Puzzling Sujala:

A refitting study of the lithic material from a post-Swiderian site in the interior of northern Finnish Lapland

Lucia Uchermann Koxvold

Master of Arts Thesis in Archaeology

Department of Archaeology, Conservation and History

Faculty of Humanities

UNIVERSITY OF OSLO

Spring 2011

Front page illustrations:

An assortment of refitted artefacts from the Sujala assemblage.

Photos by author.

Foreword

In the summer of 2005, I joined the excavation at the Sujala site in northern Finnish Lapland, together with several fellow students from the University of Oslo. It was my first encounter with field archaeology and my first visit to the northern parts of Fennoscandia. The weeks excavating at Lake Vetsijärvi that year, was an adventure. The midnight sun, sauna, reindeer, mosquitoes, and great colleagues were amongst the things, which lead me to return the following season. After the final excavation in 2006, I was invited by the excavators to come to Helsinki to conduct a refitting study on the Sujala lithic assemblage for my master thesis. I had never conducted a refitting study on a larger scale before and was naturally worried if I had the necessary skills. Through discussions and help from Sheila Coulson as well as Ingrid Fuglestvedt I decided to seize the opportunity and moved to Helsinki in January of 2007. The refitting study was not only an analysis of the lithic assemblage from the Sujala site, but also a learning process for me as a student. The study was to be conducted over a period of 4 months but I returned in November 2007, adding another 6 weeks. In the spring of 2008, I returned to photograph the refitted assemblage. Moving to Helsinki also meant moving from friends and family. Tuija, Jarmo and the dogs together with my flatmates and new-found friends at the apartment in Lappinrinne made Helsinki a home away from home and they are the reason for my many returns and visits since.

I hope readers of this thesis will find the Sujala assemblage as intriguing as I have done.

Acknowledgments

Many people have been involved during the process of writing this master thesis and many things have happened while working on it.
I wish to thank some of these people and they are listed below:

Tuija Rankama and Jarmo Kankaanpää for giving me the opportunity to work on the amazing Sujala material, for reading and commenting and for opening their home and sauna, kitos!

Sheila Coulson my supervisor/guidance counsellor for patience, support, and inspiration, thank you for all the conversations and time you have invested to make this thesis what it has become.
Thank you, Ingrid Fuglestvedt, for initiating my interest in the Mesolithic.

Esa Hertell and Mikael Manninen for help and encouragement during the refitting study as well as after, I am sorry that I turned out to be such a lousy knapper.
Thanks to my fellow Sujala volunteers from UiO: Lise Sand, Ingrid Brødholt, Hege Vatnaland, Grethe Moell Pedersen, Anneli Nesbakken and Thale Marte Dæhlien; the Sujala excavations would not have been the same without you!

Christian Westlie for articles, friendship and discussions, Joachim Åkerstrøm for his immense effort in systemising me (although it didn't really work), Gjermund Steinskog for the great map he found and Lars Thorgersen for his help, Hege Gjerde, Carina Julo, Ellen Storrusten, Herdis Hølleland and countless others for being superb colleagues and friends over many years.
Special thanks to Astrid Nyland, Elise Naumann, Tine Schenck, and Anne-Stine Uchermann Talseth for reading, commenting and coming up with good solutions. Thanks also to the I Nordic Blade Technology Workshop participants in Helsinki 2009, for all the positive feedback.

All my friends and family, thank you for all your love and support.

At last, thanks to Josephine Munch Rasmussen, without whom, nothing would be worth doing.

Index

Tables:

Illustrations:

1. Introduction

In the summer of 2002 archaeologists, Tuija Rankama and Jarmo Kankaanpää conducted a survey around Lake Vetsijärvi in the borough of Utsjoki in northern Finnish Lapland (Figs. 1 & 5). The purpose was to locate Early Mesolithic shore-bound settlement sites around the lake. On the ridge of a peninsula protruding into the lake, they made an extraordinary find. Instead of the quartz artefacts one expects to find on Finnish Mesolithic sites, they discovered fragments of large blades made from a chert-like material. The site, *Utsjoki 226 Vetsijärvi 7, Sujala*, lay on a vehicle track, about 90 meters from and 6 meters above the present day lakeshore. This was in sharp contrast to the supposed shoreline location for Mesolithic sites in Finland (Kankaanpää & Rankama 2005: 120; Rankama 1996: 719; Rankama & Kankaanpää 2007:47). Furthermore, although the chert-like material is well known from Norwegian Mesolithic sites in the Varangerfjord area, attributed to the so-called Komsa phase (Grydeland 2005: 55-57, Olsen 1994:29-30) it is not commonly found in Finland.

The preliminary results of this survey were initially interpreted as evidence of a possible inland Komsa site, with large blades. This changed during test pit digging in 2004 when a symmetrical tanged arrow point with invasive retouch on the tip was uncovered. This tanged point is diagnostic of the post-Swiderian industries of north-western Russia and the Baltic, and had previously not been found in the northern Norwegian or the northern Finnish Mesolithic (Rankama and Kankaanpää 2007:56). The closest site with similar tanged points is, Ristola, 1100 kilometres to the south in south-western Finland. Even here, the tanged points are rare (Takala 2004: 178). The Sujala site thus provides the earliest material evidence that could suggest an eastern migration to the north, as well as additional evidence of an eastern presence in the earliest settlements in what is modern day Finland.

In 2005 and 2006, excavations were conducted at the Sujala site and approximately 6400 lithics were recovered during the two field seasons. The lithics showed evidence of blade manufacture, and additional diagnostic tanged points were found. In addition to the lithics, a dark stained area, a possible hearth was revealed, containing burnt bone and charcoal. An additional dark stained area (spot) with similar contents was also discovered. Charcoal from the hearth was radiocarbon dated to 9265±65 BP (Hela-1102), and two radiocarbon dated samples of the burnt bone to 8940±80BP and 8930 ±85BP (Hela-1103 and -1104). This indicates that the site was occupied around the transition between the Preboreal and Boreal periods marking Sujala as the earliest site in Finnish Lapland and one of the earliest in all of Finland (Rankama and Kankaanpää 2007: 50-51). Compared to the northern Norwegian chronology, as proposed by Bjørnar Olsen (1994: 29-34), the radiocarbon dates from Sujala place it between Phase 1 and Phase 2. However, Sujala is located inland, not on the coast, as is the norm for the north Norwegian sites from the same period. Consequently, the Sujala site is unique both in technology and in location.

The Sujala site has several research potentials and many of these have been pursued by Rankama and Kankaanpää (e.g., 2005, 2006, 2007, 2008, and 2009). Already at an early stage of the excavations of the site, Rankama and Kankaanpää wished to integrate a refitting study as a part of the technological and spatial analysis of the lithic assemblage. The site has, therefore, been excavated, and documented, with a refitting study in mind.

Problem statement and research questions

If a lithic assemblage is not too extensive and the majority of the lithics are from the same raw material, it can provide a good basis for a refitting study (Hofman 1992). The Sujala site appears to fulfil these criteria and a total excavation has been conducted. It should therefore be optimal for a refitting study, and the following formulation can function as a point of departure in approaching the lithic finds of the site:

What can a refitting study of the lithic assemblage contributed to in the analysis of the Sujala site?

To reach some answers and insights to the overall research statement, these themes of inquiry form the focus in the study, and will be used to analyse and discuss the various implications of the lithic assemblage of the Sujala site as it appears in the refitted material:

- Raw material assessment
- Vertical and horizontal distribution of the refitted lithics
- The technological processes and the spatial organisation of the site

What information can a refitting study provide in regard to the raw material of the site? Can the refitting study contribute to determine if the site have been occupied more than once? Is the site undisturbed or can the analysis of a refitting study identify post-depositional movements? What sort of technological processes can be identified by the use of refitting? Is it possible to detect these technological processes spatially at the site? Would it be possible to interpret the spatial organisation of the Sujala site based on the analysis from the refitted assemblage?

In an attempt to answer these questions I will use the method of *chaîne opératoire* were the main object is to form a methodological basis to create systematic reconstruction of the steps used in a production process. The *chaîne opératoire* is both a method to approach the choices people made from initial selection of the raw material to finished product and discard, as well as an analysis of the techniques used during this process (e.g. Lemmonier 1986:149, Pelegrin 1990:116, Eriksen 2000:75). When recognising steps in the *chaîne opératoire* of a particular lithic material it is also possible to discuss the spatial organisation of these activities (e.g. Cahen et al. 1979:663; Cziesla 1990:11; De Bie 2007:31; Inizan et al. 1999:94-95). The site can be seen as a social room where intentional behavioural choices are made. These choices can leave material evidence in the technology and the spatial organisation of the site (Dobres 2000; 168).

This approach provides a base to the analysis and discussion on the technological practice seen in the refitted material. Further, I hope to make substantial assessments in regard to the raw material in use, and be able to recognise activities and activity areas at the Sujala site.

Structure of the thesis

The following chapter contains a presentation of the geographical area and the research history of northern Fennoscandia, where the Sujala site is located (Figs. 1 & 2). This will be succeeded by a discussion of the post-Swiderian cultures, to which the Sujala site has been assigned. In chapter 3, the discovery and excavation history of the Sujala site, dates of bones and charcoal and the lithic assemblage are presented. In chapter 4, the methodological choices of this study will be considered and how the application of the *chaîne opératoire* has been used to approach my research questions. In chapter 5, the results of the analysis of the refitted material will be presented, beginning with the raw material and then the taphonomic assessment followed by an analysis of the vertical distribution. I will then discuss technological processes as well as spatial distribution at the site based on the results of the refitted material. Finally, the results of the analysis will be discussed and I will attempt to retrace the *chaîne opératoire* of the technological practice spatially and suggest a general organisation of the site as interpreted through the refitted material. This will be followed by my conclusions in chapter 7.

2. Geographical area and research history

The archaeological assemblage recovered from the Sujala site is arguably neither typical of the north Norwegian coastal early Mesolithic sites nor of the quartz- based Finnish Mesolithic. On the basis of the diagnostic tanged arrow points found, the Sujala site most closely resembles the post-Swiderian cultures of north-western Russia and the eastern Baltic. However, as the term *post-Swiderian* is debated it also needs to be discussed further. This chapter is an attempt to do so, as well as to present the north Norwegian and Finnish Mesolithic for the purpose of placing the Sujala site in regional and research historical context. Terms, like *post-Swiderian*, inevitably touch upon research areas where international geopolitics forms an important backdrop. I have found it necessary to consider various terms and chronologies applied to the Mesolithic in an area that has, in modern times, formed a disputed borderline between east and west (e.g. Havas 1999 and 2002). (See Fig. 1 for map of geographical area).

Swiderian and the post-Swiderian- debatable connections

The post-Swiderian cultures emerged in the east Baltic and north-western Russia in the early Preboreal (10,000 -9000 B.P). As the name suggests, the post-Swiderian cultures were originally considered descendents of the Upper Palaeolithic Swiderian culture. The Swiderian culture is traditionally seen as contemporary of the Ahrensburg culture, were the latter belonged to the west side and the former on the east side of the Oder river (e.g. Dolukhanov 2008:296; Kobusiewicz 1999:118, 2004:134; Kozlowski 1990: 435). The post-Swiderian culture's emergence has been attributed to climate change and alteration of livelihood during the younger Dryas-Preboreal transition. The consequent north-eastern migration of the Swiderian population is, then, presumed to have resulted in the adaptation of new tools and a changing technology (e.g. Carpelan 1999: 155; Kozlowski 1990: 440; Kobusiewicz 2004:133-134; Shumkin 2006:320; Takala 2004: 164-165; Zhilin 1996: 278; Zvelebil 2008:23-24).
The post-Swiderian cultures are suggested to include groups such as Butovo, Kunda, Pulli, Parch and Veretye (Fig. 2) and had similar technology, tool kits and economic bases (e.g.

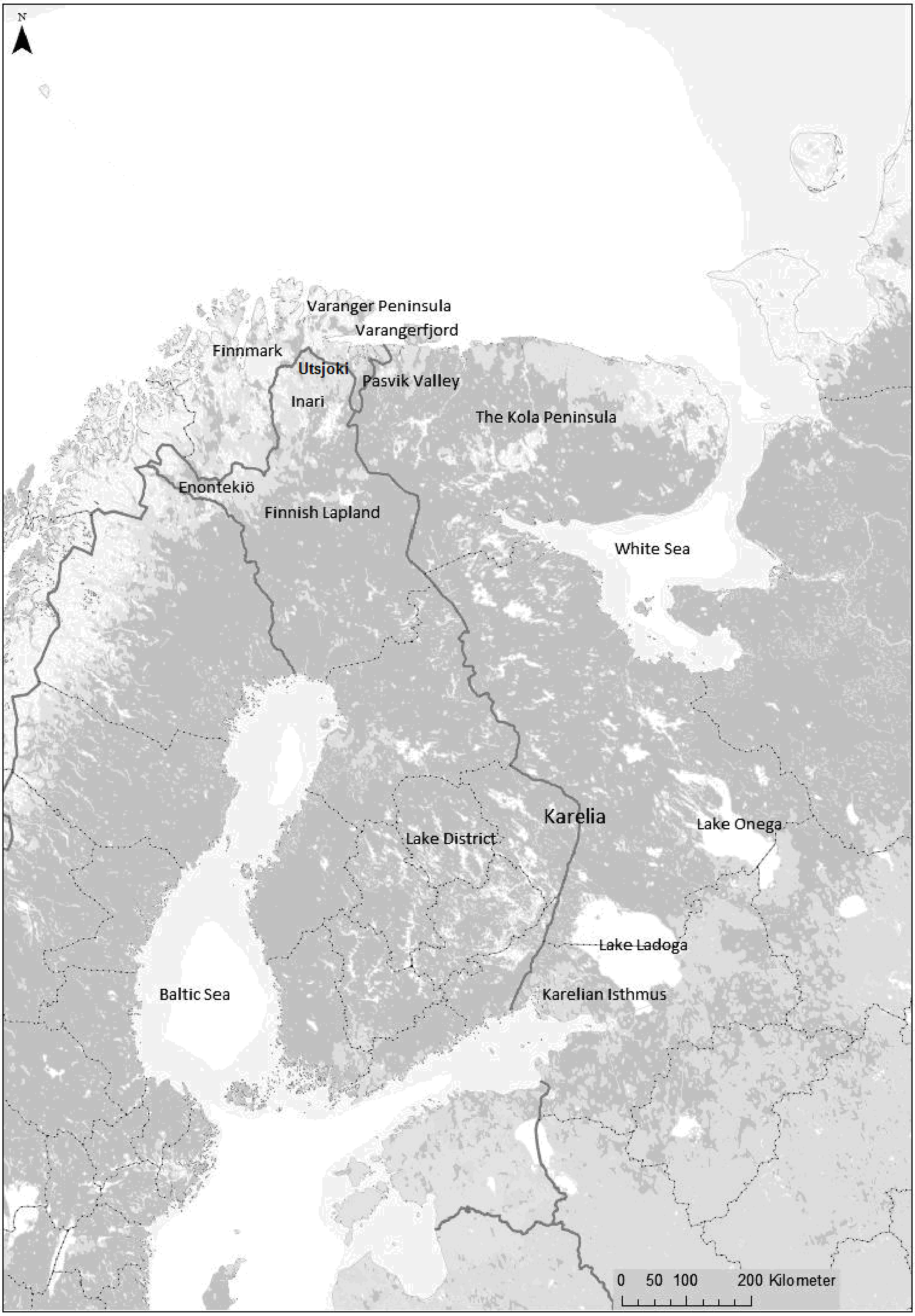


Figure 1: Map showing research area with places and names used in the text.

Carpelan 1999:155-157, Jussila et al 2007:159, Koltsov & Zhilin 1999: 359-360, Shumkin 2006:321, Takala 2004: 133-134; Zaliznyak 1999:213-216; Zvelebil 2008:24). Stefan
Carpelan 1999:155-157, Jussila et al 2007:159, Koltsov & Zhilin 1999: 359-360, Shumkin 2006:321, Takala 2004: 133-134; Zaliznyak 1999:213-216; Zvelebil 2008:24). Stefan
Kozlowski (2009: 365, 1990:435) criticises the studies conducted on the post-Swiderian cultures for being “insufficient” and “unequal“, and consequently suggests “north-eastern techno complexes” as an alternative term.

According to Kozlowski (2009: 364), the lithic assemblages of what he calls north-eastern techno-complexes include conical cores, pressure technique, regular blades, intentional blade sectioning, burinations conducted on broken blades, end scrapers on blades, and micro-retouched inserts as well as post-Swiderian tanged points. These tanged points have been made from both broad and narrow blades; they are straight in their profile and are seldom produced from flakes. The points have inverse semi-abrupt retouch at the base and often at the tip. Inverse retouch is rare but occurs, according to Kozlowski (2009:365-369). However, when analysed by Mikhail Gennadievich Zhilin (1996:281-282); the base and point are retouched by either semi-flat or semi-steep technique on one or both sides of the point. The points are, for the most part, symmetrical. In summary: flat inverse retouch is commonly found in several of the post-Swiderian assemblages, and is a diagnostic trait of the post-Swiderian points (e.g. Burov 1999:282; Kobusiewicz 1999:118; Koltsov & Zhilin 1999: 350; Oshibkina 1999: 326; Siemaszko 1999: 190; Takala 2004:130: Zhilin 1999:300).

The Swiderian culture as the originator for some of the groups and sites attributed to post-Swiderian is highly debated (e.g. Kozlowski 2009: 265, 1990: 433; Potekhina 1999: 333; Takala 2009: 33). For instance, Alexandr Volokitin (2005: 17) argues that there are no Swiderian elements in the lithic assemblage of, for instance, Butovo and no connection between the Swiderian points and the post-Swiderian points. Consequently, the term *post-Swiderian* and the question of which cultures that can be attributed to it are largely unresolved (Dolukhanov 2008: 299; Takala 2009: 33; Volokitin 2005: 17). However, though the definitions are unclear, the term post-Swiderian, is still commonly used when referring to early Mesolithic sites in eastern Baltic, north-western Russia and more recently Finland on an interregional level, and specifically when discussing the diagnostic tanged points (e.g. Carpelan 2008; Jussila et al 2007; Kankaanpää & Rankama 2009; Koltsov & Zhilin 1999;

Figure 2: Map of sites presented in the text.1. Sujala, 2. Saarenoja, 3. Ristola, 4. Helvetinhaudanpuro, 5. Likolampi, 6. Antrea net find, 7. Kunda Lammasmägi, 8. Pulli, 9.Veretye 1, 10. Butovo, 11. Mortensnes, 12. Sarnes, 13. Slettnes, 14. Komsa, 15. Myllykoski.

Kozlowkis 2009, 1990; Rankama & Kankaanpää 2007, 2008 ;Shumkin 2006; Siemaszko 1999; Sorokin 1999; Takala 2009, 2004). In this study, the Sujala site is referred to as a post-Swiderian site with allowance made for these uncertainties. I chose to consider the term post-Swiderian as an analytical tool that helps connect the site to others with similar technology, tool kits, and economic basis. The term connects sites regardless of modern states borders and research traditions in the north-eastern parts of Europe and will therefore, be used as an analytical instrument rather than a culture *per se* or as indicating descent from the Swiderian culture.

The earliest settlements of northern Norway and Finland

To contextualise the Sujala site, the assemblage must be seen both in the light of the northern Norwegian as well as in the light of the Finnish chronology of the Mesolithic. The following Figure (Fig. 3) presents the periodic chronologies that will be used and discussed throughout the chapter.

Northern Norway

According to Bjørnar Olsen (1994:25) the ice retreated from the coast of northern Norway about 13 000 to 14 000 years ago leaving a small stretch of land open. This implies that the coast would be free of ice as early as 11 000 years ago (Anundsen 1996: 214; Bergman et al. 2004). During Preboreal (10,000 BP-9000 BP) and Boreal (9000-8000 BP), time the ice is believed to retreat from the inland as well (Andersen 1980: 211). The northern Norwegian coast of Finnmark is presumed to have been partly utilised by people 10.000 years ago (Olsen 1994: 25). Evidence of this is found in the archaeological record, for instance, the Slettnes site on Sørøya, has a radiocarbon date set at 9610+- 80 BP. The Sarnes site on Magerøy has a debated radiocarbon date to 10280+-80 BP, while another date from the same site is 8120+-75 BP has been suggested as more likely (Blankholm 2004:41).Mortensnes on the coast of the Varangerfjord in Finnmark is carbon dated to 8500+-120 BP (Hesjedal et al 1996: 14; Olsen 1994: 29-31; Blankholm 2004: 49-51; Thommessen 1996: 236-237).

