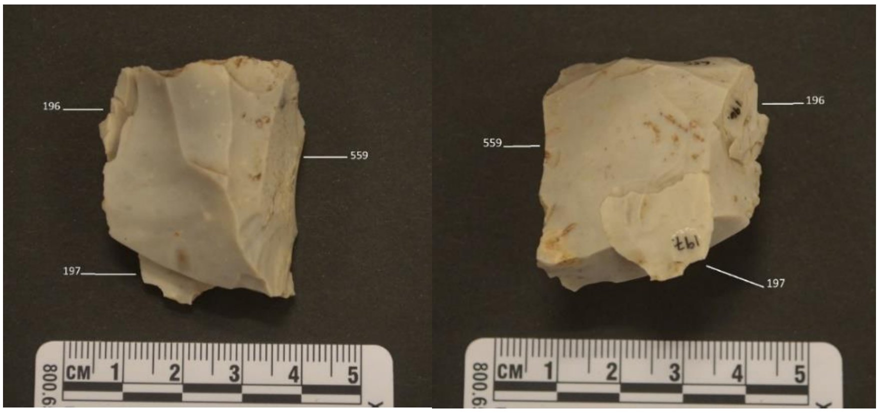


REFIT ID	LOCATION	CLASSIFICATION
25	226x 853y, SE, layer 1	Flake
132	226x 854y, NW, layer 1	Flake

Refit group 3.11

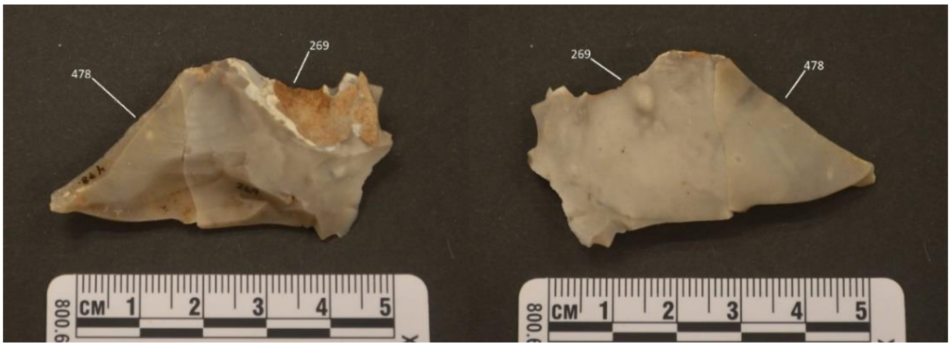
REFIT ID	LOCATION	CLASSIFICATION
349	227x 853y, SE, layer 2	Flake fragment
389	227x 853y, SW, layer 1	Fragment

Refit group 4.1



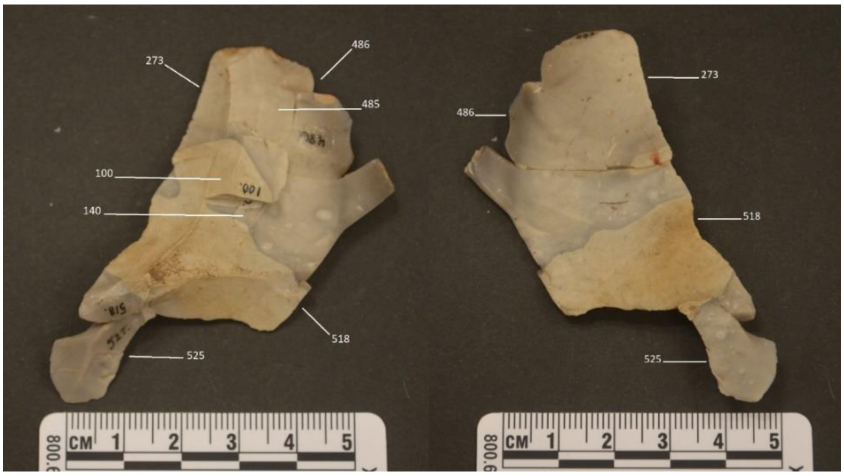
REFIT ID	LOCATION	CLASSIFICATION
559	226x 853y, NE, layer 1	Core
196	226x 854y, NW, layer 1	Fragment
197	226x 854y, SE, layer 1	Flake