Younger Dryas	Preboreal	Boreal	Atlantic
11,000-10,000 BP	10,000 -9000 BP	9000-8000 BP	8000-5000 BP

Komsa /Phase 1 10.000-9000 BP	Sælneshøgda/ Phase 2 9000-7500/7000 BP	Trapeze/ Phase 3 7500/7000-5600 BP

Ancylus Mesolithic 9300-8000 BP	Litorina Mesolithic 8000-6000BP

Baltic Ice Lake	Yoldia Sea	Ancylus Lake	Litorina Sea
13,500/13,000-10,000 BP	10,000 -9500 BP	9500-8400/8000 BP	8400/8000 BP- present

Figure 3: The archaeological chronologies of the north Norwegian and Finnish Mesolithic compared to both quaternary studies of the northern hemisphere (top) and the quaternary studies of the Baltic Sea basin (bottom). Based on Andersen 1980; Matiskainen 1990; Olsen 1994; Tikkanen 2006 and Woodman 1993.

The Mesolithic settlements in northern Norway between 10 000 BP and 5600 BP were originally referred to as belonging to the Komsa culture (e.g. Bøe and Nummedal 1936; Odner 1964, 1966, Olsen 1994, Thommessen 1996; Woodman 1993, 1999). The term *Komsa culture* was invented after the Komsa sites were discovered in Finnmark in the 1920s (Bøe and Nummedal 1936) and was first considered to be a solitary phenomenon. The origin of the Komsa was uncertain at the time, and was linked both eastward to the Kola Peninsula, as well as to the south-west of Norway and the Mesolithic Fosna culture found there (Nummedal 1975; Odner 1966; Olsen 1994; Thommessen 1996:235; Shumkin 2006). Today there is a general consensus that both the Komsa and the Fosna culture represent the same period in the earliest phase of settlement in Norway, and thus are not separate cultures (e.g. Bjerck 1994, 2008:101; Grydeland 2005: 43; Odner 1966: 132; Olsen 1994:35; Thommessen 1996: 237; Woodman 1999: 308-309). The Norwegian coast is considered to have been settled at a rather rapid speed, only within 200-300 years, and although there are regional differences the material culture of the earliest settlements could generally be considered to contain the same basic characteristics (Bjerck 2008: 103; Fuglestvedt 2009: 153; Grydeland 2005:45; Thommessen 1996: 236).

Peter Woodman (1993:58) considered the Komsa to be a much shorter period and, based on lithics from three sites, divided the Mesolithic in northern Norway into three distinct periods. These he called; the Komsa, the Sælneshøgda and the Trapeze Phase (Fig. 3 and Table 1) (Woodman 1993: 74-75, 1999:301). This chronology was modified further by Olsen into Phase 1 (10 000-9000 BP), Phase 2 (9000-7500/7000 BP) and Phase 3 (7500/7000-5600 BP) (Fig. 3 and Table 1). He proposed that while the inland is being used from Phase 2 and onwards, Phase 1 is strictly coastal (Olsen 1994: 29-34). Although it should be noted, that the inland has yet to be surveyed thoroughly.

Table 1: Summary of the main feature of the northern Norwegian chronologies referred to in the text. After Olsen 1994.

Woodman Chronology	**Olsen Chronology**	**Time estimate In BP**	**Characteristic Finds**	**Raw materials**	**Site locations**
Komsa Phase	Phase 1	10 000-9000 BP	Single and two edged tanged arrow points, flake axes, bipolar cores and disco cores	Quartzite, quartz, rock crystals and several types of cherts	Presumably only coastal.
Sælneshøgda Phase	Phase 2	9000-7500/7000 BP	Micro blades, conical and cylindrical cores. Fewer tanged points and increase in burins and retouched artefacts	Quartzite, quartz and several types of cherts	Coastal but with possible use of the inland in some seasons.
Trapeze Phase	Phase 3	7500/7000-5600 BP	Trapezes, scrapers and bipolar cores	Quartz	Use of the inland as well as the coast

Phase 1 (10 000- 9000 BP) is characterised by single and double-edged tanged arrow points, flake axes, bipolar cores and discos cores. In this early phase quartzite and quartz is the dominant raw material type but also various cherts (Hood 1992b) and rock crystal where used.

Phase 2 (9000-7500/7000 BP) include micro blades and conical and cylindrical cores. The use of tanged arrow points decreased while scrapers, burins, and retouched artefacts increase. This Phase include the use of a variety of raw materials such as cherts, quartzite, and quartz.
Phase 3 (7500-7000- 5600 BP) is characterised by trapezes and scrapers and bipolar cores. The main raw material is quartz (Hesjedal et al 1996: 235-236; Hood 1992b; Olsen 1994: 29-34; Thommessen 1996:239; Woodman 1993:62-67, 1999:301-303).

Finland

About 62% of present day Finland's surface has at some stage been beneath the water level of the Baltic Sea. Exceptions are Lapland and eastern Finland, but these areas have been covered by local ice lakes for shorter periods of time (Tikkanen 2006: 65). The deglaciation of Finland took place between 12 100 BP and 9200 BP (Tikkanen 2006). Most parts of Finland were likely ice free around 10,000 BP, while some of the interior in the northernmost areas may still have had smaller longer-lasting glaciers (e.g. Kankaanpää & Rankama 2005: 111; Rankama 1996: 292-295 & Fig. 67: 302). The dating of Finnish Stone Age sites has mainly been based on shore-line displacement chronology on the Holocene land upheaval and quaternary studies on the Baltic Sea (Matiskainen 1989b:379; Siiriäinen 1974: 5). The oldest site in Finland is Myllykoski, at Orimattila (Fig. 2), located in the south, and dated on burnt bone to 9480+-90 BP or 9070-8670 CalBC. At this site, all artefacts are made of quartz (Takala 2009:31-32).

The Mesolithic in Finland was initially called the Pre-ceramic period or, Suomusjärvi culture, (Matiskainen 1989a: vii). The name is still used today, especially by non-Finnish scholars, and particularly when discussing or presenting larger regions as Fennoscandia (e.g. Bergman et al. 2004; Kozlowski 2009; Zvelebil 2008). The Suomusjärvi culture was seen as quartz dominated, and therefore, the term "the quartz Mesolithic" is also commonly used. However, the Suomusjärvi term, as the original Komsa term, has proven insufficient when addressing the whole of the Finnish Mesolithic. Heikki Matiskainen (1990:212) offers a different terminology for the Finnish Mesolithic based on the two youngest phases of the Baltic Sea basin; the Ancylus and Litorina Mesolithic (see Fig. 3 and Table 2). The division is based on both the quaternary studies on the Baltic Sea basin (Miettinen et al 2008:78; Saarnisto 2008:128; Tikkanen 2006) and on lithic typology (Matiskainen 1990:212).

Table 2: Chronology of the Finnish Mesolithic, as proposed by Matiskainen 1990:212.

Phase name	Time frame	Diagnostic tools
Ancylus Mesolithic	9300-8000 BP	Leaf-shaped slate points and coniform-holed mace heads
Litorina Mesolithic	8000-6000 BP	Oblique-blades quartz points and south Finnish even bladed adzes

The Ancylus Mesolithic, 9300-8000 BP is the first stage of settlement where lithic diagnostic artefacts include leaf-shaped slate points and coniform-holed mace-heads (see Table 2).The Litorina Mesolithic, 8000-6000 BP, follows with lithic diagnostic artefacts being oblique-bladed quartz points and the south Finnish even bladed adzes (Matiskainen 1989b:389). Except for the late Mesolithic oblique arrowheads, there are very few types of quartz artefacts to separate into phases according to Matiskainen (1989b:387); therefore the typological characteristics of the Ancylus and the Litorina Mesolithic were based on artefacts of other raw materials such as slate. However, it is important to stress that quartz is the most dominant raw material type during the Mesolithic in Finland (Carpelan 2004: 25; Matiskainen 1996:259-260; Rankama 2009: 813; Schulz 1990: 13). Some concerns have been voiced as to the usefulness of the chronology on regional or smaller scale inquiries, especially in northern and inland areas (Räihälä 1999: 203).

The problem of the chronological placement of the northern Finnish inland Mesolithic sites is twofold: first, the shore displacement chronology cannot be used for the reasons stated in the previous section and also as mentioned the quartz assemblage is not easily categorized, expect for the oblique arrow points (Manninen 2005:32; Rankama 1996:607, 2003:38). Local chronologies, (Fig. 4), based on radiocarbon dated sites have been suggested in the northern parishes of Enontekiö and Inari (Fig. 1) (Kankaanpää & Rankama 2005: 117, 129). Researchers working with the earliest settlements in the northernmost parts of Finland also tend to use, discuss or refer to the North Norwegian phases (Fig. 3 & Table. 1) when presenting their material (e.g. Carpelan 2004: 24-26; Halinen 2005: 31; Manninen 2005: 36-38, 2009: 102; Kankaanpää & Rankama 2005:130, 2009: 39; Rankama 1996:566-567, 2003: 43).

1

Ancylus Mesolithic	Litorina Mesolithic
9300-8000 BP	8000-6000BP

2

Early Mesolithic	Middel Mesolithic	Late Mesolithic
8850-7700 BP	7700-6550 BP	6550-6050

3

Early Mesolithic	Late Mesolithic
8000-7300 BP	7300-6200 BP

Figure 4: General Finnish Mesolithic chronology (1) compared to the local Mesolithic chronology of Inari (2) and to the local Mesolithic chronology of Enontekiö (3).

The dated sites in Finnish Lapland indicate that the quartz dominated Finnish Mesolithic stretched from the south or southeast to northern Finnish Lapland during the Ancylus Mesolithic around 8400 BP, though there are dates from Inari stretching as far back as 8800 BP(Carpelan 2004: 24-25). The lithic material from these sites consist mainly of quartz, however, other raw materials such as slate, jasper and chert are also found (Carpelan 2004:25; Halinen 2005:75-78; Manninen 2005:32-33; Kankaanpää & Rankama: 2005: 155; Rankama 2003:38).

There are only a few indications of contact between the inland population and the coastal population of northern Fennoscandia in the early Mesolithic, although some artefacts made from chert are found on inland boreal period Finnish sites. However, these chert artefacts, which probably derived from the north Norwegian coast, are few in number and scattered (Carpelan 1999:165, 2004: 25; Grydeland 2005: 70-71; Rankama and Kankaanpää 2005: 120). There is an ongoing debate in regard to where the earliest settlers in northern Finland came from (Carpelan 2004: 21; Kankaanpää & Rankama 2005: 126; Manninen 2009:102; Rankama 2003: 45). Although this is still debated, the general consensus, according to Oili Räihälä (1999:204), is that Finland was settled from the south and the south east.

The easternmost parts of Finland and the western part of Russia (see Fig. 1) are called Karelia and the area between Lake Ladoga and the Baltic Sea is the Karelian Isthmus (Lavento 2008b:50). The Karelian Isthmus has a long archaeological as well as modern political history and as such it has been considered an important passage for cultural influence into Finland (Lavento 2008a, 2008b). In 1914 in Korpilahti in the Karelian Isthmus, researchers found what would be considered one of the most important archaeological finds in Finland and one of the oldest fishing nets in Europe, popularly called the Antrea Net find (Fig.2 for site location) (Carpelan 2008: 88; Miettinen et al. 2008: 71). Initially the net was suggested to be about 5000 years old (Carpelan 2008:102). More recently it has been radiocarbon dated to 9140+-135 BP, which places it in the maximum of the Ancylus transgression around 9200-9100 BP (Miettinen et al 2008: 71). This find initiated a long debate and the search for its origin was a major contributor to the study of early Mesolithic in the Baltic and Finnish areas (Carpelan 2008:88; Zvelebil 2008: 24). The Antrea Net find is now attributed to the Kunda culture of the Baltic (Carpelan 2008, 1999; Timofeev et al. 2004: 93).

Christian Carpelan (2008: 123) argues that the Antrea fish net, together with other finds, prove that early Mesolithic people were in the outer archipelagos of the Lake Ladoga-Baltic Sea (Fig. 1) (Carpelan 2008). Because of the transgression of the Ancylus and the massive changes that occurred, Carpelan (2008) argues that these pioneers were in the Karelian Isthmus no later than during the Yolda /Ancylus transgression around 9500 BP. Other dates from comparable sites support this view. As mentioned by Pavel Dolukhanov et al. (2009: 51), the locations of the prehistoric sites found in this area show that the hunter-gatherer groups moving in this area were effectively controlled by the changes of the Baltic Sea basin.

The Mesolithic sites found in the Karelian Isthmus include lithics known from the Baltic Mesolithic, as well as some arrow points referred to as belonging in the post-Swiderian culture complex (Carpelan 2008; Halinen et al. 2008: 250; Jussila & Matiskainen 2003: 670). One can speculate that perhaps the Karelian Isthmus provided a corridor where both the Butovo (Fig. 2 for site location) of Central Russia and the Kunda (Fig. 2 for site location) from the Baltic countries could move towards the north (Carpelan 2008: 123)

Post- Swiderian in Finland

The Finnish Mesolithic sites dominated with quartz yield few evidences of direct technological connections to the flint using cultures in the east and south (Matiskainen 1989a). However, it is believed that Finland has been populated from the east and the south. The quartz characteristics are not like flint when knapped, and different technological strategies need to be applied when using it (e.g. Knutsson 1998; Lindgren 2004). As Hannu Takala (2004: 170) points out that archaeological material shows evidence that local raw material, like quartz, seems to have come swiftly into use. The change of technological strategies and the transition to utilize local raw material could have been rapid.

Sites like Ristola, Saarenoja, and Sujala (Fig. 2 for site locations) bear signs of a different technology and raw material than the quartz-based ones. These sites contribute to make a more complicated picture of the quartz-dominated early Mesolithic in Finland. The use of flints and cherts, blades and arrow points at these sites offer clues to connections between Finland and the areas to the north, south, and east, like Kunda or Butovo or Varangerfjord (Jussila et al. 2007:157; Jussila & Matiskainen 2003:670; Rankama & Kankaanpää 2008:884; Sulgostowska 1999:85-86; Takala 2009:31).

Ristola is a multi-period site located in the south of Finland, close to the city of Lahti (Fig. 2 for site location). The oldest period at Ristola represents the earliest stage of post glacial settlements in Finland, thus making the site one of the oldest in Finland (Takala 2004: 9). It has been dated in relation to a sea shore displacement curve to around 9500-9200/9000 BP, calibrated 8850-8400/8150 BC and a radiocarbon date shows that the site was still occupied around 8880 BP (Takala 2004: 160-161). The oldest parts of the Ristola site revealed 101 flint artefacts including five tanged arrow points of the post-Swiderian type. In the Ristola material Takala has differentiated between the points and categorised two of them as Pulli-type arrow points (Takala 2004: 133-134). The flint assemblage also includes a blade core, retouched blades, scrapers, inserts and burins as well as production debris (Takala 2004: 110). Pressure technique has also been detected in the Ristola flint material (Takala 2004:117).

Saarenoja (Jussila et al. 2008) in the south east of Finland (Fig.2 for site location), is another early Mesolithic site with a lithic assemblage associated to the post-Swiderian groups, including an arrow point and several flint blades. The site was dated on burnt bone to 9310+-75 BP calibrated to 8600 BC (Jussila et al. 2007: 143-144; Jussila & Matiskainen 2003: 669).

Also worth mentioning is the Ne Savo sites, including Helvetinhaudanpuro and Likolampi (Fig. 2 for site location), which are located in the great Lake District (Fig. 1) in eastern central Finland, and are, according to Timo Jussila et al. (2007) the only excavated stone age sites in this region. Both sites revealed quartz assemblages but also some pieces of flint. The black translucent flints found at Ne Savo are very well known from post-Swiderian attributed sites in Lithuania, Russia, and Belarus. While it its more uncommon in Latvia and Estonia, an exception is the early Mesolithic Pulli site in Estonia (Fig.2) where about 1500 pieces of this black flint were retrieved. This flint is also known from sites attributed to the Butovo culture (Jussila et al. 2007: 157). In Finland, there is evidence of this raw material at the Ristola site, as well as the Ne Savo sites. The presence of this flint type may help shed some light on questions concerning contact and trade. The researchers and discoverers of these sites considered them a good reference material regarding stone technology and adaptation to quartz in the earliest settlements of Finland (Jussila et al. 2007: 159).

However, while the Ristola site (Takala: 2004) and Saarenoja (Jussila et al. 2007) and perhaps the Ne Savo settlements (Jussila et al. 2007), may be connected to the Ancylus and or the Litorina phases of the Mesolithic, they do not fit within the typological definitions these phases are divided by. These sites are, therefore, evidence of diversity in the earliest settlements in Finland. According to Takala (2009: 31) the most recent studies shows that the earliest pioneer settlements started around 9500-9200 BP in the south of Finland and moved north-west and into the northern parts. Today, the presence of flint microblades in the earliest Mesolithic sites is interpreted as evidence of this pioneer settlement (Halinen & Mökkönen 2009:113; Jussila et al. 2007:157).The earlier typological characteristics of the Finnish Mesolithic, and the notion of it being exclusively in quartz, need adjustment to include the evidence of this “new” early Mesolithic.

Lithic material of eastern technological origins has been detected in the Finnish Mesolithic, but only in the south and east, with the Ristola site as perhaps the most prominent (Takala 2004). The third site with eastern related technology and lithic assemblage was discovered in northern Finnish Lapland in 2002; Sujala site. The following chapter will address this site.

Summary

In this chapter, an overview of the earliest settlements, dates, and chronologies of northern Fennoscandia represented for northern Norway and Finland has been presented. The northern Norwegian chronology as suggested by Woodman (1993, 1999), and later modified by Olsen (1994), and the Finnish chronology based on the Baltic Sea basin by Matiskainen (1989b), lay the foundation for several of the researchers investigating the earliest settlements in these areas. However, local chronologies have been suggested for some areas of Finnish Lapland since neither of the above mentioned chronologies has proven sufficient when addressing the inland settlement in these areas. Compared to the raw material found at northern Norwegian Preboreal sites, the Finnish sites have yielded primarily quartzes, which has proven difficult to typologically classify (Manninen 2005:32). The lithic assemblages in the Finnish archaeological material represented by Ristola and Saarenoja bear significant evidence of a more diverse early Mesolithic in Finland and makes connections to the east and south plausible. Now, with the find of Sujala, these connections are found as far as Finnish Lapland. These sites are associated with the post-Swiderian. The suitability of this term, its background, and implications regarding material culture has been discussed in this chapter. Based on the conclusion that it is uncertain to what degree a *post-Swiderian* culture can be detected, I have suggested that the term *post-Swiderian* should be considered simply as a convenient analytical tool. Using this term, with these provisos, makes it possible to connect similar sites across national boarders, not to detect or define specific culture groups, but as a way of contributing to a more dynamic, interpretive approach on lithic technologies at an interregional level.

3 Site location, excavations and finds

In previous chapter, I presented the research history and some interpretations of the earliest settlements in northern Norway and Finland and discussed the post-Swiderian cultures. In this chapter, I will present the discovery of the Sujala site, as well as the site's excavation history and details. Following this I will discuss the archaeological finds and in particular the lithic assemblage, that forms the main focus of this thesis.

Lake Vetsijärvi

In 2002, during a survey in Finnish Lapland in the borough of Utsjoki around Lake Vetsijärvi archaeologists Tuija Rankama and Jarmo Kankaanpää discovered the Sujala site (Figs. 5 & 6). Lake Vetsijärvi was one of the research areas for Rankamas doctorial-thesis (1996), where she argued that inland lakes and their fish resources were important in the prehistoric economy of the region (Rankama 1996:154-155). Rankama also argued that the inland lakes could have been exploited in the early Mesolithic (Rankama 1996:299, 525-527). Lake Vetsijärvi is one of the larger lakes in the Utsjoki region with its 8.2 km² surface area (Rankama & Kankaanpää 2005:113). The lake lies on a tundra plateau about 60 km inland from the Varangerfjord and 30 km from Utsjoki, and is situated approximately 274 meters above sea level (Rankama & Kankaanpää 2006: 104). Lake Vetsijärvi is connected to the River Teno through the Vetsijoki River (Rankama 1996: 44). The Vetsijoki River and Lake Vetsijärvi were found to be one of the areas with the highest diversity of fish resources in the Teno River drainage (Rankama 1996; 189-190, 220, 717).

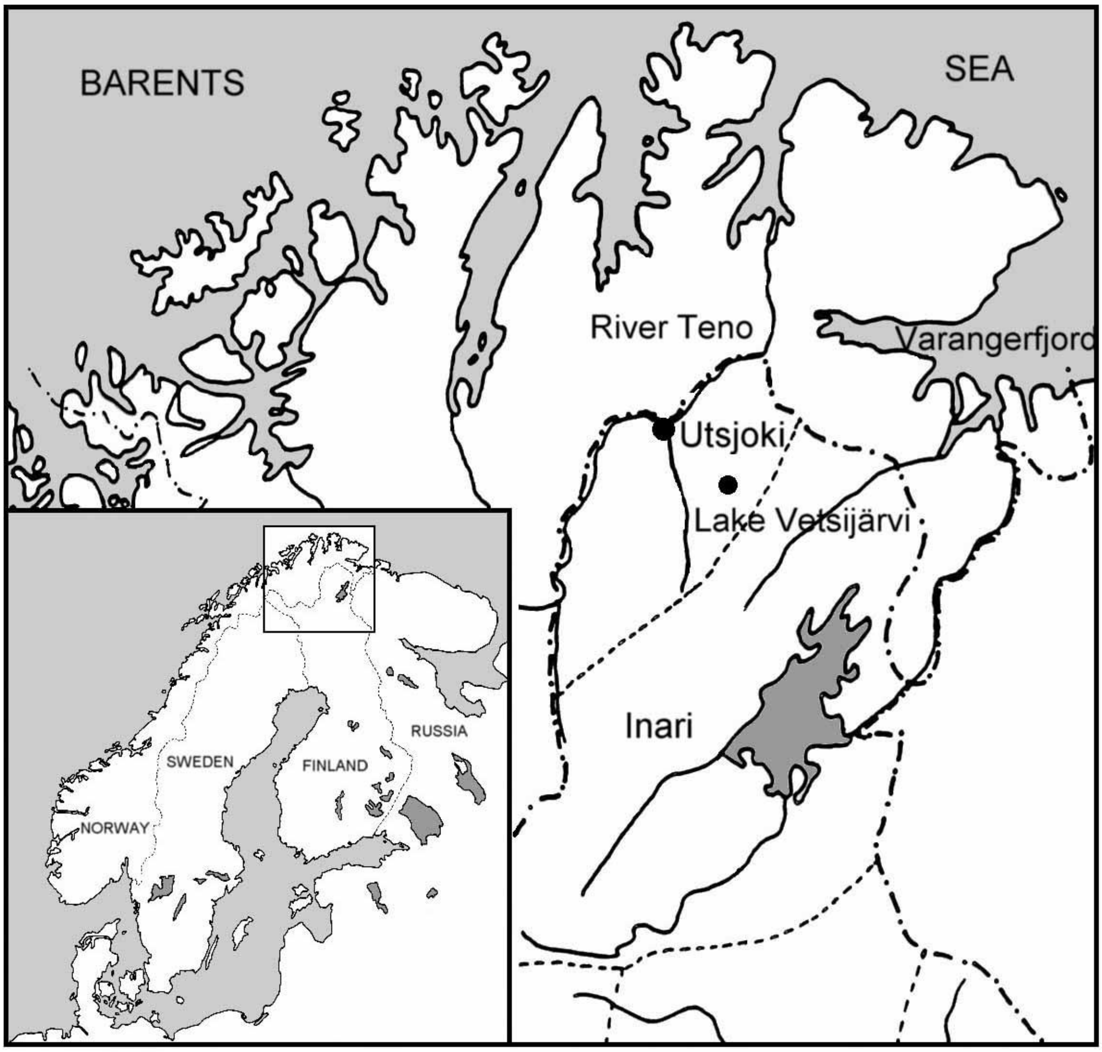


Figure 5: Location of Lake Vetsijärvi in the borough of Utsjoki in northern Finnish Lapland. The River Teno marks the border between Norway and Finland. After Rankama & Kankaanpää 2008:886.

The strategy of the survey was both to search for prehistoric sites along the shoreline of the lake, since the lake area would have been favourable for prehistoric hunters-fishers, and to test the hypothesis suggested by Rankama regarding the economic value of inland lakes (Rankama 1996: 719; Rankama & Kankaanpää 2005: 113; 2006: 104). Instead of sites close to the lake's shoreline, they found scattered material on the ridge of a peninsula at the southern part of the lake; about 90 meters from the shoreline and 6 meters above the present lake (Fig. 6). Rankama and Kankaanpää (2005:115) suggest that the lake's water level has gone down, rather than risen, during the Holocene (for more details on the history of Lake Vetsijärvis and the region; see Rankama & Kankaanpää 2005 and 2006). They also suggest that if this is the case, extended research of the lake's geological history is needed (2005:115; 2006:105).

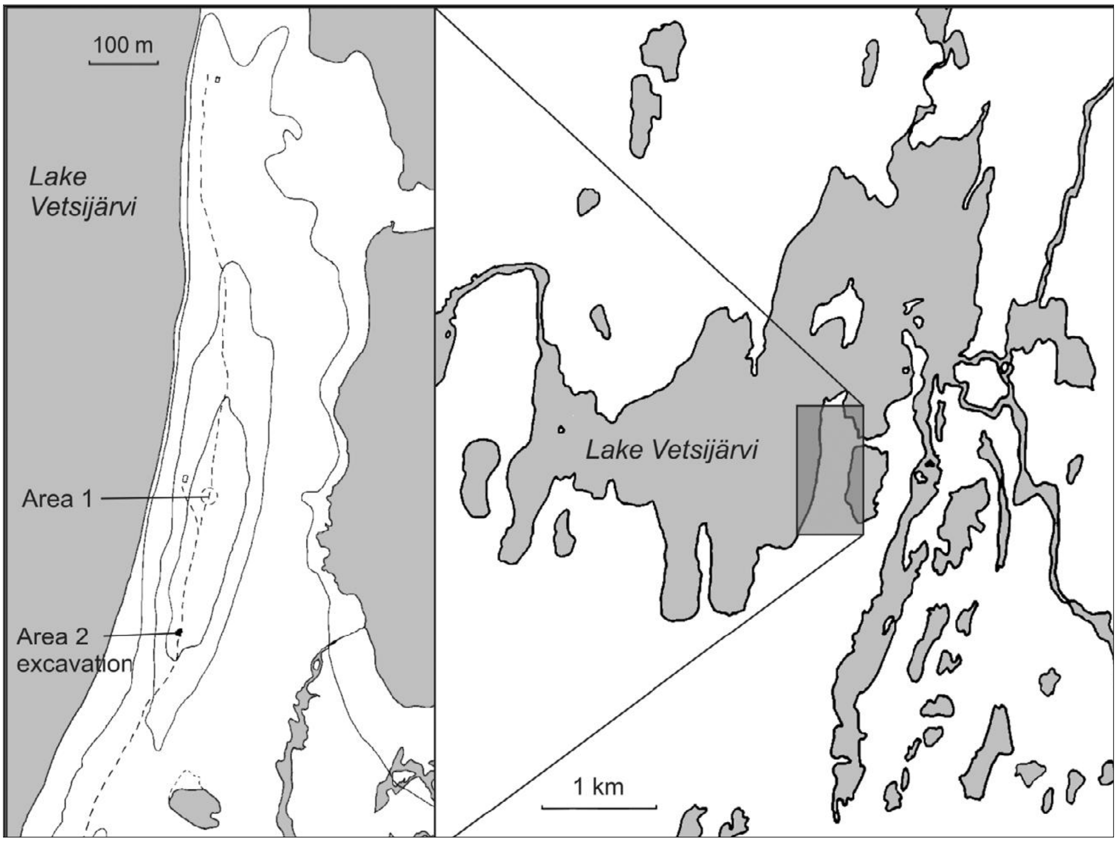


Figure 6: Location of the Sujala site on Lake Vetsijärvi and the two find concentrations Area 1 and Area 2. The stippled line indicates the dirt track running along the ridge of the peninsula. After Rankama & Kankaanpää 2008:886.

Along the ridge of the peninsula, an unsealed road has exposed the mineral soil. While surveying the dirt track and the peninsula, nine sites were discovered. All but one, Sujala, had a quartz flake assemblage, characteristic to Finnish Stone Age and Early Metal Age sites (Rankama & Kankaanpää 2005: 114; 2006: 106; Kankaanpää & Rankama 2009:38). Unlike these, the Sujala site (official name: *Utsjoki 226 Vetsijärvi 7*) stood out because of its non-local raw material and what appeared to be a predominantly blade based technology (Rankama & Kankaanpää 2004). This site was, therefore, different from the rest both in raw material and in technology and had no obvious counterpart in the north Finnish Stone Age. The raw material was similar to a type of chert known from sites in the Varangerfjord area in Norway, and blade technology known from the earliest settlements of the north Norwegian Mesolithic, albeit exclusively at coastal sites (Rankama & Kankaanpää 2005:116; 2007:45; Olsen 1994:28). The raw material will be discussed further in chapter 5 and 6. For the sake of this study I have chosen to refer to the raw material as a chert-like material or as chert.

Sujala site

Initial excavation

In 2004, surface collection followed by initial text excavation revealed two lithic scatters, 200 meters apart. Both scatters yielded artefacts of a chert-like raw material and what seemed to be the same blade-based technology. Eight 1x1 metre test squares were dug in and around both scatters (Rankama & Kankaanpää 2004; Kankaanpää & Rankama 2009). The total amount of finds from the preliminary survey was 379, including two exhausted blade cores and one tanged point (Rankama & Kankaanpää 2005:117). The scatters were named Area 1 to the north and Area 2 to the south (see Fig. 6). The two cores and the tanged point derived from Area 2. The excavations carried out in 2005 and 2006 focused on Area 2; leaving Area 1 for future study (Figs. 6, 7 & 8) (Rankama & Kankaanpää 2007:47-48).

Figure 7: Excavation in Area 2, 2005, view towards the south with the dirt road running through the site. Photo by author.

Excavations in 2005 and 2006

The excavation of Area 2 was carried out in 2005 and 2006 over a total of 5 weeks. Overall, 11 archaeologists, and students, were involved in the excavations (see Figs.7 & 8). The entire excavated area was approximately 77 m² (see Fig.9 and Appendix 2) (Rankama & Kankaanpää 2008:887). The 1x1m squares were excavated in layers of 2.5cm except layer 1 (2005), which was excavated in 5 cm (see also Appendix 1). Each individual find was tagged with the exact position from which they were retrieved, within the x and y-axis of the squares. With the exception of a few clustered finds that were excavated in blocks of 20x20 cm and 10x10 cm, most of the finds were given individual bags and catalogue numbers (Rankama & Kankaanpää 2006: 107). The elevation of artefacts interpreted as tools was measured with a surveyor's level against a fixed benchmark. All soil was sieved in a 4x4 mm mesh screen, except the clustered finds excavated in 10x10 and 20x20 squares that were sieved using a 2x2 mm hand sieve. Bone and charcoal material was wet-sieved (Rankama & Kankaanpää 2007: 50-51).

Figure 8: The excavation of Area 2 in 2006, with Lake Vetsijärvi in the background seen towards the north-west. Photo by author.

Deposits were found to be shallow, only about 15 cm, allowing the site to be completely excavated in just four to five layers (Rankama & Kankaanpää 2007:48; Kankaanpää & Rankama 2009:39). After concluding, the excavations in 2006 most of the finds were photographed/drawn, marked and catalogued accordingly. The catalogue also includes size, weight and find position as well as diagnostic features and raw material classifications.

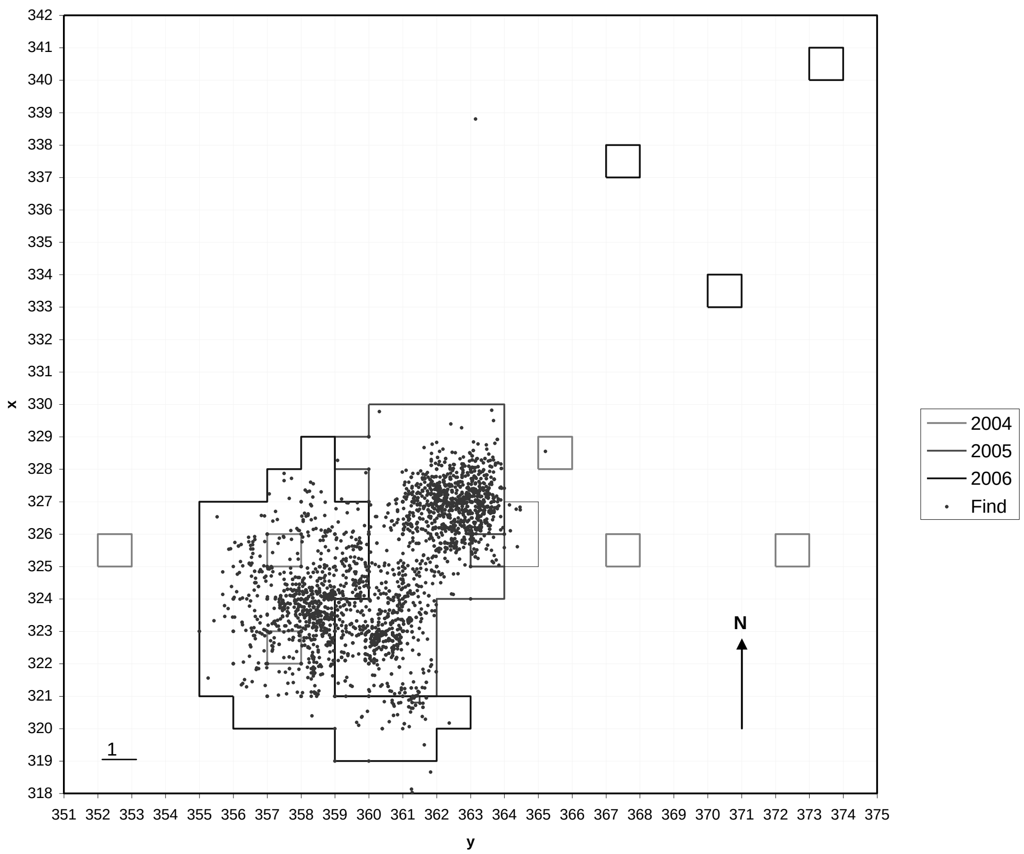


Figure 9: Total excavation of Area 2 in 2005 and 2006 including test pits and general find distribution. Map by J. Kankaanpää.

Finds

Four concentrations with and a total of approximately 6400 lithics were identified (See Figs. 10 & 11) (Rankama & Kankaanpää 2007:48; 2008:887). No definite structures were found. However, the excavations revealed a circular dark stain (2 meters in diameter) and an even darker spot (some 20 cm in diameter). The larger yielded both burnt bone and charcoal suggesting a dwelling and a fireplace (Fig. 10), while the smaller, spot, was interpreted as a refuse pit (Rankama & Kankaanpää 2007: 48; 2008: 887). The bone and charcoal finds allowed for radiocarbon dating (Kankaanpää & Rankama 2009: 39).

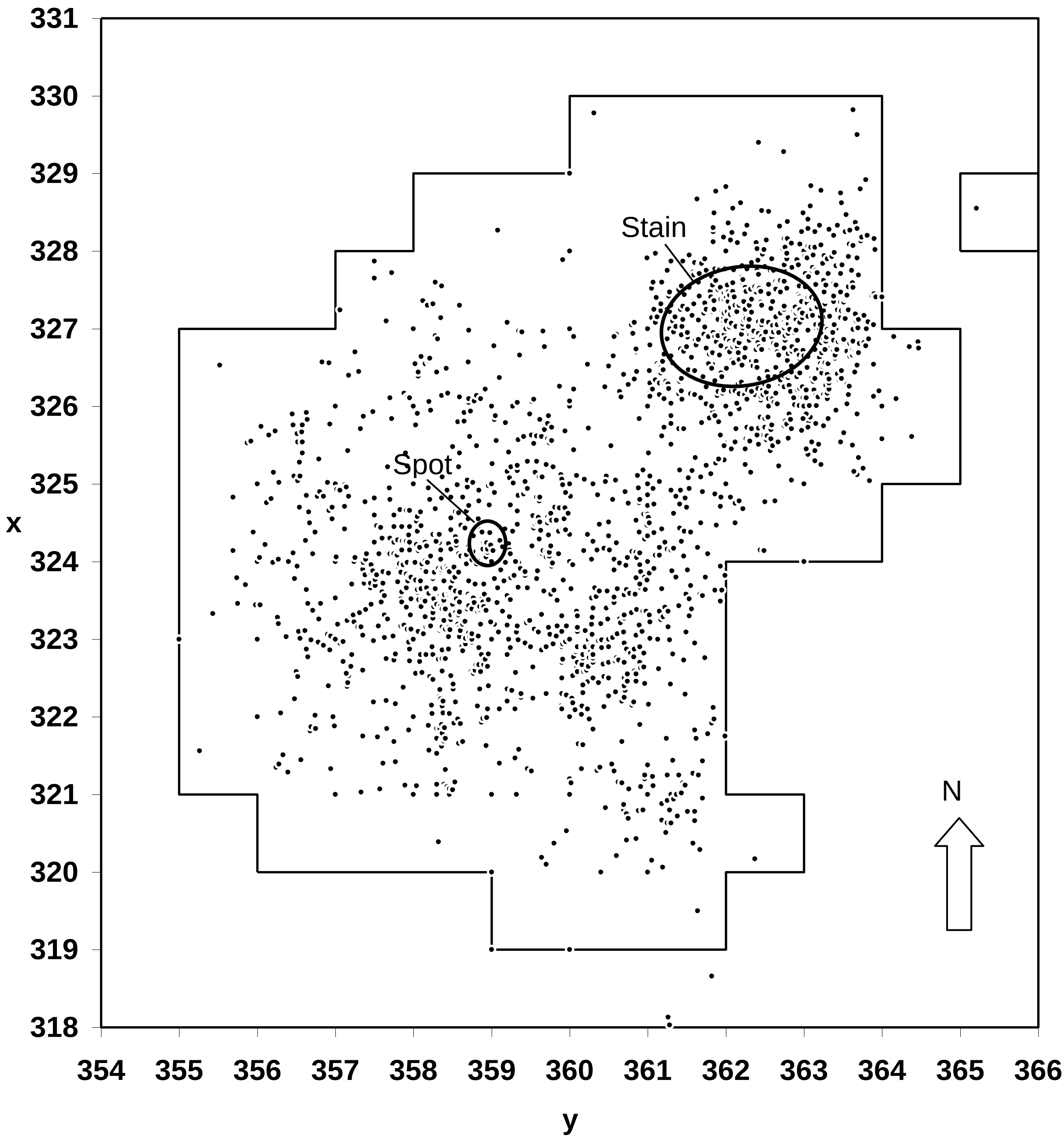


Figure 10: General finds distribution with the location of the dark stain and spot. After Rankama and Kankaanpää 2007:49.

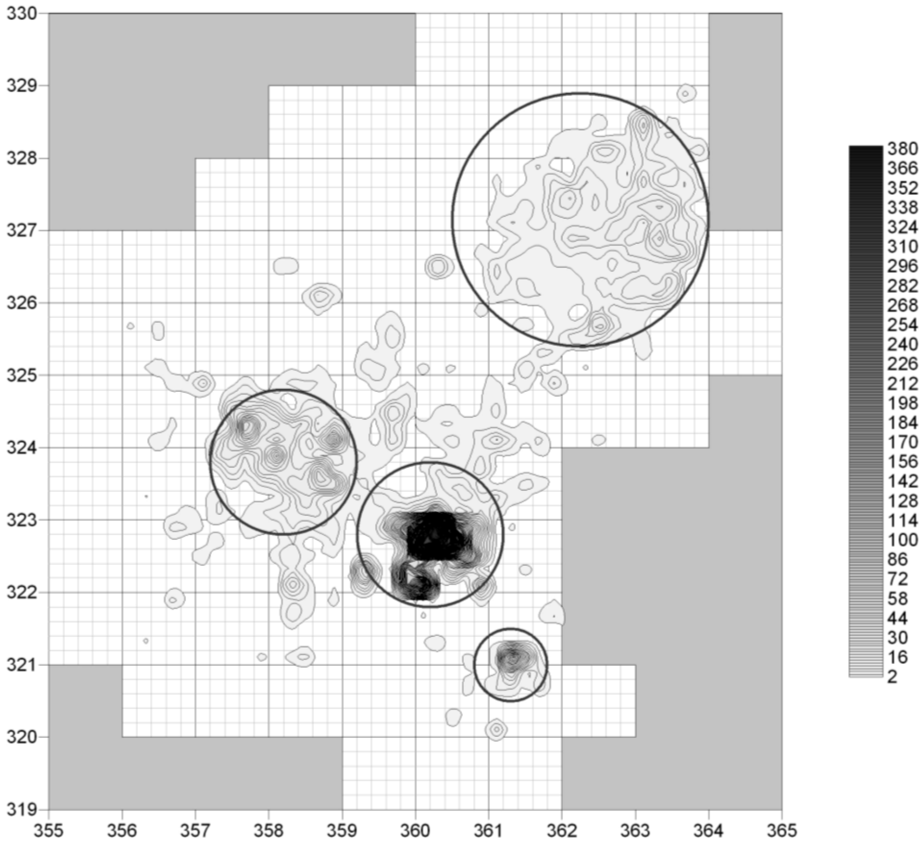


Figure 11: Density map of the lithic scatters with borders of the four concentrations indicated. Surface finds and turf layer excluded. Map by J. Kankaanpää.

Bones and charcoal

The bone finds were small, fragmented, and amount to about 600 grams. Eeva-Kristiina Lahti (2006) performed an osteological analysis and determined these to represent reindeer, unspecific deer bones and bird bones including two types of divers, one identified as a black-throated diver. Two of the charcoal samples were analysed and identified as birch (Rankama & Kankaanpää 2007:50-51).