Refit group 4.2



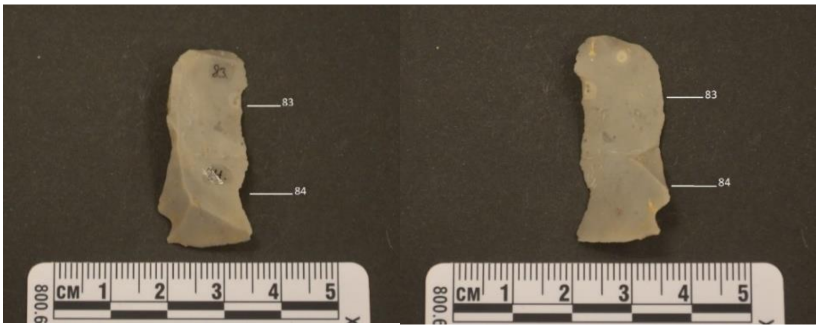
REFIT ID	LOCATION	CLASSIFICATION
269	232x 852y, NW, layer 1	Flake fragment
478	232x 852y, NE, layer 1	Flake fragment

Refit group 4.3



REFIT ID	LOCATION	CLASSIFICATION
518	228x 851y, NW, layer 2	Flake fragment
485	232x 852y, SE, layer 1	Flake fragment
486	232x 852y, SE, layer 1	Flake fragment
273	232x 852y, SE, layer 1	Flake fragment
100	230x 852y, SW, layer 2	Flake fragment
140	229x 851y, NE, layer 1	Shatter fragment
525	230x 852y, SW, layer 2	Flake fragment

Refit group 4.4

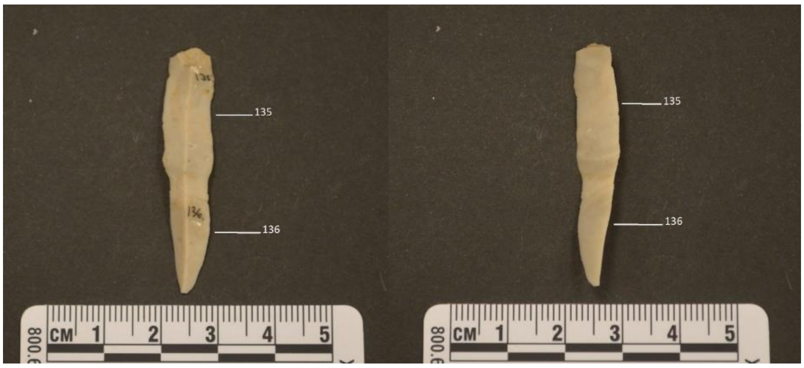


REFIT ID	LOCATION	CLASSIFICATION
83	226x 853y, NE, layer 2	Flake fragment
84	226x 853y, NE, layer 2	Flake fragment

Refit group 4.5

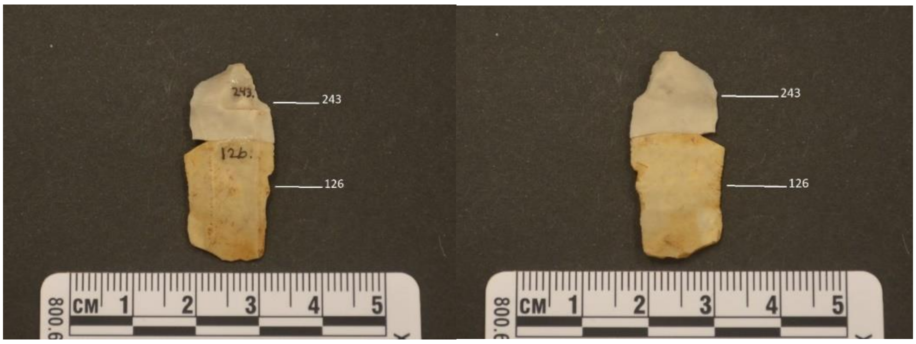
REFIT ID	LOCATION	CLASSIFICATION
92	227x 853y, SE, layer 2	Blade fragment
34	227x 853y, SE, layer 1	Blade fragment

Refit group 4.6



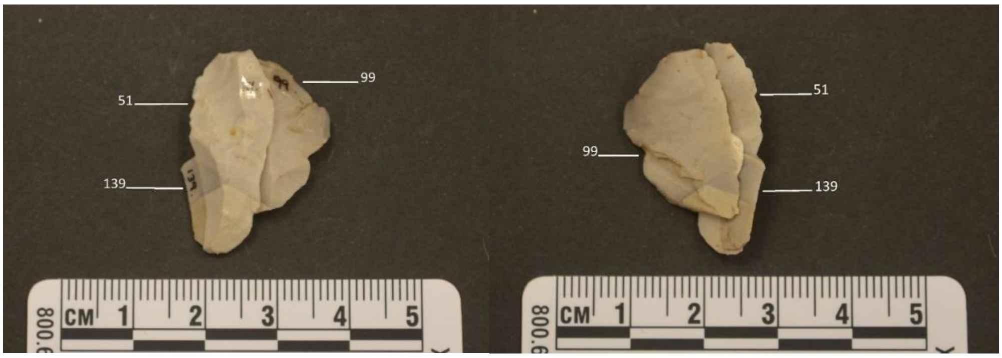
REFIT ID	LOCATION	CLASSIFICATION
135	227x 853y, SW, layer 1	Microblade fragment
136	227x 853y, SW, layer 1	Microblade fragment

Refit group 4.7



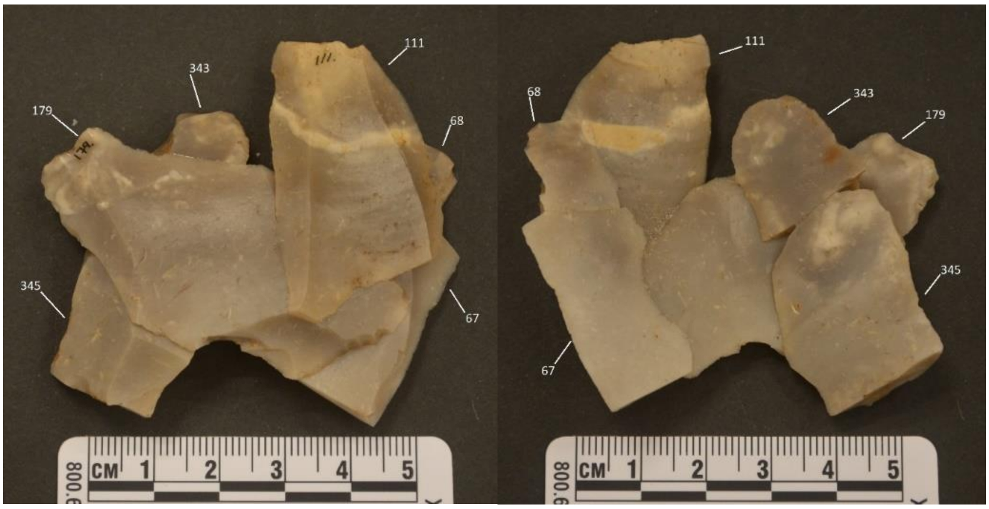
REFIT ID	LOCATION	CLASSIFICATION
126	234x 850y, SW, layer 3	Blade fragment
243	232x 851y, NW, layer 1	Blade fragment

Refit group 4.8



REFIT ID	LOCATION	CLASSIFICATION
51	232x 851y, NW, layer 1	Flake
139	229x 851y, NE, layer 1	Flake fragment
99	230x 852y, SW, layer 2	Flake

Refit group 5.1

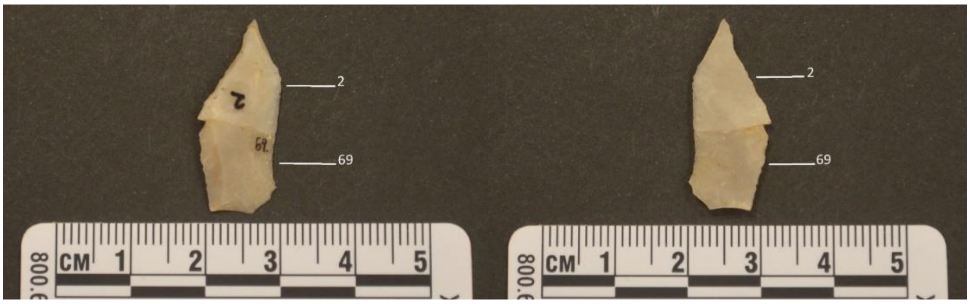


REFIT ID	LOCATION	CLASSIFICATION
111	232x 849y, NE, layer 2	Flake
179	231x 850y, SE, layer 1	Flake/retouch
343	231x 850y, NE, layer 1	Scraper
345	231x 851y, SW, layer 1	Scraper/hafting end
67	232x 852y, SW, layer 1	Flake fragment
68	232x 852y, SW, layer 1	Flake fragment