C-14 samples and dating

Two samples of charcoal and two samples of burnt bone from the large stain, as well as one charcoal sample from the refuse pit, were submitted for radiocarbon dating at the University of Helsinki Dating Laboratory (Hela) (see Fig. 12).

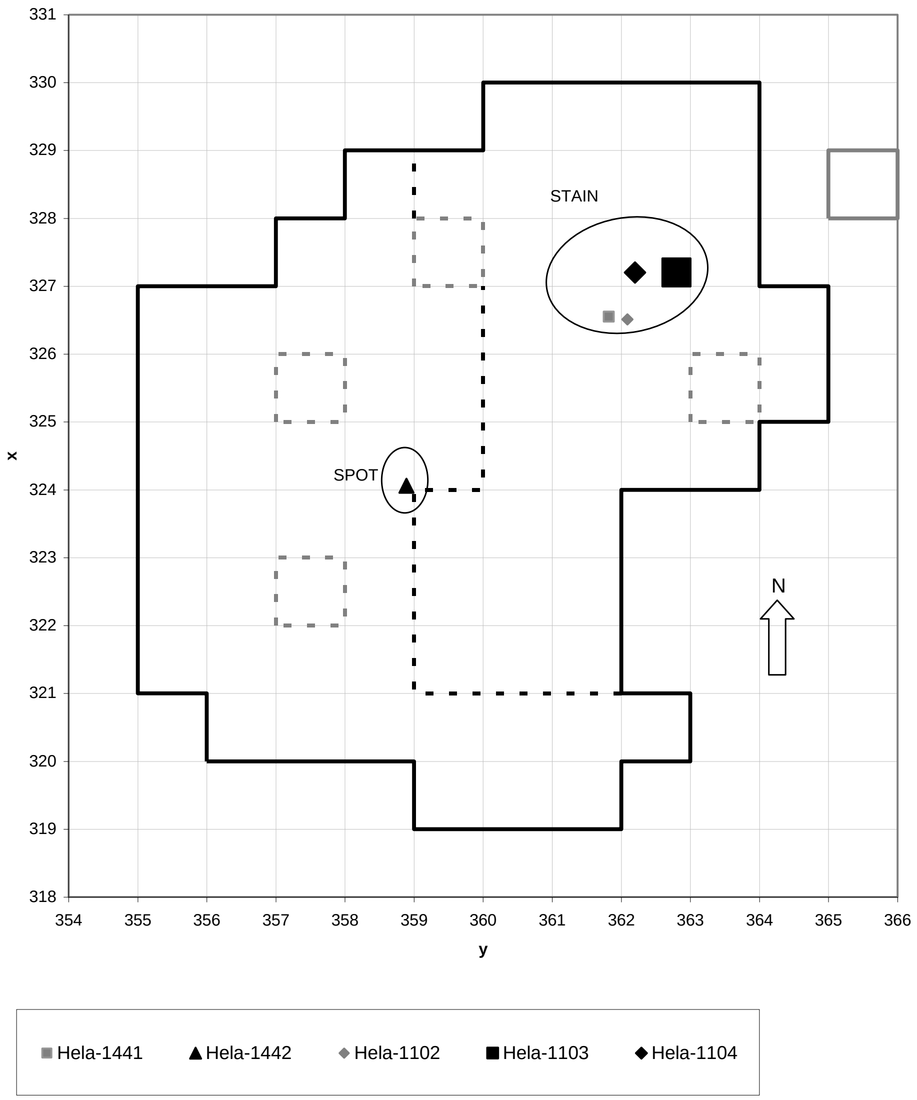


Figure 12: Location of the charcoal and bone samples taken for C-14.

Table 3: C-14 samples.

Sample material	Uncalibrated	Sample ref.	Calibrated
Bone sample 1	8940± 80 BP	Hela-1103	8290-7820 BC
Bone sample 2	8930±85 BP	Hela-1104	8290-7790 BC
Charcoal sample 1	9265±65 BP	Hela-1102	8640-8300 BC
Charcoal sample 2	9140±60	Hela-1441	c.8640-8300 BC
Charcoal sample 1	9240±60 BP	Hela-1442	c.8640-8250 BC

The median dating are 8100 BC for the charcoal and 8500 BC for the bone (see Table 1), thus placing the site at the Preboreal/Boreal transition and making it the earliest radiocarbon dated archaeological site in Finnish Lapland (Rankama & Kankaanpää 2007: 51). Kankaanpää and Rankama (2009: 40) argue that the bone dates can be considered more reliable and point to problems with old wood at some Lapland sites (Carpelan 2004: 37-40). However, since the identified wood in this case is birch, that does not live as long as conifers and rot rapidly when they die, means that the problems with old wood may be smaller in this case (Rankama & Kankaanpää 2007: 50-51). Rankama and Kankaanpää (2008:888) maintain that it is unlikely that the bone and wood age differences can be explained as separate occupation episodes. Based on this, they highlight the overlap of the date ranges and suggest 8300-8200 BC as the feasible dates for the Sujala site (Table 3 for details on the specific samples).

Lithics

The total number of lithics found during the three field seasons of 2004, 2005 and 2006 from Area 2 at the Sujala site amounts to 6409. While 6363 are of a brownish chert-like material, only 46 lithics are made of other raw materials, these are mainly quartzes. The lithic assemblage include exhausted cores, core tablets, and rejuvenation flakes from platform shaping, as well as blades, blade fragments, trimming flakes and modified blanks and tools (Table 4).

The Sujala material contains a large amount of production debris. The number of core tablets (Fig. 13) from platform preparation is 341 (Table 4). Flakes interpreted as core edge trimming flakes are as many as 1322. The core tablets vary in size, the largest being around 65 mm wide (Fig. 13). The general impression is that the core tablets were deliberately hinged, possibly to avoid damaging the core face (Rankama & Kankaanpää 2007: 53). There are 3 blade cores and 11 blade core fragments (Fig.13). Several of the latter are deliberately detached core bases. The three cores seem to have been conical in shape, though they are now heavily damaged. The cores have only one platform which seems to be prepared by striking off rejuvenation flakes ending in hinges. Though hinging is commonly interpreted as a knapping error (Inizan et, al. 1999: 36), at Sujala it seems to be an intentional strategy for platform preparation (Rankama & Kankaanpää 2007: 53).

Table 4: Artefacts from Sujala Area 2. After Rankama & Kankaanpää 2007:50

Categories	**Amount**
Tanged points, fragments and preforms	55
Blade tools (scrapers, burins etc)	47
Blades and blade fragments	2150 (313 retouched)
Blade cores and fragments	16
Burin spalls and fragments	35
Core tablets	341 (6 retouched)
Trimming flakes	1322
Flakes and elongated flakes	174 (9 retouched)
Fragmented artefacts/ trimming flakes	2223 (14 retouched)
Total amount of cherts	6363
Other lithic material	46
Total amount of lithics	6409

This indicates that when regarding the larger sized tablets, they are not necessarily the size of the original platform. The high number of core tablets and the core edge trimming flakes in the assemblage validates the assumption that either there was production from an early stage of the reduction sequence at the site, or the core trimming was continuously conducted throughout the technological processes.

35% of the Sujala assemblage consists of blades, blade fragments and tools made from blades (Fig. 14) Around 40 complete blades were found; the blades vary in thickness but are generally symmetrical with regular and parallel sides. The blades show careful platform preparation; edge trimming is present in 99, 8 % of the studied proximal ends. The proximal ends have lips on the ventral side, indicating the use of a soft percussion technique like an antler hammer. The bulbs are short and rounded, a feature normally associated with the pressure flaking technique (Rankama & Kankaanpää 2007: 53, Pelegrin 2006:46).

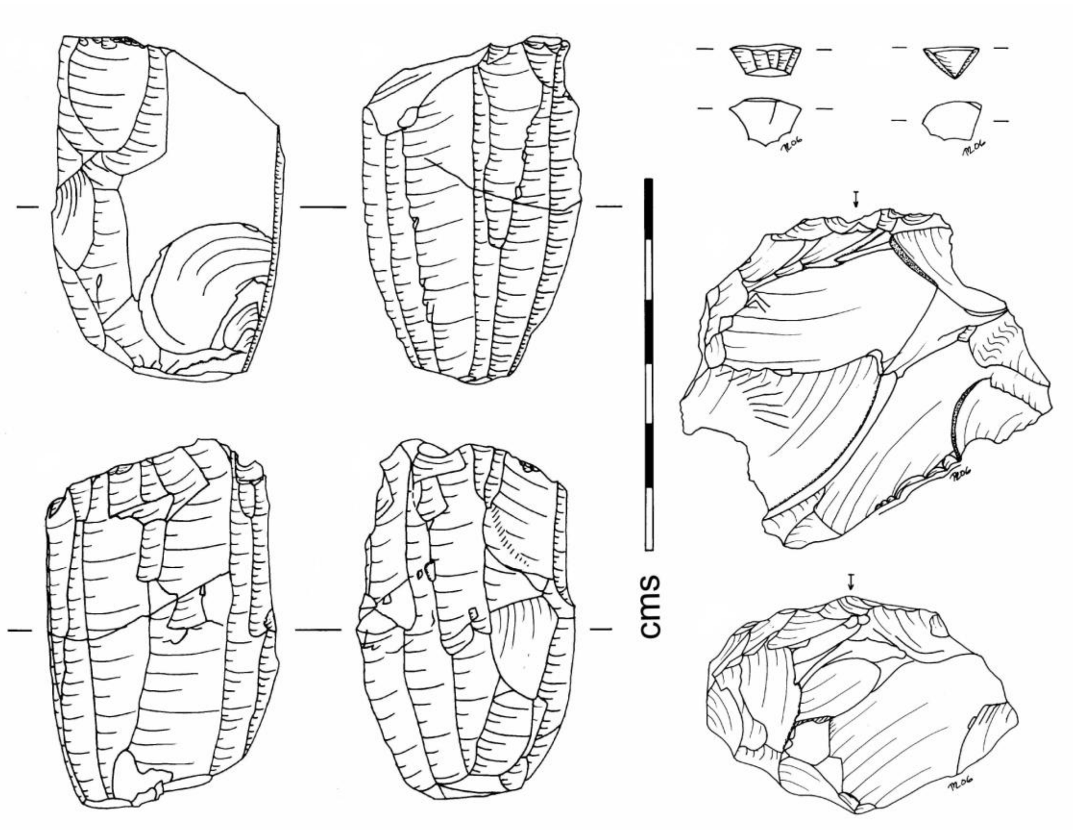


Figure 13: A conical-shaped blade core, a core fragment and two core tablets. Drawings by T. Rankama in Rankama & Kankaanpää 2008: 889.

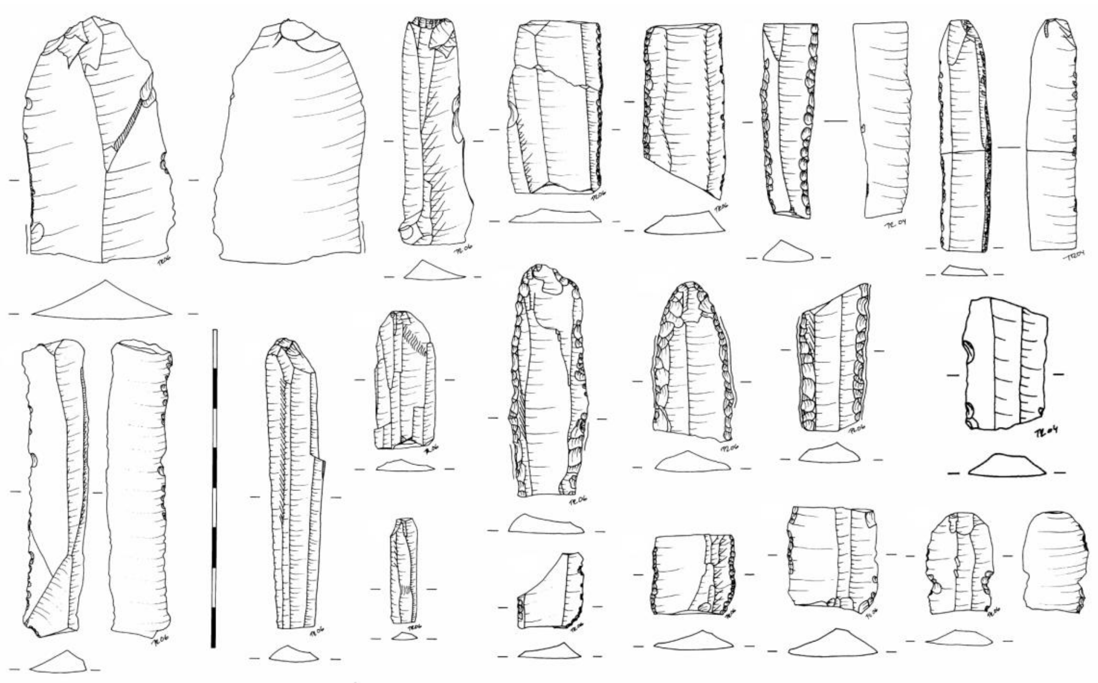


Figure 14: Blade fragments from the Sujala material. Drawings by T. Rankama in Rankama & Kankaanpää 2008: 890.

There are more than 360 blades and blade fragments with semi-abrupt retouch along the edges in the assemblage (see Fig. 14). Several of the blade fragments are intentionally snapped. The snapping is possibly conducted by placing them on an anvil and striking them on the central dorsal ridge. The breaks are mainly perpendicular to the blade axis and conducted to produce rectangular medial blade fragments for tool manufacture, for instance points, scrapers, and inserts. There are approximately 20 scrapers in the Sujala material, all but one, are made from broken blades (Rankama & Kankaanpää 2008:888-889).

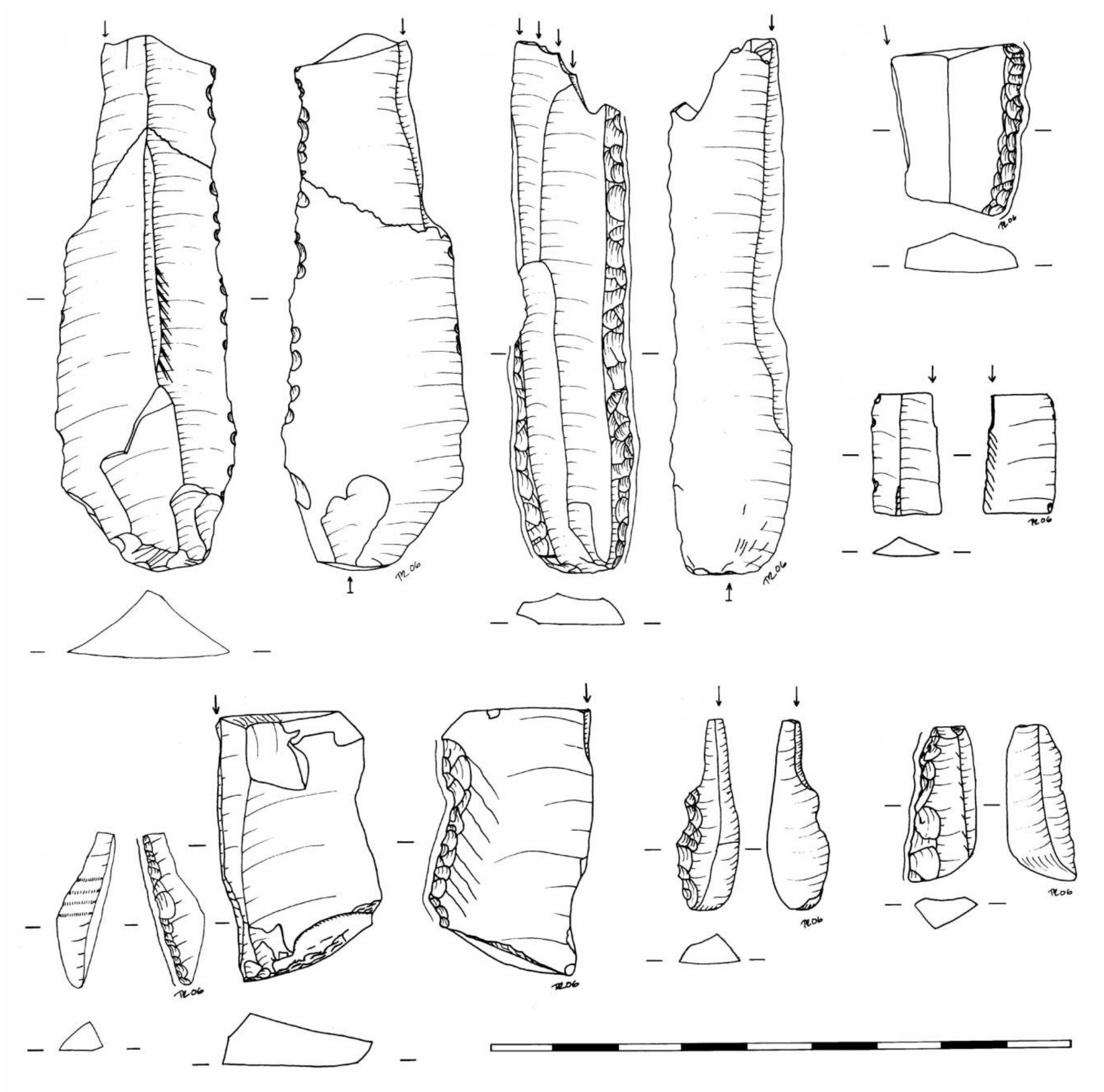


Figure 15: Examples of burins and burin spalls. Drawings by T. Rankama in Rankama & Kankaanpää 2008: 891.

The Sujala lithic material also includes a number of burins (Fig.15). The burinations are executed on the edges of retouched and non-retouched blades, both unbroken and snapped, in the latter case by using the fracture surface as a platform (Rankama & Kankaanpää 2007:54).

55 tanged points, fragments, and preforms were retrieved from the Sujala site. These include 4 complete points, 3 virtually complete and 48 fragments (Fig.16 for examples). A general principle seems to be that the dorsal ridge should run symmetrically along the central axis of the point, though this is not always the case. The tang of the point occurs at the proximal end of the original blade suggesting that the tip was intentionally placed in the thickest part of the distal end. The points have bifacial invasive retouch on the tip and the tang (Rankama & Kankaanpää 2007: 55).

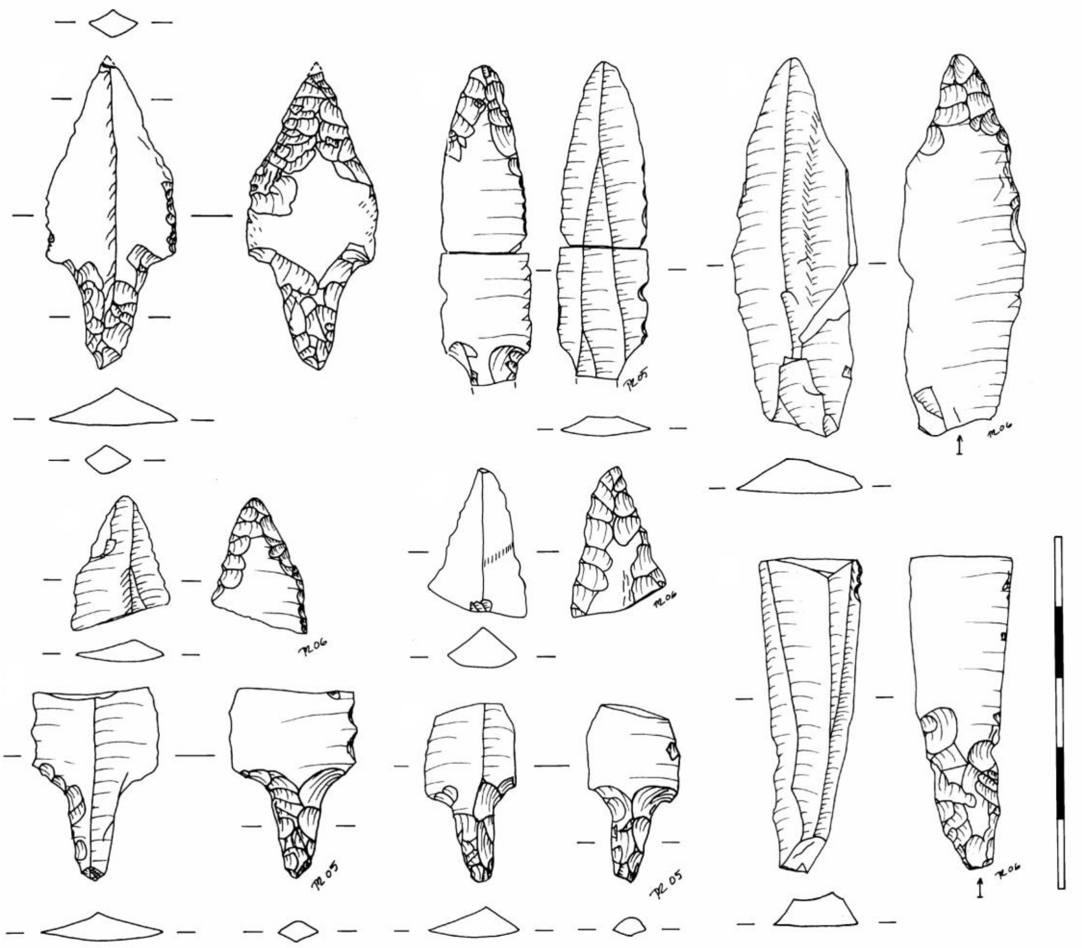


Figure 16: Some of the Sujala tanged points, preforms, point fragments, and a possible reamer. Drawings by Rankama from Rankama & Kankaanpää 2008: 893.