Refit group 5.2

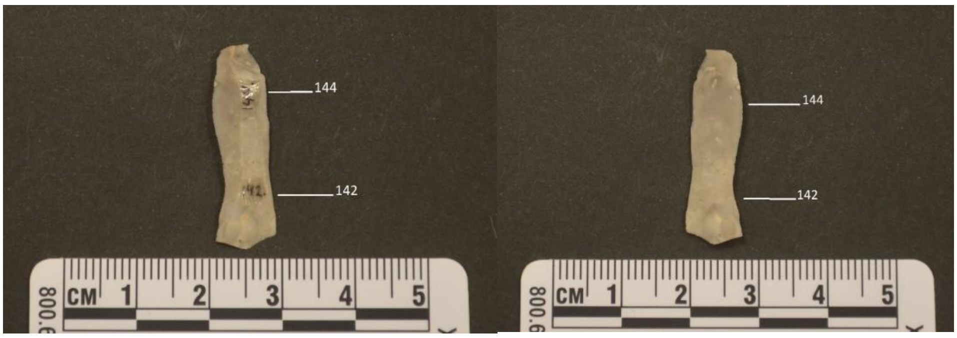
REFIT ID	LOCATION	CLASSIFICATION
48	232x 850y, SE, layer 1	Flake fragment
49	232x 850y, SE, layer 1	Flake

Refit group 5.3



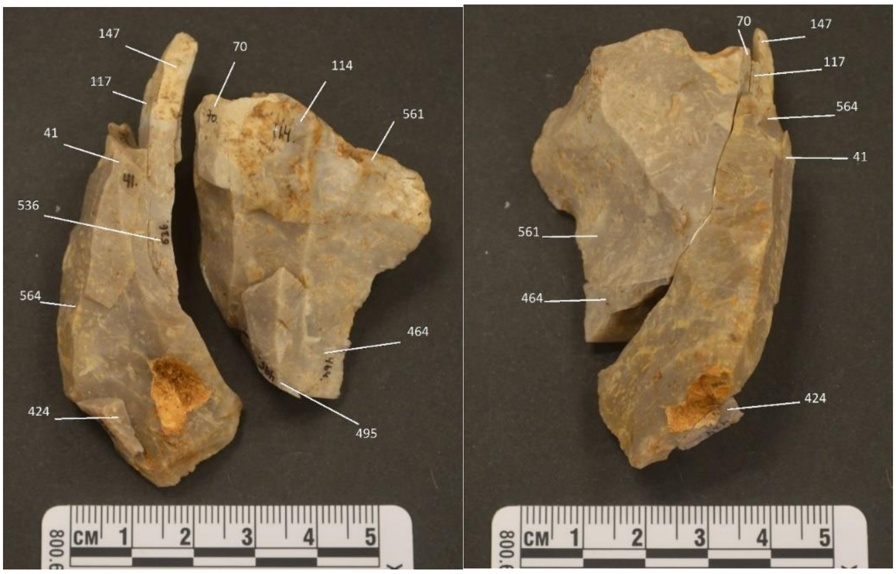
REFIT ID	LOCATION	CLASSIFICATION
69	232x 852y, SE, layer 1	Fragment
2	233x 851y, SE, layer 1	Lanceolate