4 Methodological approach

This chapter will introduce the methodology that is the basis for the upcoming analysis of the refitted assemblage from the Sujala site. The *chaîne opératoire* analysis and refitting are well known methodological tools within prehistoric archaeology and in the following; I will present the basic premises of these approaches. I will also present the refitting strategy and some statistic results of this study before moving on to the analysis in the following chapter.

Refitting

The aim of refitting is to put the pieces back to their original position (Cahen et al 1979:663; Hofman 1992:1), or as Utsav Shurmans puts it; "refitting is the reassembly of lithic artefacts ultimately to the nodules of raw material that were selected by prehistoric humans for knapping" (2007:8).

In Norway, the method of refitting is well known and has been used on Stone Age sites such as the lake *Gyrinos* sites (Schaller-Åhrberg 1990), *Rørmyr 2*, better known as *Høgnipen* (Skar and Coulson 1989,1986), several sites from Songa, Telemark (Coulson 1986), *Galta 3* (Fuglestvedt 2007) and *Vinterbro 12* (Jaksland 2001) to name a few. To my knowledge, no refitting studies have been conducted on lithic material from northern Norway. In Sweden, refitting is not as widely preformed, but some sites have been studied, such as *Rågången 383, 503* and *181* (Andersson 1998, 1999). In Finland, only one lithic refitting study has been published (Manninen 2003), thus making the present investigation one of the few studies conducted on a Finnish material so far.

The groundbreaking work of the upper Palaeolithic sites of *Etiolles* and *Pincevent*, where the *chaîne opératoire* framework was applied together with refitting, demonstrated that refitting can not only be as a method to study the operational procedure, but also to consider the social processes as mediated in the technology of the site (Bodu et al 1990; Eriksen 2009:141). Another example is the *Meer 2*, site in Belgium, where researchers identified a left-handed knapper, amongst other individual behavioural traits (Cahen et al 1979:667-668). Studies such as these proved the value of refitting for *chaîne opératoire* based research.

Refitting has essentially contributed in two major areas of investigation; lithic technology and spatial distribution. Within the *chaîne opératoire,* both aspects can be observed (e.g. Balin 2000:121; Cahen et al. 1979:663; Cziesla 1990:11; De Bie 2007:31; Inizan et al. 1999:94-95).

Chaîne opératoire

The age, location, and technology of the Sujala site make it an exceptional find. There are few sites like it in Finland and, to date, none in Norway. The Sujala site is in many respects a blank page, so it was vital to investigate the entire of the lithic assemblage, rather than just the tools. Therefore, I chose to use the *chaîne opératoire* approach since it provides a framework to investigate the complete lithic assemblage; from raw material selection, through technological strategies, how these were executed, until final discard. As a methodology, it requires the researcher to observe and document techniques within a framework concerned with practical, social, and ideological aspects of conduct and transformation of raw material (e.g. Barndon 2002:7; Eriksen 2000: 78-79; Lemmonier 1986:149; Leroi-Gourhan 1943, 1945; Pelegrin 1990:116). Whit a *chaîne opératoire* analysis every lithic artefact is considered to be the product of a process where choices are made, and that these can be recognised and studied through the application of refitting and the results of experimental studies (Eriksen 2000: 84; Inizan et al. 1999:100; Pelegrin 1990: 116). I have chosen refitting as my approach to the Sujala lithics, and I will use the *chaîne opératoire* approach as a framework for the upcoming analysis. The Sujala sites lithic assemblage is optimal for a refitting study as the site is completely excavated, with methodical mapping of every find and with a limited number of lithics, making the assemblage a reasonable sized research (e.g. Balin 2000: 109-110; Cahen et al. 1979:662; Hofman 1992: 9-10; Morrow 1996:359; Shurmans & De Bie 2007:2).

According to the French archaeologist Jacques Pelegrin (1990: 116-118) the artefacts in a *chaîne opératoire* analysis, can be seen as elements in a dynamic system that consists of several integrated subsystems. The approach can be useful for interpretations of:

- Identification and use of the raw material
- Production methods, with the help of refitting and experimental studies
- Technological classifications of artefacts within the production stages represented at the site or within a specific production process

- The separation of blanks, artefact types, and the modifications of these
- Discarded and/or abandoned material

The different stages are manifested by different lithic debris. The debris can be used to trace a possible *chaîne opératoire* for a specific tool, for a raw material strategy, for social concepts of spatial organisations or for dividing the technological process between different individuals (e.g. Bodu et al. 1990; Cahen et al. 1979:667-668; Coulson 1986; Manninen 2003; Schaller-Åhrberg 1990; Skar and Coulson 1989, 1986).

A technological analysis of lithics requires evidence of technologies that is accessible through morphological classifications, from the results of experimental archaeology and refitting studies (Pelegrin 2006; Sørensen 2006). *Chaîne opératoire* analysis, together with the method of refitting provides a picture of a reduction sequence. The technological process is marked by choices made by the knapper: refitting makes it possible to observe these choices. This also permits observations to be made as to how a core was prepared. Which types of blanks were produced and how did the knapper proceed to produce the tools they wanted? Were the tools modified repeatedly etc. (Pelegrin 1990:116)? For the purpose of spatial analysis, the results of refitting are beneficial. The *chaîne opératoire* provides the framework to recognise choices made in the production stages, and refitting provides the evidence required to make this a dynamic process.

The *chaîne opératoire* framework addresses provides the evidence to investigate both functional and symbolic aspects of technologies. The method recognises that steps of production are being conducted by an operator, who knows how to make the desired shape, and based on this knowledge, makes choices during the process of production. When one studies the interwoven relationship between the stages of the production and social meaning, the focus of research shifts from the artefact, or pure typology, towards a broader context (e.g. Apel & Knutsson 2006:12; Dobres & Hoffman 1994:230; Edmonds 1990:65; Eriksen 2000: 75-76; Ingold 1990: 6; Lemmonier 1986:151-153; Schlanger 1996: 234-235).

With research focusing on operational procedures rather then pure typology, the knapper's position as a participant in the technological making is recognized and the need to redefine the term technology seems crucial. As Ingold (1990:6) puts it, technology represents something theoretic, objective, something we talk about while technique is something practical and can not be separated from the subject performing the act, arguing further that when one studies prehistoric technology it should be perceived as the definition of technique (Dobres 2000: 229, Dobres and Hofman 1994). *Technique* embodies abilities and knowledge, therefore it is an individual's inner experience and so an active ingredients in the making of personal and social identity (Fuglestvedt 2005:149-150). Fuglestvedt (2005:151) argues that through meaningful actions, based on a known world, the agents of the past create meaning in the unknown world. The pioneer stages, and how to relate to the new landscape and how a group will change its perceptions of the unknown can be read as thus: the subjective represent the individual's experiences, bodily perhaps, in the new landscape. The intersubjectiv is the definitions or the conclusions that the groups or humans together make out of their own individual experiences, and that can be used as directions on how to relate to and experience the new landscape and its materiality. Through intersubjectiv constitution of the material world and how to perceive it, subjective experiences become social truths or socially objective (Fuglestvedt 2005:230).

In agency theory shared experiences become structures through agency of individuals and collectives. Agents are structured by and existing within the social at the same time (Dobres 2000:133). Agency and structure is not two separate entities but are interdependent, the relationship between agents and structures becomes the process that makes society (Dobres 2000:134). Social structure in this sense is both a medium and the outcome of social interactions. They are the normative rules and social and material resources available to agents and groups. In this sense structures is a set of material and social conditions, which rules both the continuity of these structures and its transformations (Dobres & Hoffman 1994:222).

Technology is the social practice and process-ing of the material world; it is an unfolding intersubjectiv dynamic that is not reducible to the activities of artefact making and use. There are three fundamental claims that this rests upon; first that technologies are meaningful acts of social engagements with the material world that serve as a medium through which world views, values and social judgments are expressed tangibly and reaffirmed or contested in practice, secondly technological practice "produces" not only things, but also personal, practical and cultural knowledge that can serve both discursive and non-discursive interests and finally that technologies are fundamentally about people, mindful communities of practice, and social relations of production (Dobres 2000:96-97).

It is argued that agents make decisions based on and with lived experience, perception, as well as ideological and symbolic factors that serve as structures for them. This makes the agents choices culturally reasoned (Dobres & Hoffman 1994:224).

Marcia- Anne Dobres (2000:168) argues that the *chaîne opératoire* give us valuable information on how stone tools were made, chosen and modified, while simultaneously highlights people acting in the social and living spheres of their material culture. The *chaîne opératoire* approach thus connects the static leftovers of prehistoric technology with knowledge, values, decision making and active, participating bodies (Dobres 2000:168).

For the purpose of this investigation, these will be considered important aspects of this *chaîne opératoire* analysis:

- The complete lithic assemblage, not just tools should be studied.
- Lithic refitting is an important tool to identify technological processes at the site, where the aim is to understand and discuss these processes.
- The spatial analysis of individual artefacts of a refit group may provide a dynamic picture of the technological processes at the site.
- By connecting technological processes to the spatial organisation, it should be possible to discuss the social interactions and activity areas at the site.

Practical issues in refitting the Sujala material

The refitting study of the Sujala material was conducted in Helsinki, Finland over a period of 5 months, (from February to June) and was concluded in November 2007. The material was briefly studied from a refitting perspective beforehand by Sheila Coulson, Associate Professor at the University of Oslo. In addition, some refits were identified during the field seasons and when the material was catalogued by Rankama and Kankaanpää.

Before I started the study, all finds had been numbered, catalogued in a spreadsheet database, and boxed according to catalogue numbers. The Sujala lithic material from Area 2 consists of approximately 6409 pieces, with all but a miniature percentage (< 1) being made from a chert-like material. All of the lithic material from Area 2 was included in the study, with an emphasis on the chert-like material. The smaller resharpening flakes and debris were presumed to yield little information, compared to the labour output, in contrast to other parts of the assemblage. After a preliminary study, pieces smaller than 5mm were therefore excluded. Some fragments less than 1 cm were refitted, but this was mainly due to the association by spatial vicinity to refitted sequences, or attributes towards a specific artefact category. This reduced the number of lithics under investigation, putting the final number at approximately 4000.

There was a need for different strategies concerning typological categories. By using a combination of the spreadsheet catalogues and checking the find boxes, the blades and blade fragments were sorted into proximal, medial, and distal end pieces. The distal, medial, and proximal ends were divided into subgroups relating to number of dorsal scars and size/thickness, and retouch/no retouch. The 2200 blades, blade fragments and tools, accounts for 35% of the total amount of finds from the site and became the obvious starting point of the refitting study.

Memorisation became an important tool throughout the study, as it was not possible to lay out all of the material at the same time. Initially, it seemed logical to make subcategories in the sorting of the blades based on colour, texture and general visual appearance. My second approach was to consider the pieces found in close proximity of each other, and this time, fragments smaller than 1 cm (across) were included. The core tablets and platform rejuvenation flakes were sorted into size and number of removal scars on the core face. Spatial proximity to find refits was integrated earlier for core tablets and platform rejuvenation flakes than for the blades (e.g. Hofman 1992; Morrow 1996).

Every refitted piece was photographed, sketched and subsequently the refitting information was added to spreadsheet database. The spatial distribution maps were made during and after the refitted sequences were identified. These maps were used both as a method for finding more refits to add to existing refitted sequences, and to enable initial spatial organisations to be explored.

A common problem when refitting is that the acetone used to dismantle the refits tends to erase the ID-number from the individual pieces. When conducting the study I found a solution to this problem that proved to be satisfying. Instead of acetone-solvent glues, I used water soluable glue sticks; this not only solved the problem concerning the potential loss of ID-number but also made the process of deconstructing refit sequences a less tedious procedure. The glue sticks were strong enough to keep the sequences adhered for the extent of the study.

While refitting, I also experimented with the use of plasticine; or modelling dough, to get a positive print of the missing fragment or fragments on the enquiry for dorsal-ventral refits in the sequences. This method proved to be quite useful. To be able to “see” the missing piece’s dorsal or ventral side in a 3D model simplifies the search in a large body of material. The method is best used on robust artefacts like cores, since applying the plaster needs to be done with a certain amount of force.

The refits are still available in their refitted form in Helsinki. During the summer of 2009, a group of Nordic Stone Age archaeologists specialising in technology and the French archaeologist Jacques Pelegrin had the opportunity to examine the entire collection of refits as well as the blade assemblage at a seminar in Helsinki. The Sujala site and its lithics are still being studies by the project administrators Rankama and Kankaanpää (2004, 2005, 2006, 2007, 2008, and 2009).

Sujala refit statistics

The refitted material accounts for 5, 2 % of the total lithic assemblage. The refits from the Sujala site consist of 115 refit groups (Appendix 3 for details). This includes 285 individually numbered pieces or 330 pieces if the individual refits are considered. The apparently low number of refits does not deduce its value, according to Hofman (1992:11), “refitting is not a statistical analysis so the size of the refitted sample is not directly correlated with its interpretive potential”. The information retrieved from the refitting study proved invaluable in resolving the research questions which were the aim of the study.

Table 5: The refitted assemblage divided into categories.

Blade groups	Core and core tablets	Flakes and fragments	Burins and burin spalls
69 groups	23 groups	10 groups	13 groups

60% of the refit groups are in the blade category. Core and platform rejuvenation flakes make up 20%, while flakes, fragments, burins, and burin spalls are 9% and 11% of the refitted material (see Table 5).

5 Analysis of the refitted lithics from the Sujala site

In this chapter, I will present and analyse the results from the refitting study conducted on the Sujala lithic assemblage. The presentation of the analysis begins with the raw material, then the post-depositional questions, before considering technology and spatial organisation. As there is not enough space in this thesis to present all 115 refit groups individually, I have chosen a selection that will show the variations of the refitted lithic assemblage. For further reference, all refit groups are presented in Appendix 3.

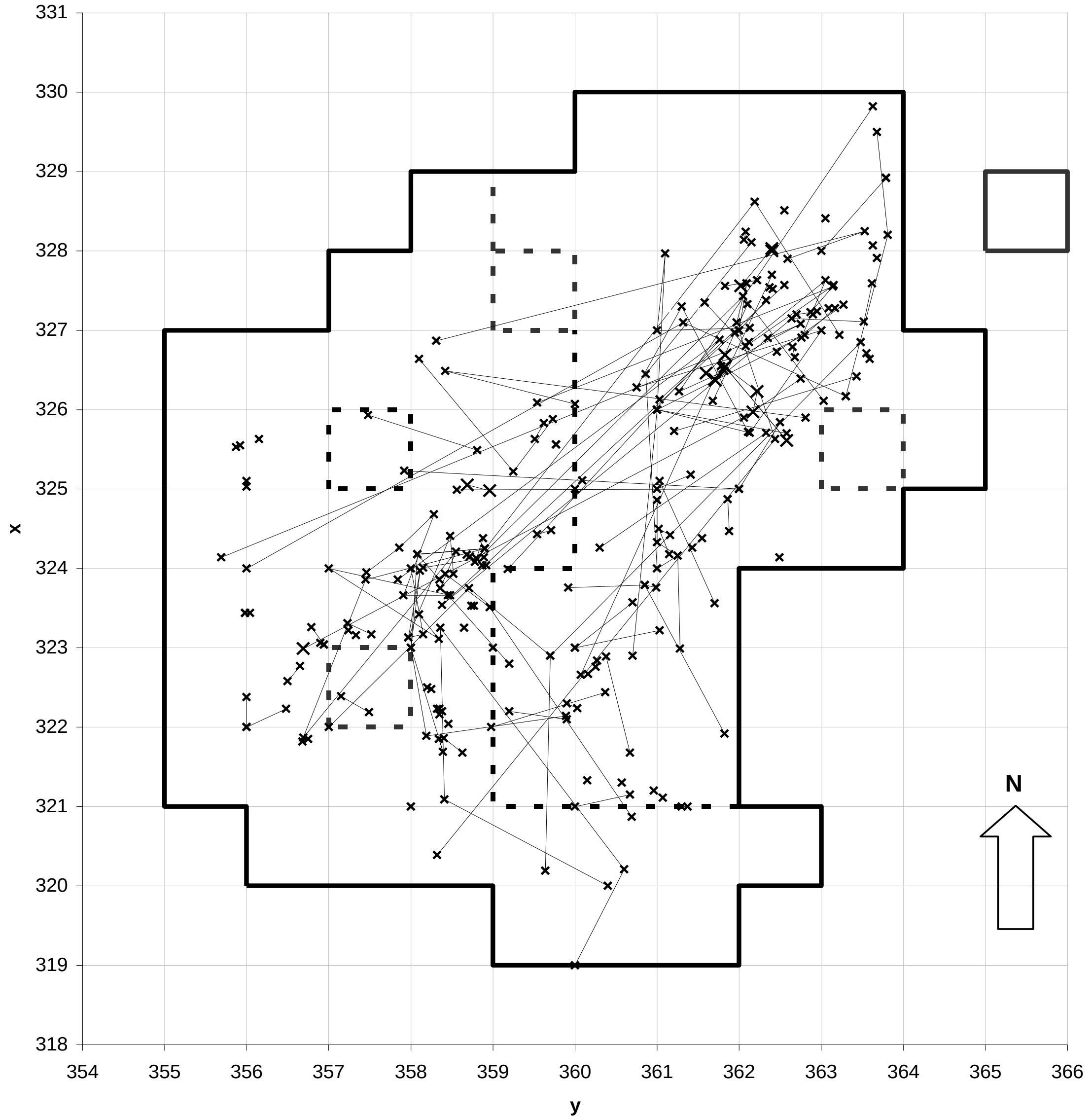


Figure 17: All refits with connection lines indicating movements within the sites borders.

Raw material

The classification and identification of a raw material is a vital foundation for any study concerned with lithic technology. So far in this thesis, I have only briefly addressed the raw materials of the Sujala site (Chapter 3). This refitting study has focussed primarily on the chert-like material, which is the main raw material used at the site. As mentioned, it appears in many colours, and it is unlikely that the source of the raw material lies in close proximity of the site. In this section I will show how the refits contributed both to the inquiry of the variety of colour in this material and to the vertical distribution of these varieties. In chapter 6, I will return to discuss the implications suggested by the refit study of the raw material, what it is and where it may have come from.

The wide range of colour and texture variations found in this chert assemblage, contain colours ranging from white to almost black, and the texture of the pieces differ from fine to coarse. Some pieces have hair-thin, shiny, crystallised lines in them. Sometimes these are straight other times they are more organic. These variations can perhaps lead to the supposition that they represent several raw materials. The first inquiry would therefore be if this could indeed be the case. The tendency is that the whiter pieces appear more worn, and their texture is coarser than the darker ones. During the refitting study, it became clear how diverse a refitted artefact can be in colour and texture. Refitting as a method is a very good way for differentiating between raw materials at a given site; if you can refit two supposed different raw materials, the raw material assessment may be incorrect (Simpson 1996:87). In the refitted assemblage, there are artefacts that contain as many as five different colour variations in one refitted entity. The pieces portrayed in Figure 17 confirm that the colour variations in the cherts found at the Sujala site are not due to differing raw materials. Further, the refitted blades in the same Figure provide another observation: that the colour differences follow the individual pieces (Fig. 18). For instance, one will not find significant varieties within one individual piece.

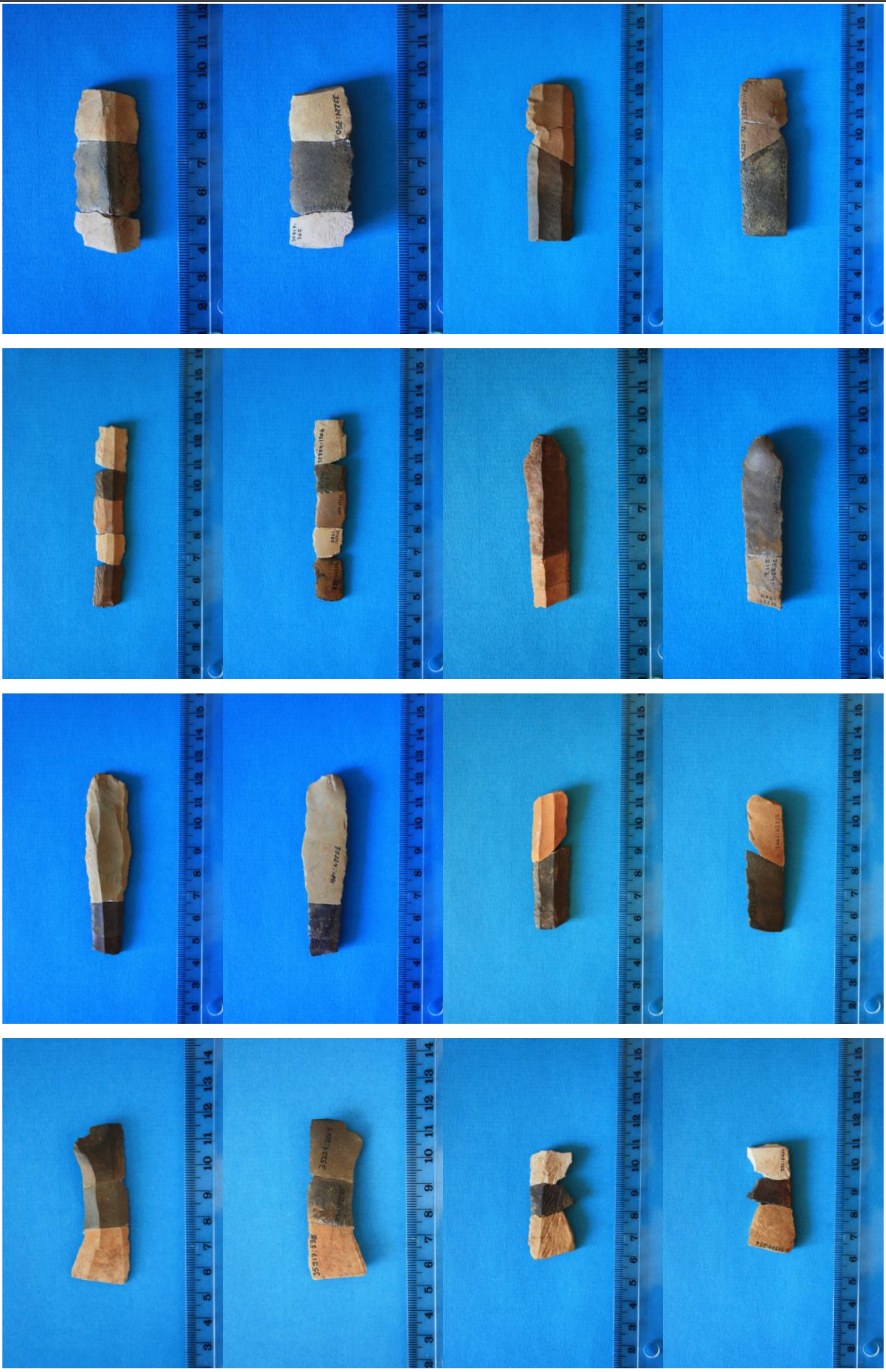


Figure 18: Examples of colour variation in refitted blades and burins from the Sujala assemblage.

Would the deposits in different areas of the site produce different colours and can these be detected in the spatial distribution of the refitted individuals? I have chosen to use five colour categories in the map; which represent a simplified version of the colour categories used in the catalogue (Appendix 3). The colour categories are not based on any specific colour system. When analysing the horizontal distribution of the refitted individuals, where all the layers are included, the first observation is that the colour variation is present throughout the site. The exception, perhaps, of the darkest colours that seem to occur mainly in the north-eastern part of the site, the lighter pieces, on the other hand, appear to be dispersed throughout the horizontal layering (Fig. 19).

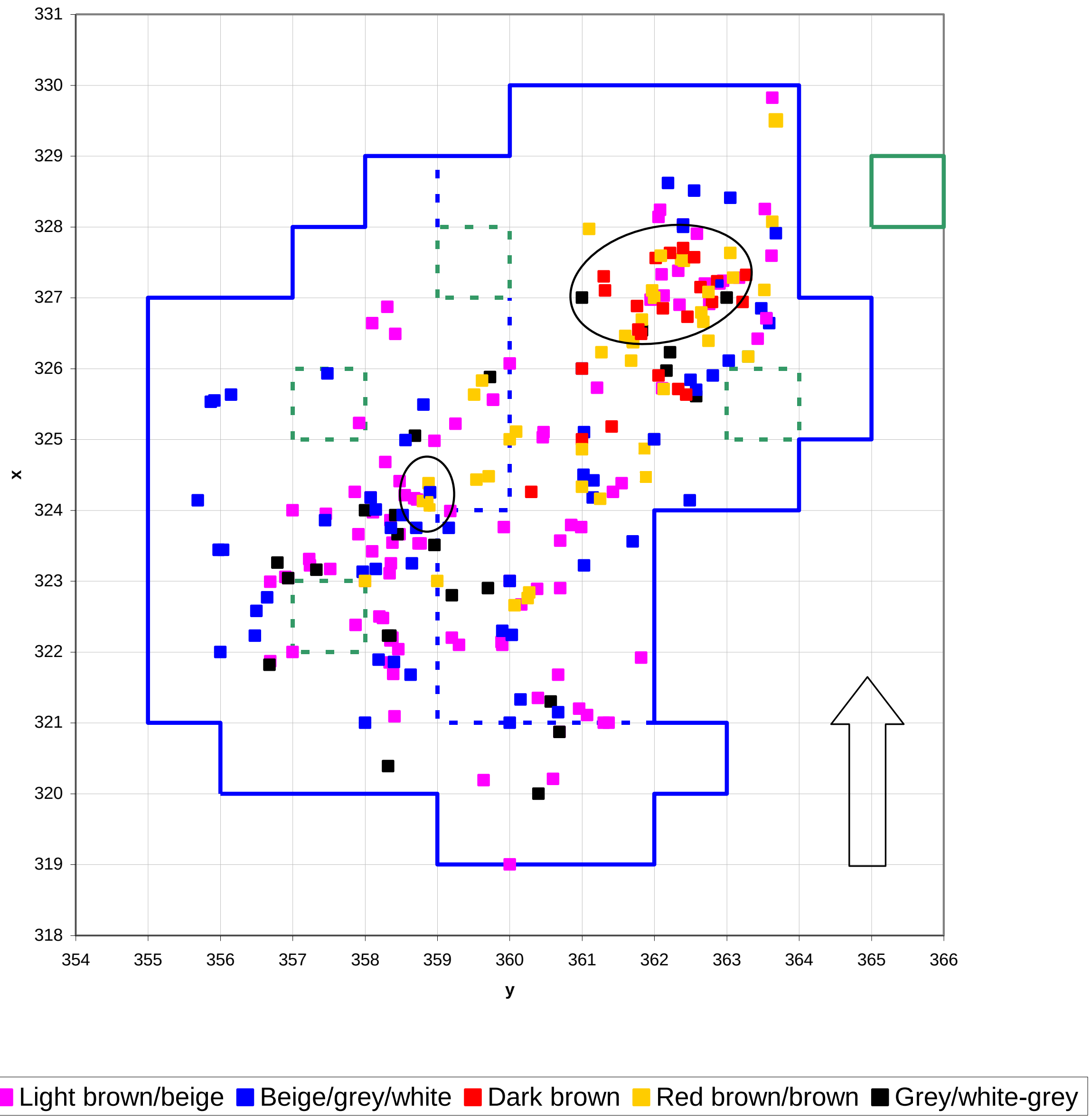


Figure 19: Horizontal distribution of colour variations in the refitted individuals with approximate outline of stain and spot.

Rankama & Kankaanpää (2007:49) suggest that the dark colour is probably the original one and that the pieces turn lighter due to oxidisation. They base this on observations that the darker pieces seem to be from the deeper excavation layers, while some of the surface finds are almost white in colour. However, when looking at the colour variations in the refitted material in vertical distribution, this is not the case (Fig. 20).

The vertical distribution of the colour variations in the individual pieces of the refits is presented in four horizontal maps. These represent the surface finds, the turf layer, and the following two layers that are divided into two maps of 5 cm each. The last 5 cm of the site is not represented in a vertical presentation as there was only one refitted individual from this layer, but the colour of that individual is light brown to beige. The first map shows the individuals found on the surface, (Fig. 20 top left) there are not many individuals, but both darker and lighter pieces are found on the surface. The second map (Fig. 20 top right) is the distribution of the turf layer. This layer includes more individuals and all of the five colour categories are present. At this point, it is possible to detect a slight horizontal difference. The lighter pieces seem to disperse throughout the site while the darker are more concentrated. The third map (Fig. 20 bottom left) portrays the first 5 cm under the top turf layer. This is the main find producing layer and, consequently, the layer where most of the refitted individuals were found. Once again it is possible to detect some variation in the horizontal layout of the colours. The lighter pieces are again present throughout the site but at this point seem to be more dominant in the western part. The darker pieces, on the other hand, seem to cluster at the northern parts of the site. The last map (Fig. 20 bottom right), shows refitted individuals from the following 5 cm. The number of individuals decrease but the patterns from the previous map can be detected here too, where the darker pieces are clustered in the northern parts and lighter pieces dispersed more generally across the site.

The colour differences in the chert-like materials of the Sujala site cannot be explained solely by their placement in the horizontal or vertical distribution of the matrix. The horizontal distribution is, however, more telling. The darker pieces are, almost exclusively, found within the northern parts of the site, while the lighter seems to spread more widely. The dark stain area was situated in the northern parts of the site (Figs. 19 & 20) where it was detected in layer 2.

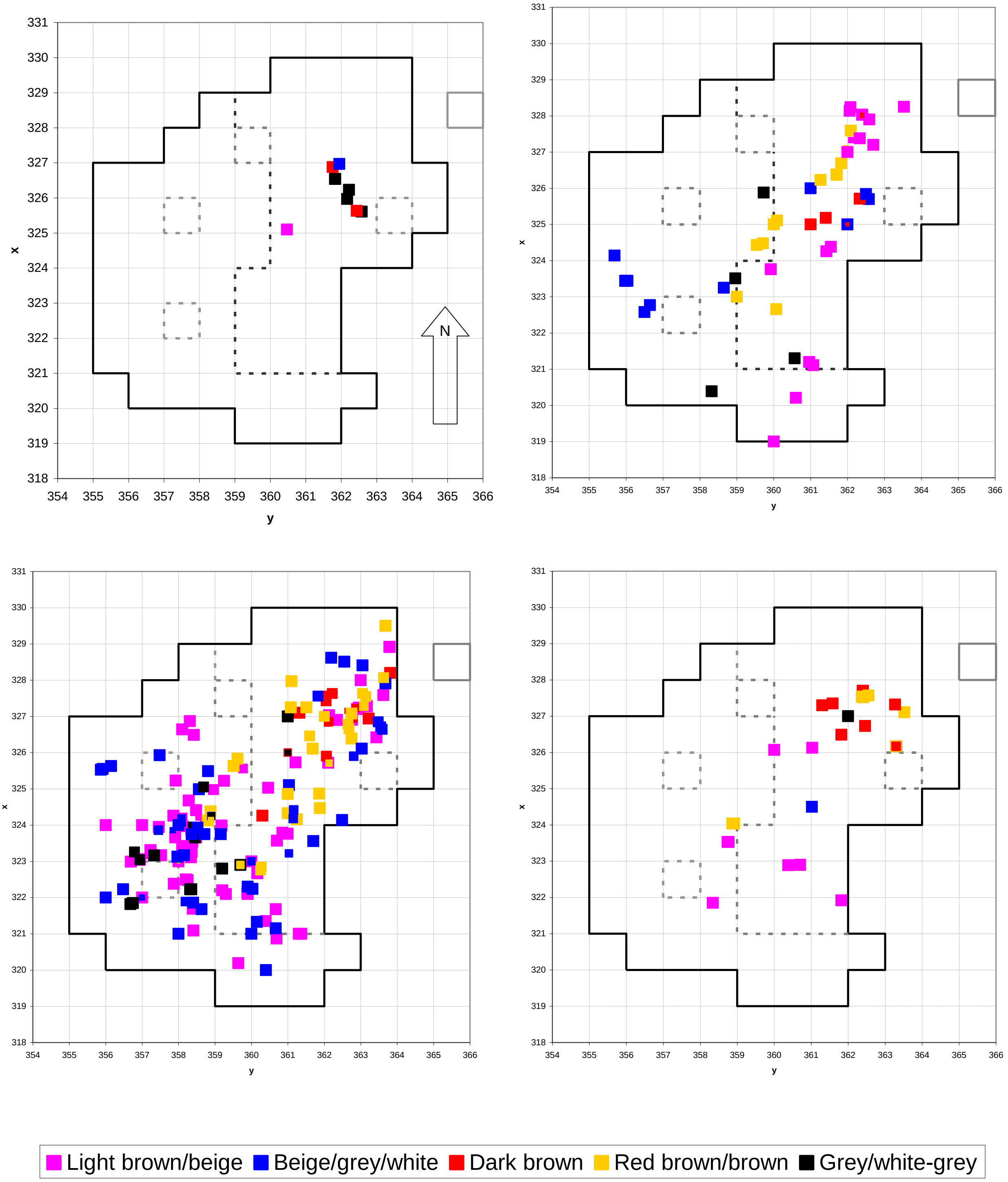


Figure 20: Colour distribution of the refitted material in layers. From top left: Surface finds, Turf layer, first 5 cm (c-layer 1 in 2005 and c-layer 1+2 in 2006) and second 5 cm (c-layer 2a and 2b in 2005 and layer 3 and 4 in 2006).

I will use an example from the refitted artefacts to illustrate colour variations within an area and contained in the same refitted entity. Refit group 53 consists of 4 medial and 1 distal blade fragment (Fig. 21) When refitted, the group is 8, 3 cm long and 1, 2 cm wide and the colour varies between beige/white, dark brown, brown, beige/white and then dark brown again. All of the individual pieces that makes up Refit group 53 are found in the first 5 cm below the turf (see Appendix 2). The horizontal distribution of R 53 places the individual pieces between 1 and 5 meters apart (Fig. 21). Assuming that components in the surrounding soil are affecting the colour of the chert, it is necessary to consider causes for the distributions seen within the colour variations. These can for instance be explained by post-depositional disturbances or as evidence of spatial organisation.

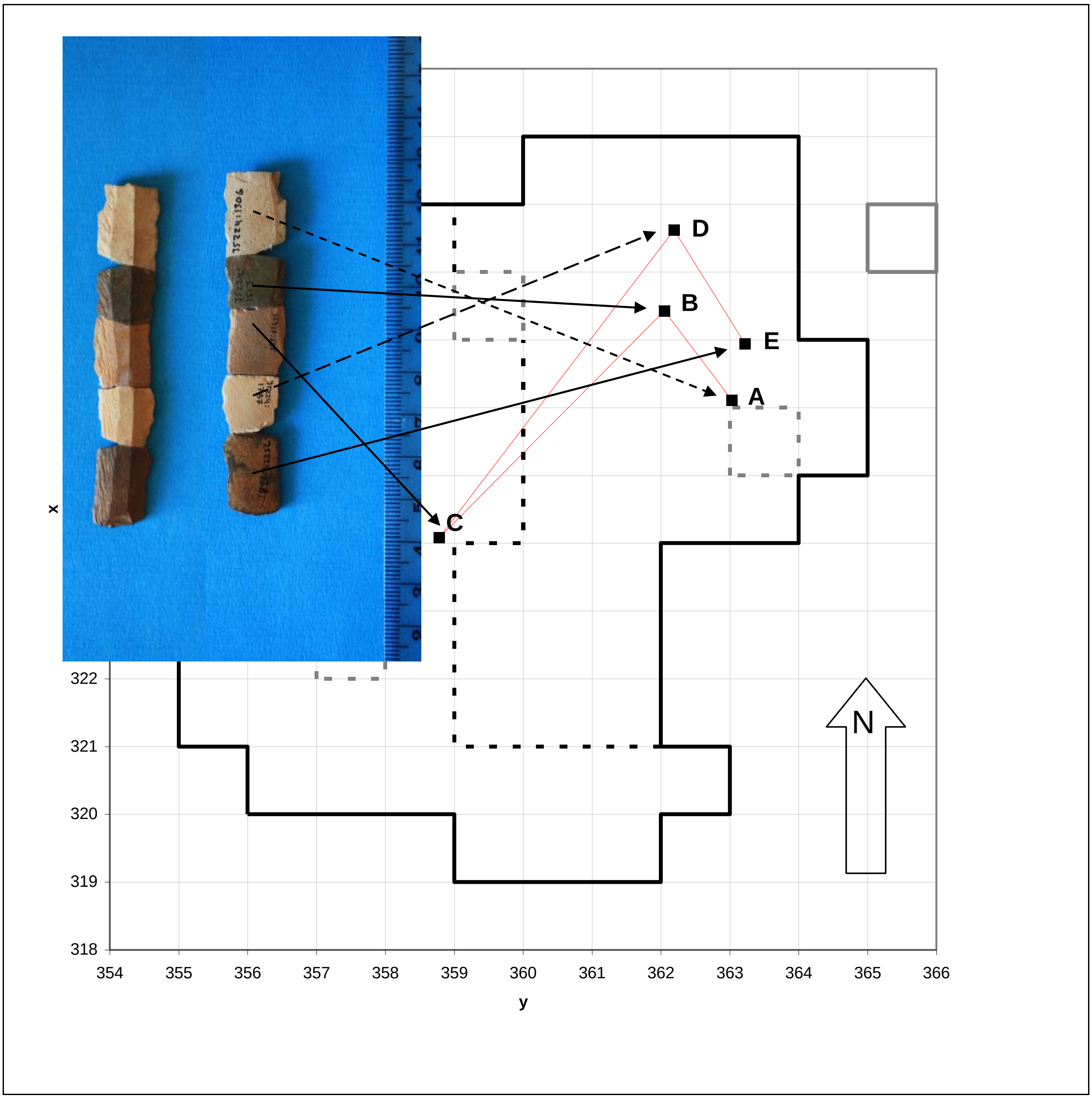


Figure 21: Spatial distribution of refit group 53 where all the individuals are found in the same layer. While the colour differences between fragment A and E is significant, the spatial proximity is not.

Post-depositional / taphonomic assessment

The post-depositional and taphonomic assessment of a site is sometimes ignored or taken too lightly according to Shurmans (2007:9). He stresses the importance of investigating possible disturbances before assuming that the site in question is close to undisturbed. The horizontal distribution of refitted artefacts can provide evidence of the intentional spatial organisation at the site and contemporarity of a given assemblage if the post-depositional movements are studied and taken into account (Dibble et al. 1997: 640). When investigating intentional spatial organisation using horizontal connection lines between refits, it is important to acknowledge that these can also be evidence of disturbance, for example by animals or ground movement, rather than behavioural. This vertical distribution of the refits in a taphonomic assessment is also a major contributor to inquiries about the sites occupation phases (e.g. Coulson 1986: 22; Skar & Coulson 1986: 101). Refits between excavation layers may suggest that the site is a single occupation but has suffered from vertical movement, due to post-depositional disturbance, rather than intentional human activity (e.g. Cahen & Keeley 1980: 177; De Bie 2007:39; Hofman 1992:2-4; Shurmans 2007: 9-10; Villa 1982: 279). For example, weather and temperature can alter a site dramatically. In spite of such disturbances, through refitting, one can assess different chronological scenarios since refits between different layers give vital information on the sites chronology (Balin 2000:110-111; Collcutt et al. 1990: 224-226; Fischer 1990:458).

Horizontal distribution

The horizontal distribution shows that the refits extend in all directions and cover the site with both longer and shorter refit connection lines (Figs. 17 & 22). When these lines and individual groups connect a site in general this would suggest contemporary use of a site (Bodu et al 1999: 159; Cahen et al. 1979: 671; Shurmans 2007:10). When one is addressing horizontal distribution, the more links between clusters done by refitting, the more likely the contemporarity of the clusters and, therefore, the site. Questions concerning post-depositional disturbance and its relation to intentional spatial organisation cannot be answered with absolute certainty, but results of refitting can render some scenarios, as being more likely than others (Ashton 2004:58; Hofman 1992: 12).