Refit group 5.4



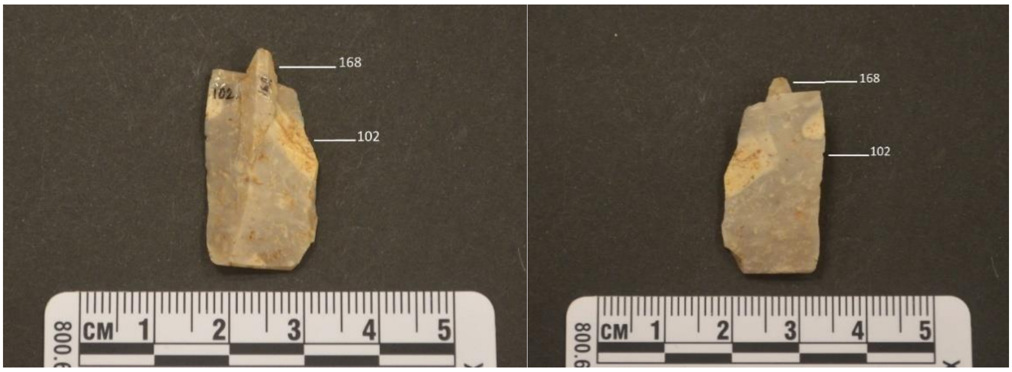
REFIT ID	LOCATION	CLASSIFICATION
142	230x 851y, SW, layer 1	Microblade fragment
144	231x 851y, NW, layer 1	Microblade fragment

Refit group 6.1



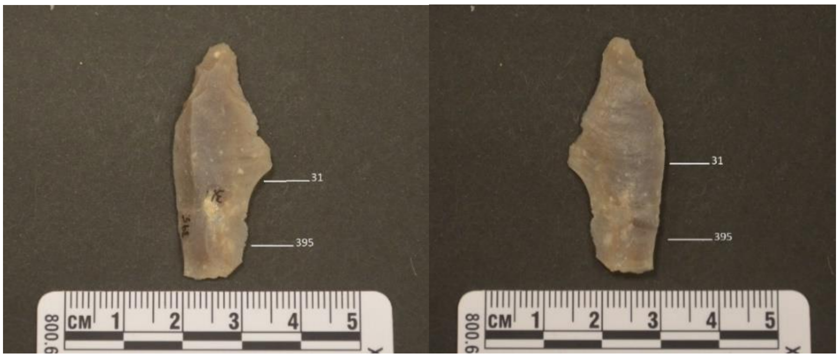
REFIT ID	LOCATION	CLASSIFICATION
561	231x 851y, SW, layer 2	Core
564	231x 850y, NE, layer 2	Core fragment
114	232x 851y, SW, layer 2	Blade
117	232x 851y, SE, layer 2	Blade
70	233x 850y, NE, layer 1	Blade
464	232x 851y, SE, layer 1	Fragment
495	233x 851y, SE, layer 1	Fragment
424	231x 852y, SW, layer 1	Fragment
536	232x 851y, SE, layer 2	Blade fragment
147	231x 852y, SW, layer 1	Blade fragment
41	231x 851y, SW, layer 1	Blade

Refit group 6.2



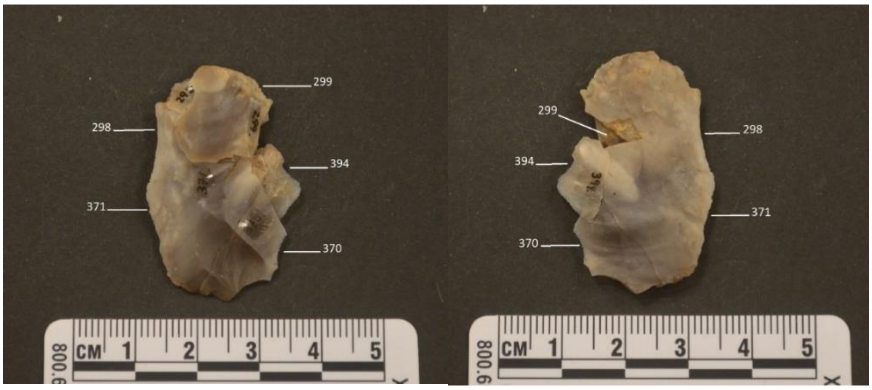
REFIT ID	LOCATION	CLASSIFICATION
102	230x 853y, SW, layer 2	Blade fragment
168	232x 851y, SW, layer 2	Flake

Refit group 7.1



REFIT ID	LOCATION	CLASSIFICATION
31	227x 853y, SE, layer 1	Lanceolate
395	227x 853y, SE, layer 1	Fragment