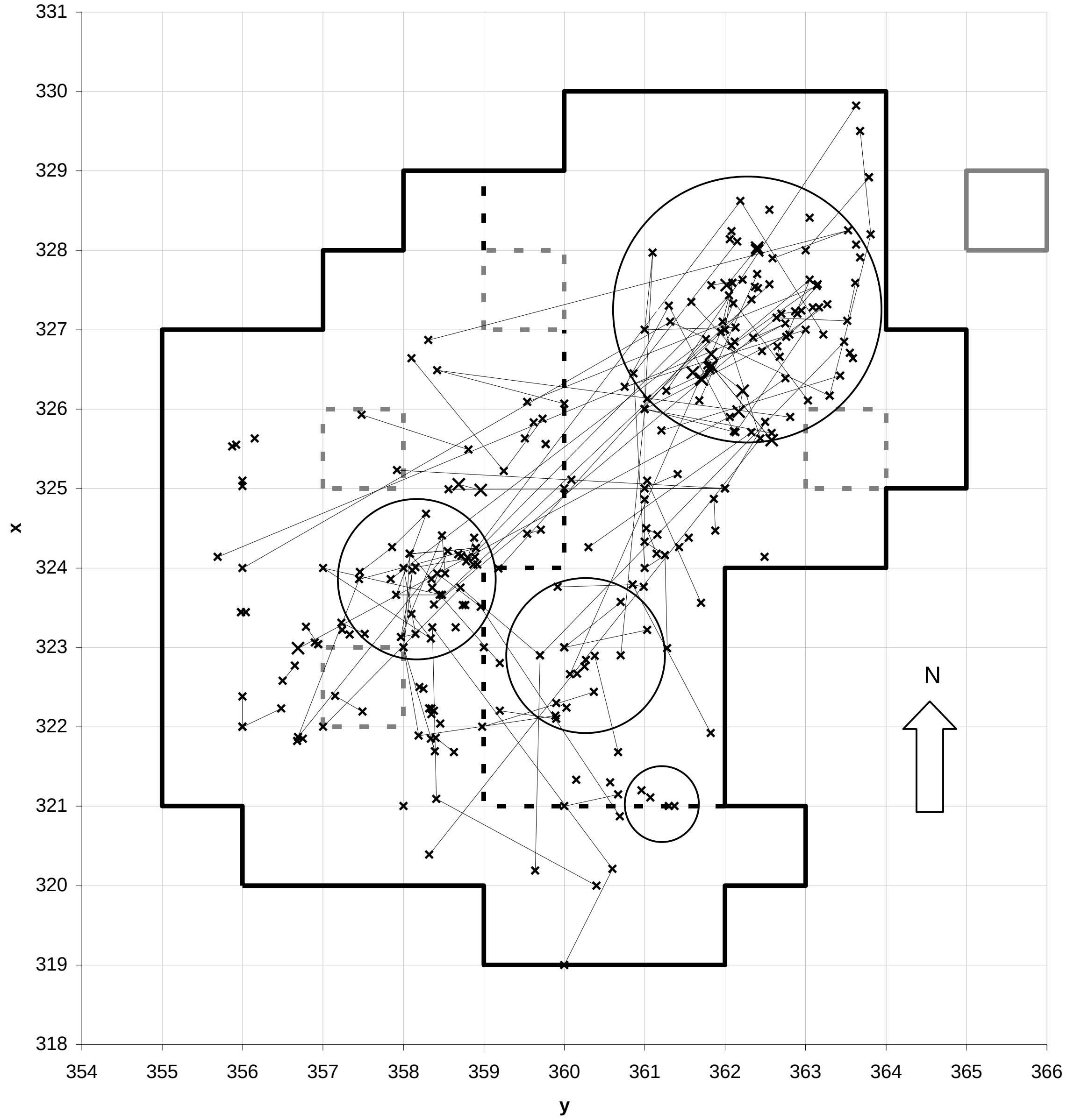


Figure 22: All refits with lines with the four cluster outlines indicated.

The three larger clusters are connected by several of the refit groups while the last cluster seems less obvious then the other three (Fig. 22). The refit lines also illustrate tendencies toward debris from knapping sequences being deposited at close proximity to each other; this is another element to the discussion of post-depositional disturbance. The site, after all, lies in the middle of a dirt road, and the vegetation of Lapland is slow growing, so one would expect some horizontal movement that cannot be attributed to intentional spatial organisation. There are, however, several refit groups with a tight spatial distribution that can be used to argue for the possibility that remaining evidence of the spatial organisation exist.

Vertical distribution

The vertical distribution on Area 2 is shallow, approximately 15 cm deep (Rankama & Kankaanpää 2007:48; Kankaanpää & Rankama 2009:39). The site was, as mentioned earlier, excavated in layers of 5 cm and later in layers of 2.5 cm (sees legend in Fig. 23 and description in Appendix 2). The majority of the refits were from the first 5 cm. In 2006 the top 5 cm were dug as two layers of 2, 5 cm which showed that the refit individuals seems to predominantly appear in the top 2.5 cm. This accord with the general finds of the site (Fig. 23). The refitted material from the Sujala site contains individual pieces from all of the layers, although some of the layers are more prominently represented (see Appendix 2 and Fig. 20). Refits between layers are usually interpreted as evidence of post-depositional, stratigraphic disturbances, and can, therefore, be used for ruling out the possibility of repeated occupations (Shurmans 2007:9; Villa 1982: 279-283).

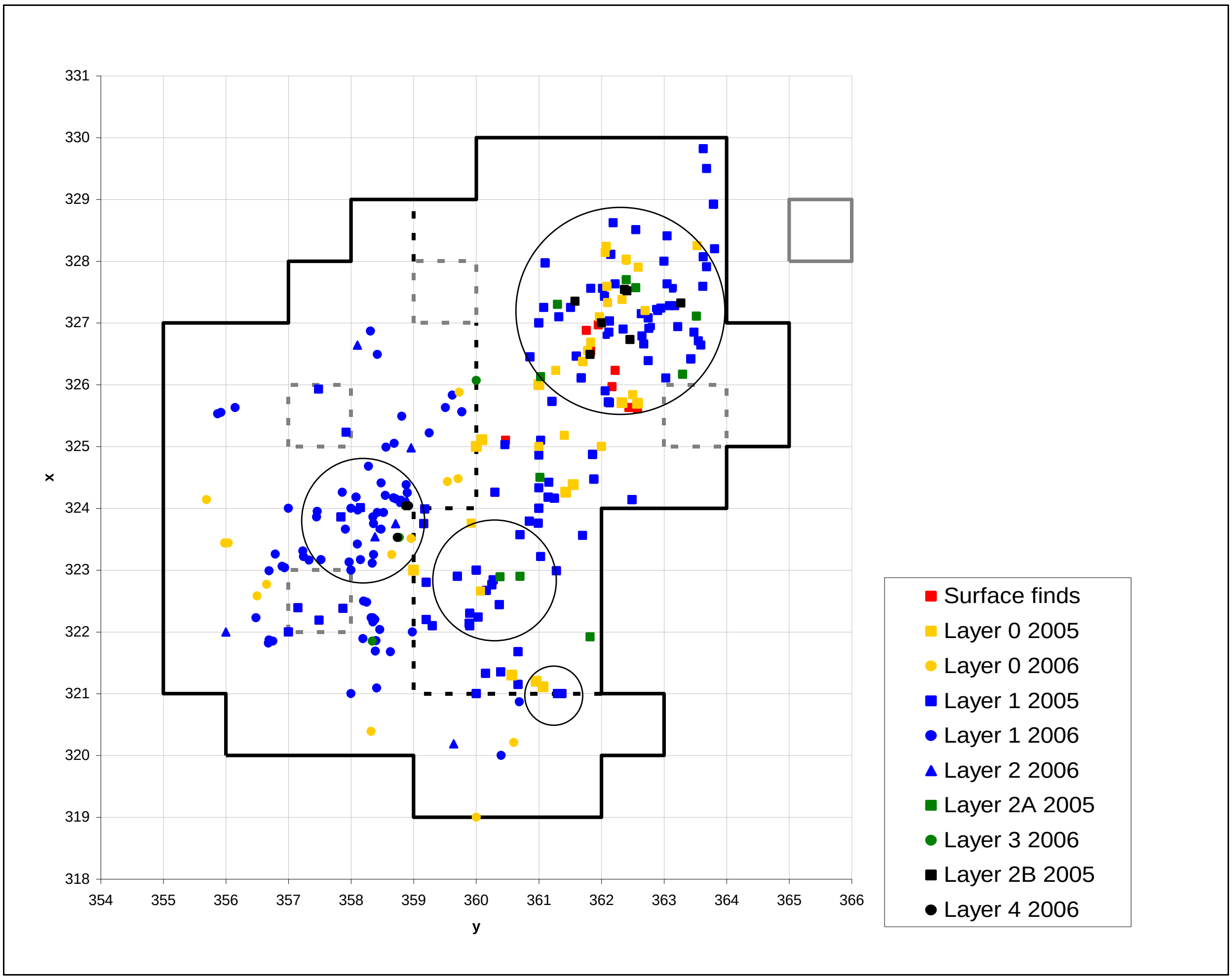


Figure 23: All refit individuals in accordance to excavation layers.

Other agents of disturbance

Two other factors potentially affect the post-depositional assessment and, therefore, need to be addressed. The first factor is the modern vehicle road that runs across the site. Due to the shallowness of the deposit, it is likely that it would have had an impact on the post-depositional movement of the artefacts, both horizontally and vertically. The second factor is Area 1. As mentioned earlier, Area 1 is located approximately 200 meters from Area 2 (Rankama & Kankaanpää 2005: 117). It has the same kind of raw material and on initial observations appears to have similar technological traits. Area 1 has only been test pitted and it is, therefore, impossible to give any clear assessment regarding its contents. To date; it has not been possible to connect the two sites by refitting. However, there is a possibility that the two sites are connected. This can effect both the spatial organisation and taphonomic assessment of Area 2. If sites are contemporary, sharing of food or tools would potentially relocate pieces between the sites and could give an insight to inter-site connections (Schaller-Åhrberg 1990; Shurmans 2007:11). If the sites are not contemporary but rather evidence of more than one settlement from the same group, raw material or tool scavenging could have occurred resulting in both vertical and horizontal disturbance (Balin 2000:111; De Bie 2007: 41). There could also be missing elements in the assemblage (Morrow 1996). In the future, Area 1 might be excavated and contribute to increased knowledge of the two sites and their possible relationship.

While acknowledging these factors I will, nonetheless, pursue the possibility of detecting evidence of intentional spatial organisation at the site.

Technological processes identified with the refitted material

There are no complete knapping sequences or *chaîne opératoires* in the refitted material, which is not uncommon (Inizan et al 1999:16). There are, nonetheless, refitted sequences that can contribute to the understanding of the technological processes at the Sujala site. I have chosen to present the technological traits seen in the refitted material in a *chaîne opératoire* system and approach the technological processes as mediated through the refitted material with the dynamic stages as defined by Pelegrin (1990:116) as mentioned earlier.

There are no unused blocks of raw material in the assemblage and the raw material's natural appearance as well as the source location is unknown at this stage in the investigation. This makes it difficult to assess the process of acquiring and selecting the raw material and, consequently, what the initial block preparation removals would look like. However, it is my opinion that these removals are not present in the assemblage. That would imply that the initial preparation of the blocks was done elsewhere and that a schematic process would have started with preparing cores and platforms.

Preparing the core and the platform

The many core tablets and core rejuvenation flakes in the material suggests careful platform preparation of the cores. The sizes of some of the tablets and rejuvenation flakes (Figs. 13 & 24) give insight to the potentially large sizes of some of the initial cores and blocks. The number of core tablets, that seemingly do not have any other use, is approximately 1300, constituting around 36% of the total assemblage (Table 4). Core and platform rejuvenation flakes make up 23 (20%) of the total 115 refit groups (Table 5).

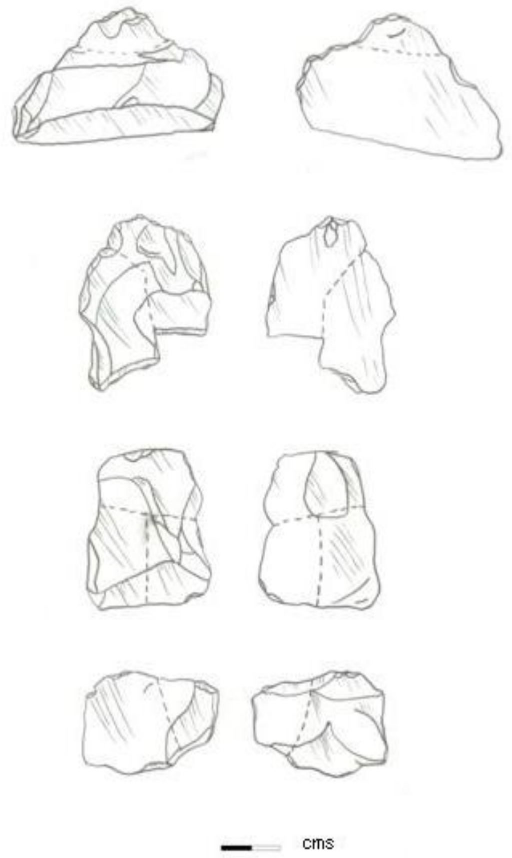


Figure 24: Platform rejuvenation flakes from the refitted assemblage.

However, it is not possible to attribute these only to the initial preparation stage. The refitted core tablets imply that removal and preparation of the cores before detaching blades, was done continually throughout the process of production (Figs 24 & 42). The high number of core rejuvenation flakes suggests that the platform was considered to be important. The intentional hinging of platform flakes may have been executed to avoid removal of the core face or plunging.

The amount of hinged core tablets and flakes imply that this is an intentional strategy. Turning what would be considered knapping errors into strategies is not uncommon and can be considered evidence of experience (Inizan et, al. 1999:38). The core tablets and flakes will decrease in size simultaneously as the cores are reduced.

Refit group 84 (Fig. 32 & Appendix 3) consists of three larger flakes and two smaller ones. This entity is perhaps the only evidence of the earliest phase of the core preparation process. The dorsal surface has several hinged removal negatives, struck from all directions. Due to the weathering of edges and fracture points it is hard to determine if the pieces were detached intentionally, accidentally or post-depositionally. There is evidence of frost fracture resulting in at least one potlid on the dorsal surface. The refitted entity was, however, intentionally detached to produce a platform. There is no evidence of a prepared core face or negative removals on the edges from blade or flake production, neither is modification visible on the refitted entity nor on the individual removals. After several preliminary blows, the large flake was removed producing a slightly concave platform. The flake may have been detached further for unknown reasons but was probably rejected and abandoned shortly after. The size and thickness of this specific entity stands out in the refitted material and is very uncommon in the lithic assemblage as a whole. The refitted entity should, therefore, be interpreted as belonging to the earlier stages of the block reduction process as it is executed at the Sujala site.

Refit group 103 (Fig. 25 & Appendix 3) is one of the more extensive refitted sequences of platform preparation or platform rejuvenation, representing a production stage succeeding group 84. The refitted entity creates what looks like a lid from production of a possible platform. As with group 84, 103 are also knapped from more than one side. The group is reduced by removing several flakes from one side, terminating in hinges, and creating deep slopes on the dorsal side of the block. It is possibly due to these incidences that the knapper continued to detach flakes. In the end, a larger and thicker removal was probably necessary. After this point, the flake detachments were performed from the opposite side, removing several smaller flakes, before turning the piece and removing another larger flake. Again, the piece is turned and thin, small flakes are removed. These are fragmented and broken in the refitted entity, and most of them have naturally occurring breaks at the thin edges. The remaining bulbs are clearly detectable, slightly protruding, and rounded, and some show evidence of bulbar scarring. In Figure 24, the knapping chronology of refit group 103 is depicted with removals plotted in the spatial grid and numbered according to their place in the detachment sequence.

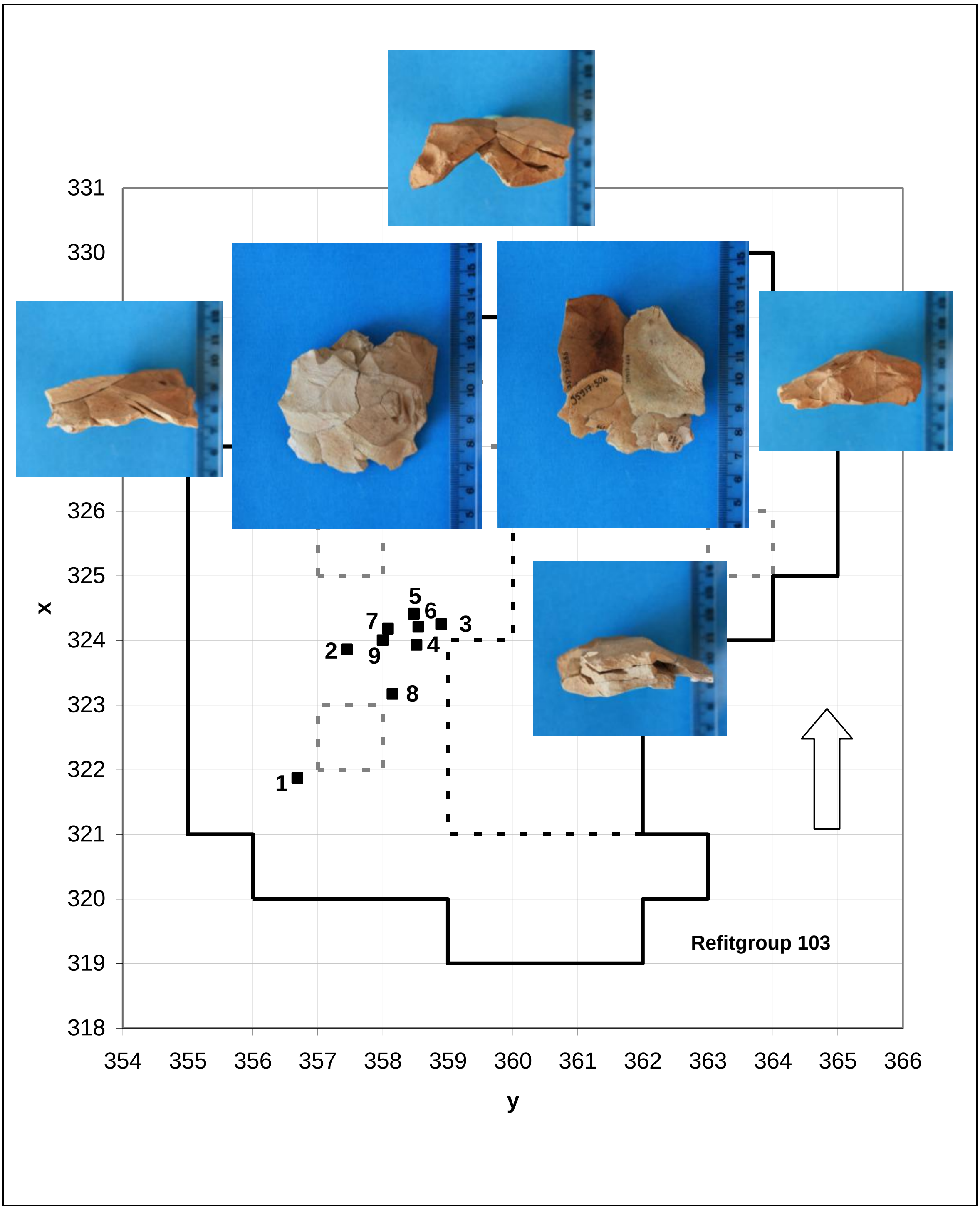


Figure 25: Knapping chronology of refit group 103 with removals plotted in the spatial grid and numbered according to the place in the detachment sequence.

Producing blanks

After the initial stage of shaping the core and preparing the platform, there is evidence of blank production. According to the lithic assemblage, the blanks that were most sought after were blades. To produce blades, the debitage is usually pre-planned, so that one will repeatedly produce blade or blade-like shapes from a core (Inizan et al 1999:71). Unfortunately, there are no blade removal sequences in the refitted material, although the blade groups constitute 60% of the refitted material. About 69 refit groups out of 115 are categorised within the blade category (Table 5 & Appendix 3). Still, it is possible to identify some parts of this process in the refitted material, represented by sequence refits of blade like flakes. Of the 69 blade refit groups, 28 have not been retouched. Some of these can be interpreted as blanks that have not been used or modified further into tools. Since the core rejuvenation refits and flakes suggests that preparation of the platforms were conducted throughout the entire technological process of the material, it is also possible that a certain number of blanks were produced and discarded before rejuvenating the platform at a later stage.

Refit group 100 consists of eight individual flakes and fragments. In my catalogue, I have defined them as core tablets and flakes (see Appendix 3). However, when refitted I do believe that the entity is not part of any platform preparation or modification but rather a result of a preparation of the core face for the production of blades. The flakes in this entity are elongated but cannot be classified as blades. The already mentioned hinging is also present here and again probably implies an intentional strategy to avoid plunging. In contrast to the refitted groups associated with preparing the core, this entire entity is detached from the same platform. The subsequent detachment of eight flakes, without evidence of remodification or use, would suggest that this refitted entity is evidence of the meticulous process of producing acceptable blanks for tool production.

I consider refit group 55 to represent the following stage of blank production. It consists of four individual pieces that are interpreted as blade-like flakes and placed in the general category of flakes in the catalogue (see Appendix 3). The refits were found by tracing a characteristic inclusion, visible as a thin line, which is found throughout the entire refitted entity. The group's individuals show different degree of wear, and have slight colour differentiation. The first three flakes are removed from the same platform, using the negative scar of the previous detachment to create a dorsal ridge and thus producing a similar elongated flake. The last flake on the other hand, is removed further down from what is now the medial section of the three first removals. However, as this piece lacks the distal end, it could be that this was the first blade removal on the core.