Refit group 7.2

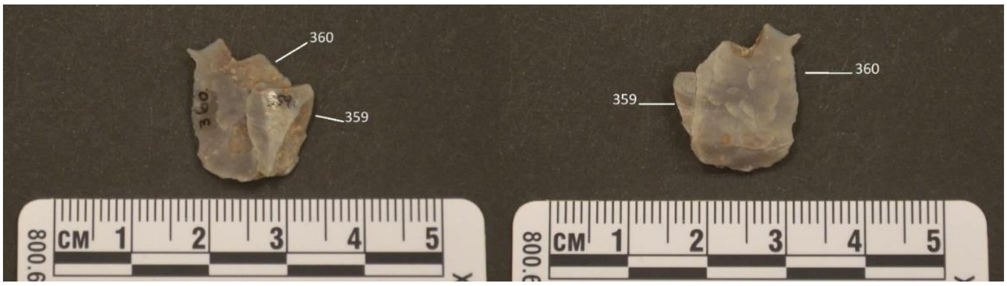


REFIT ID	LOCATION	CLASSIFICATION
370	226x 854y, NW, layer 1	Flake fragment
371	226x 854y, NW, layer 1	Flake fragment
298	227x 853y, SE, layer 2	Flake fragment
299	227x 853y, SE, layer 2	Fragment
394	227x 853y, SE, layer 1	Fragment

Refit group 7.3

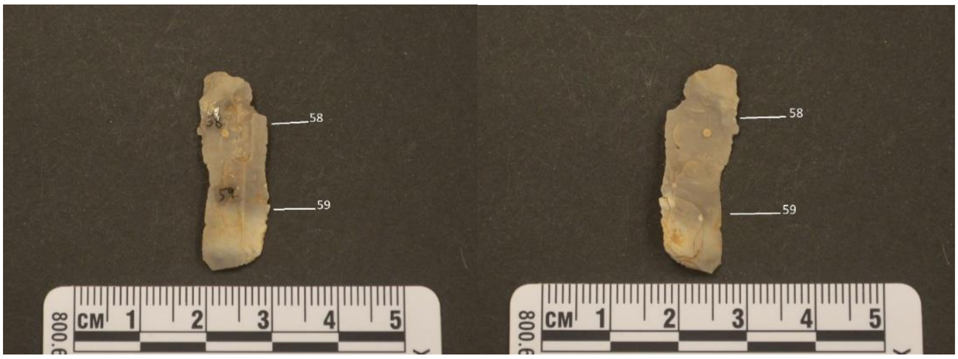
REFIT ID	LOCATION	CLASSIFICATION
109	231x 852y, SE, layer 2	Scraper
347	232x 852y, SE, layer 1	Scraper/hafting end
480	232x 852y, NE, layer 1	Fragment
484	232x 852y, NE, layer 1	Fragment

Refit group 7.4



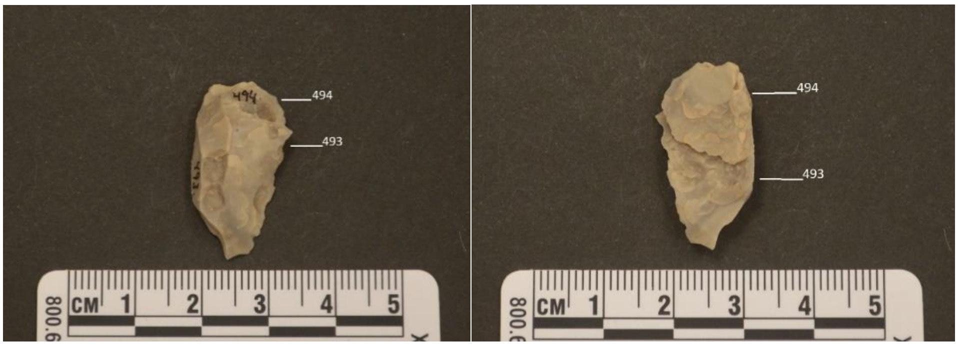
REFIT ID	LOCATION	CLASSIFICATION
359	225x 852y, NE, layer 1	Fragment
360	225x 852y, NE, layer 1	Fragment

Refit group M.1



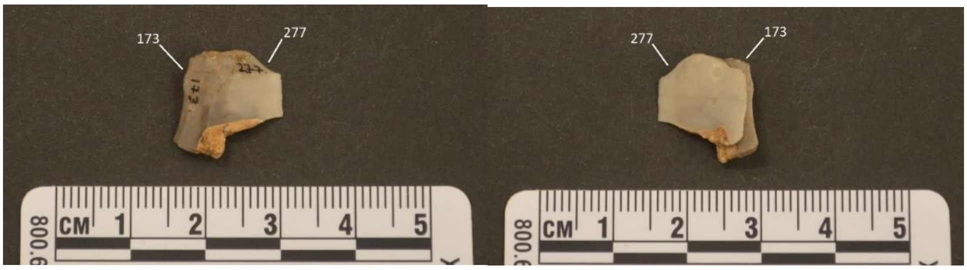
REFIT ID	LOCATION	CLASSIFICATION
58	232x 851y, NE, layer 1	Blade fragment
59	232x 851y, NE, layer 1	Blade fragment

Refit group M.2



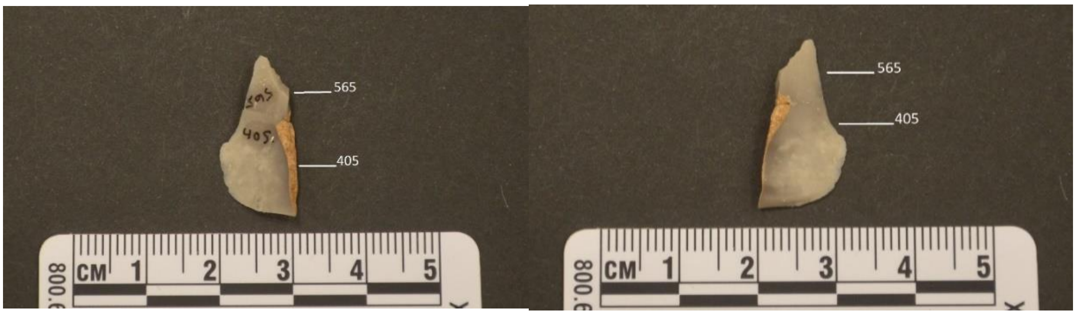
REFIT ID	LOCATION	CLASSIFICATION
493	233x 851y, NE, layer 1	Fragment
494	233x 851y, NE, layer 1	Fragment

Refit group M.3



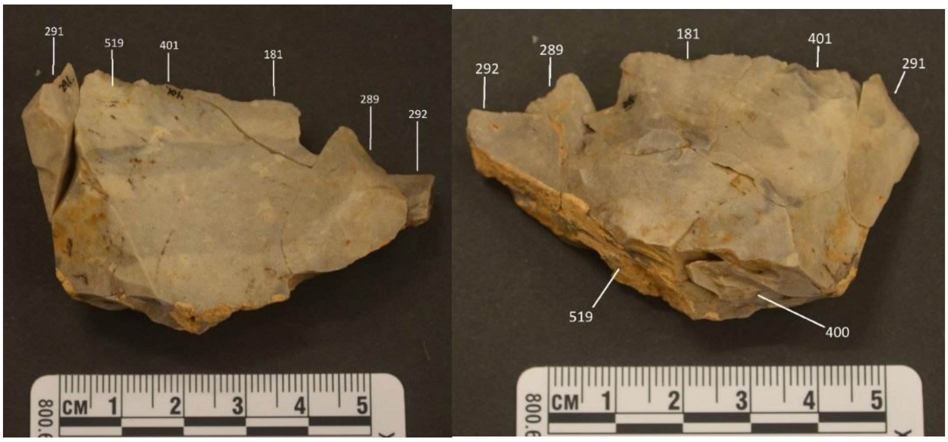
REFIT ID	LOCATION	CLASSIFICATION
277	233x 851y, NE, layer 1	Fake fragment
173	233x 852y, SW, layer 2	Flake fragment

Refit group M.4



REFIT ID	LOCATION	CLASSIFICATION
405	229x 851y, NW, layer 1	Fragment
565	230x 852y, SW, layer 1	Chip/retouch

Refit group M.5



REFIT ID	LOCATION	CLASSIFICATION
519	228x 852y, SE, layer 2	Fragment
291	227x 852y, SE, layer 2	Flake
292	227x 852y, SE, layer 2	Flake
289	227x 852y, SE, layer 2	Flake
400	228x 852y, SE, layer 1	Fragment
401	228x 852y, SE, layer 1	Fragment
181	226x 852y, NE, layer 2	Flake

Refit group R.1

REFIT ID	LOCATION	CLASSIFICATION
566	222x 846y, SE, layer 1	Blade fragment
567	223x 846y, NE, layer 1	Blade fragment