The blades from the refitted material represent a wide variety of thickness, length, and width as well as colour variations (Fig. 18). The majority of blades in the refitted material are retouched, and this will be discussed below in the chapter on modification and remodification. The number of *unmodified* blades in the refitted material is approximately 28 groups (Appendix 2) that range in width from 7 mm – 25 mm and length from 17 mm - 55 mm. Since there are no complete blades without retouch in the refitted assemblage actual length readings are incomplete. *Retouched* blades range from 8 mm – 26 mm in width and from 14 mm - 107 mm in length. The only complete blade from the refitted assemblage is a retouched blade measuring approximately 69 mm long and 12 mm wide.

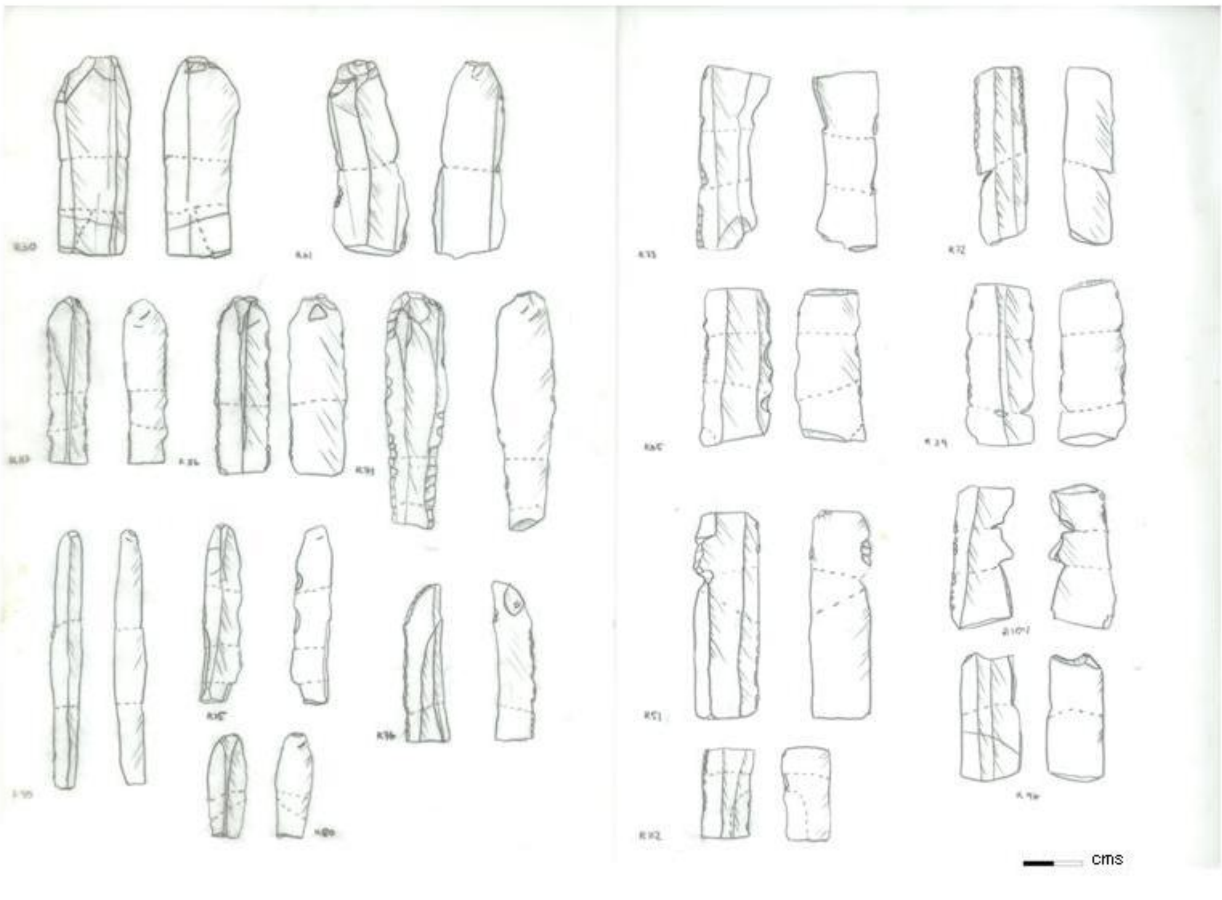


Figure 26: Example of refitted blades with and without retouch. The stippled lines represent the breaks.

Analysis, by Rankama and Kankaanpää (2007:53) conducted on the proximal ends of blades, concludes widths ranging from 2 mm – 43 mm, that the majority show substantial platform preparation with edge trimming present, and that the proximal ends on the blades have lips on the ventral side, which indicates use of a soft fabricator. The bulbs on the proximal ends of the assemblage are often short and rounded which according to Pelegrin (2006: 47), are a feature associated with the pressure technique.

Modification and remodification

After having prepared the cores and produced the blanks, some pieces were further selected for modification. This is not to say that all blanks have to be modified to be used. By performing microscopic use-wear analysis one could probably determine if unmodified blades, especially the ones with edge damage, were used in their unaltered form (Andersson 1998). The modifications visible in the refitted material are retouched pieces, broken blades and burins. This appears to be an ongoing process. Retouch can be applied before and after intentional fracturing and before and after burination. In some cases, burin spalls were removed before the blade was broken. In other words, retouching is not necessarily the first or the last step. This is connected to the dynamic of a *chaîne opératoire* at the site, where pieces move in and out of a technological process (Pelegrin 1990).

Of the 69 refitted blade groups, 41 have continuously or discontinuously edge retouch. The blades have semi-abrupt edge retouch that varies from narrow to broad depending on the width and thickness of the blades. Long, thin, and narrow blades seem to have a narrower type of retouch compared to thicker blades. The type of retouch is normal or scaled but occasionally sub-parallel retouch can be observed on some of the blades (Figs. 15 & 16). Sub-parallel retouch is where the arrises of the removals are parallel to each other while normal or scaled retouch is described as being of a pattern similar to fish scales (Inizan et al 1999: 146). As mentioned in chapter 3, the Sujala blades are thought to have been snapped perpendicularly to the axis of the blade by a blow on the dorsal ridge while placed on an anvil (see Fig. 27). When examining the break pattern, the impression is that the breaks occur from both the ventral and the dorsal direction. Some of the blades are also naturally fractured, and some cannot be determined (Appendix 3 & Fig. 29).

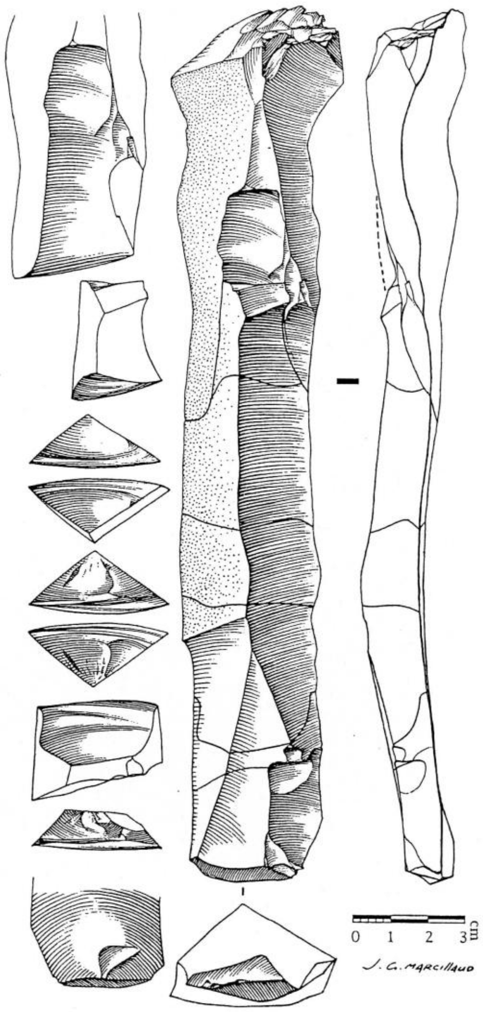


Figure 27: Example of intentional breaks; large blade with multiple clean breaks, experimental debitage by direct percussion using a wooden billet. Experiment conducted by J, Tixier. After Inizan et al 1999: Fig. 6.

During the study, I attempted to separate the blades into intentional, natural, and uncertain breaks. In some cases there appeared to be both intentional and natural breaks within one refitted blade. At times the substantial wear on the blade fragments made me unable to decide if the fracture is natural or intentional and is therefore defined as uncertain (see Appendix 3). The natural breaks are distinct as the breaks are not clean and angular as in the intentionally broken pieces. Furthermore, there is no observable evidence of a blow on neither the ridges nor the sides and the break pattern is uneven. The intentional breaks can be detected by the smooth and flat surface of the breaks and with evidence of a blow to the dorsal or ventral ridge or to the sides (see Fig. 27). Another distinct feature is the spatial placement. The intentionally broken blades are more widespread within the spatial matrix of the site, whereas the naturally broken pieces are usually found within close proximity of each other if not together (Figs. 28, 29 & 31). Within the refitted blade assemblage both non-retouched and retouched blades have been intentionally broken as can be observed in figure 28. The same can be observed with the uncertain fractures (Fig 29, left map) while natural fractures seems to occur to a higher degree within the non-retouched blade refits (Fig 29, right map).

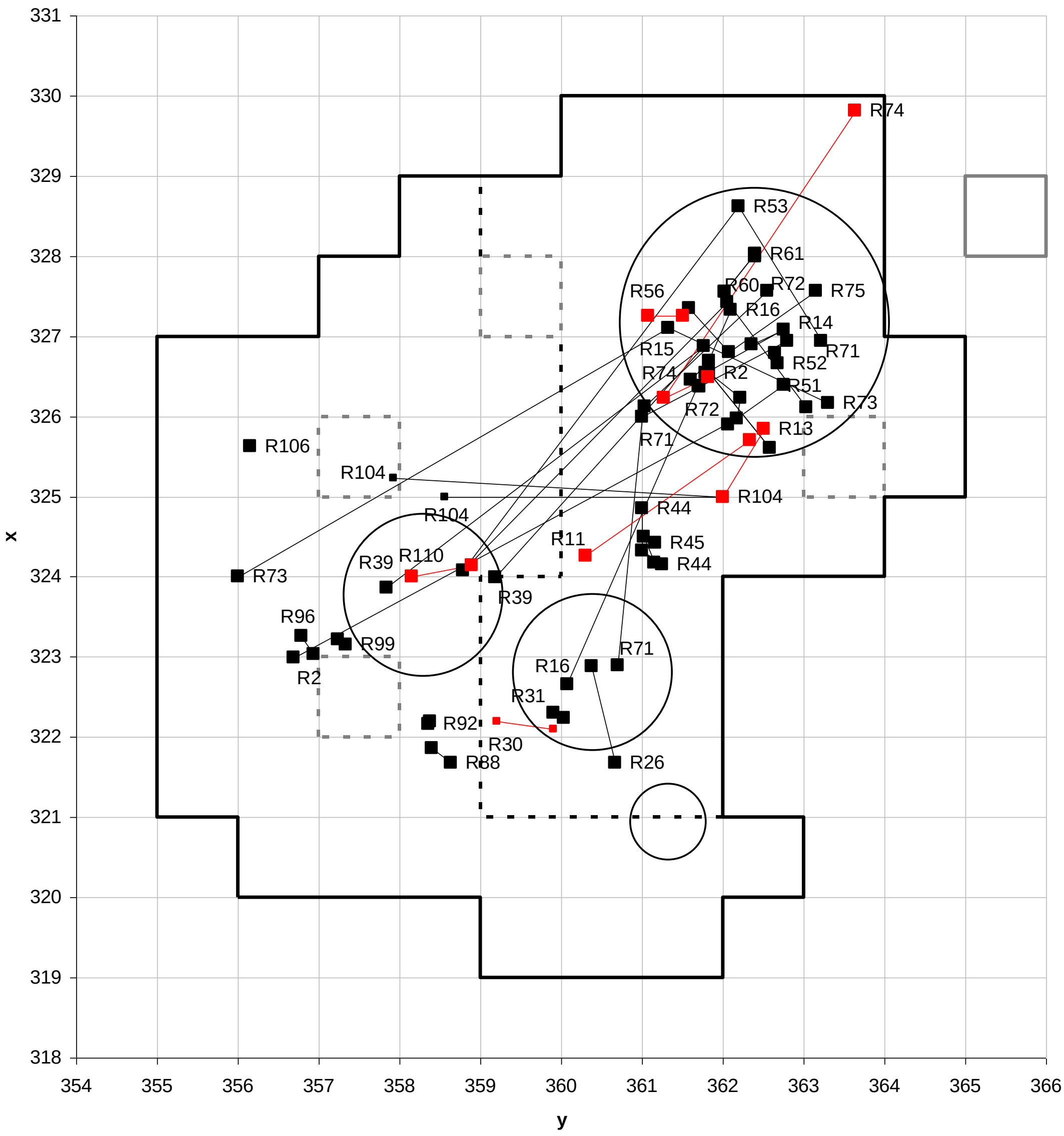


Figure 28: Intentionally broken blades. The red colour represents the non-retouched refit groups while the black colour represents the retouched blade refit groups.

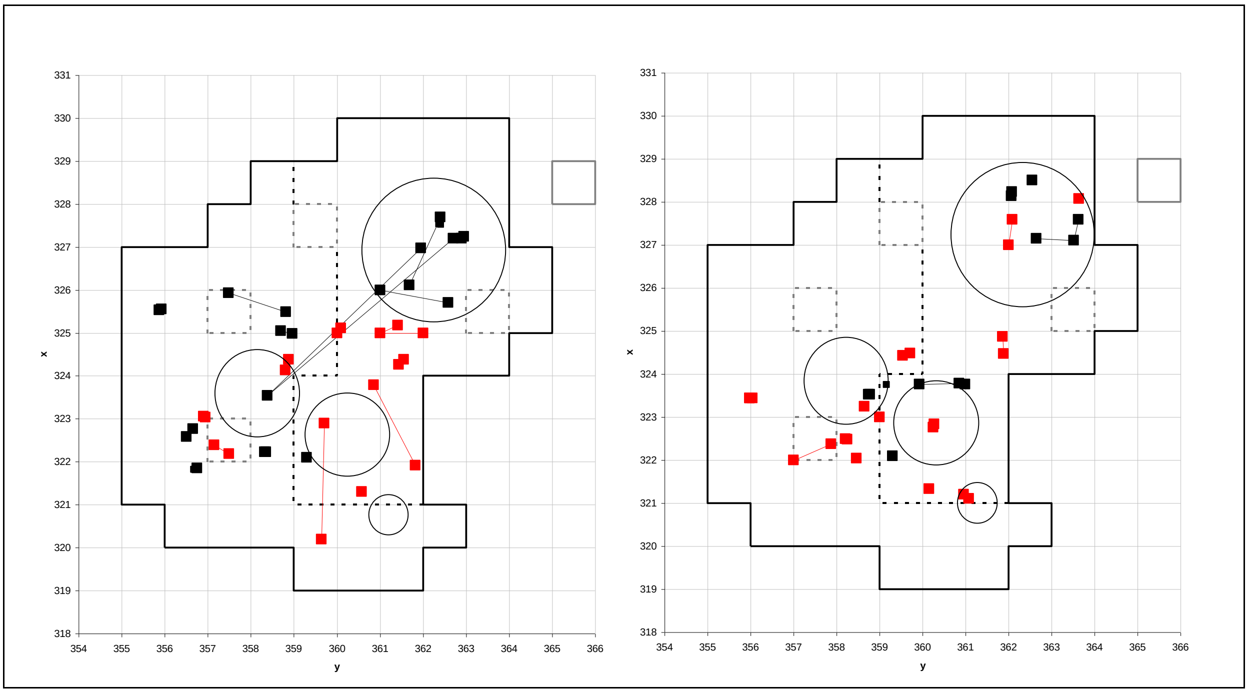


Figure 29: Map on the left side depicts refitted blade groups with breaks defined as uncertain and map on the right side depicts refitted blade groups with breaks defined as natural. The red colour represents non-retouched blades and the black colour retouched blades.

Of the total 115 refit groups, 13 have been interpreted as burins and burin spalls (Appendix 3). The burination technique is a specific action that creates a burin facet. The facet is made by removing a burin spall from the edge of a blade or a flake; this can be executed either by direct percussion or by pressure technique. Sometimes the flake or blade is modified or retouched and sometimes it is not. The burin blow can be executed on any flat surface, fracture, notch, or edge that can function as a platform. The removal of a burin spall sharpens an edge of a flake or blade. The first spall removed is the primary spall, while subsequent removals are defined as sharpening spalls (Inizan et al 1999: 132-135). In the refitted material, there are mainly primary spalls, with some refitted entities, suggesting that instead of removing a sharpening spall a new burin was made on other edges of the flakes or blades. In the refitted material, there is also evidence of remodification where burin blows have been executed on retouched edges, thus removing the retouch and creating a sharp facet. The main blank production for burin manufacture would seem to consist of blades, but there is also evidence of modification and remodification of other shapes. In the refitted assemblage, two burins are not made on blades, but on blade-like flakes (Fig. 30).

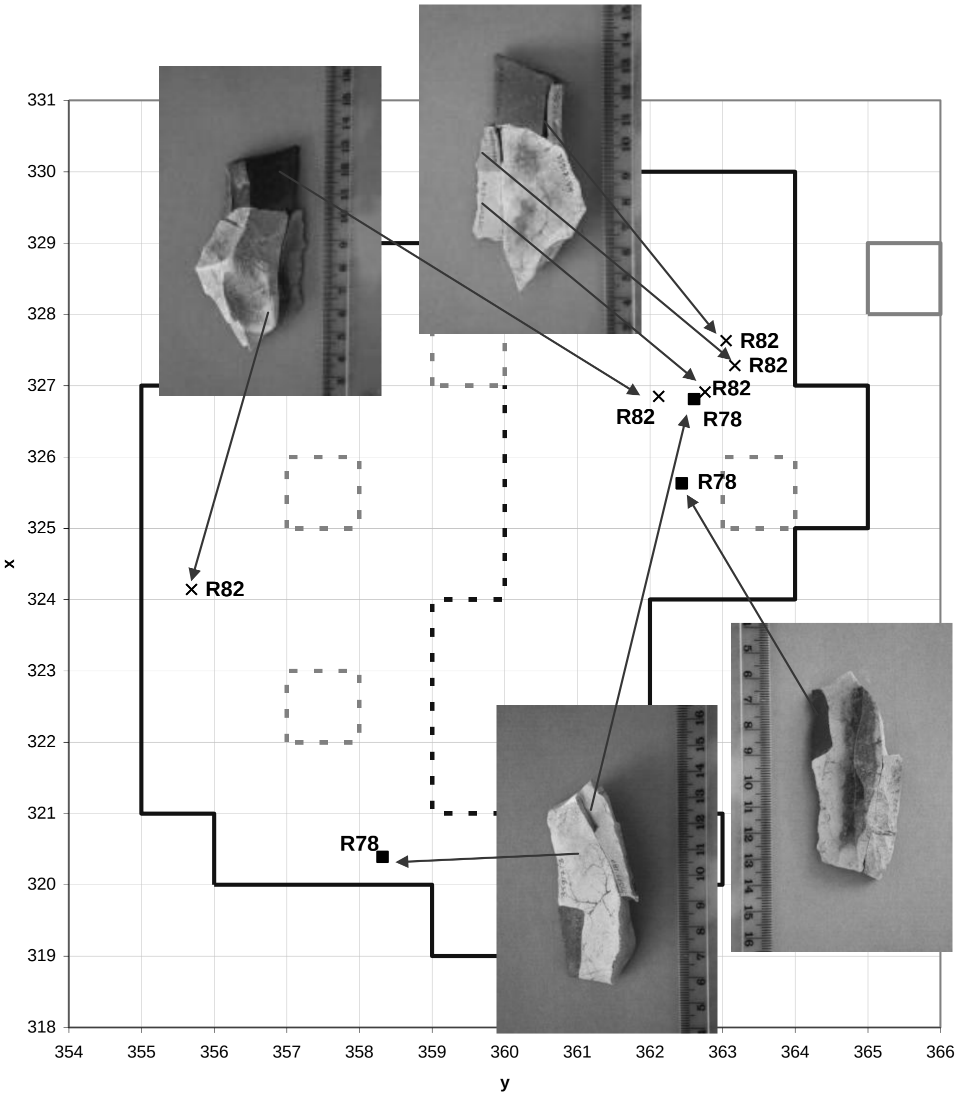


Figure 30: Spatial distribution of refitted burins R78 and R82

Refit group 78 (Figs. 30 & 34) is a thick rectangular piece with a slight convex curve to the right dorsal edge. The first of the burinations are struck alongside the convex curve of the edge. Only half of the original spall was found and refitted. This spall is retouched on the edge and has been removed using the present top end as a platform. A second burination is struck from the opposite side and terminated by a step. Refit group 82 (Figs. 30 & 34) is similar to refit group 78, but thicker and more uneven. This group contains 5 pieces where 2 are burins and 3 are burin spalls. The piece has been burinated, at least on the two edges, as demonstrated by the refitted burin spalls. The break between the two main burins is intentional, but this may not be the case, as there are variations in the texture of the two (see Fig. 31 for break patterns in refitted burins).

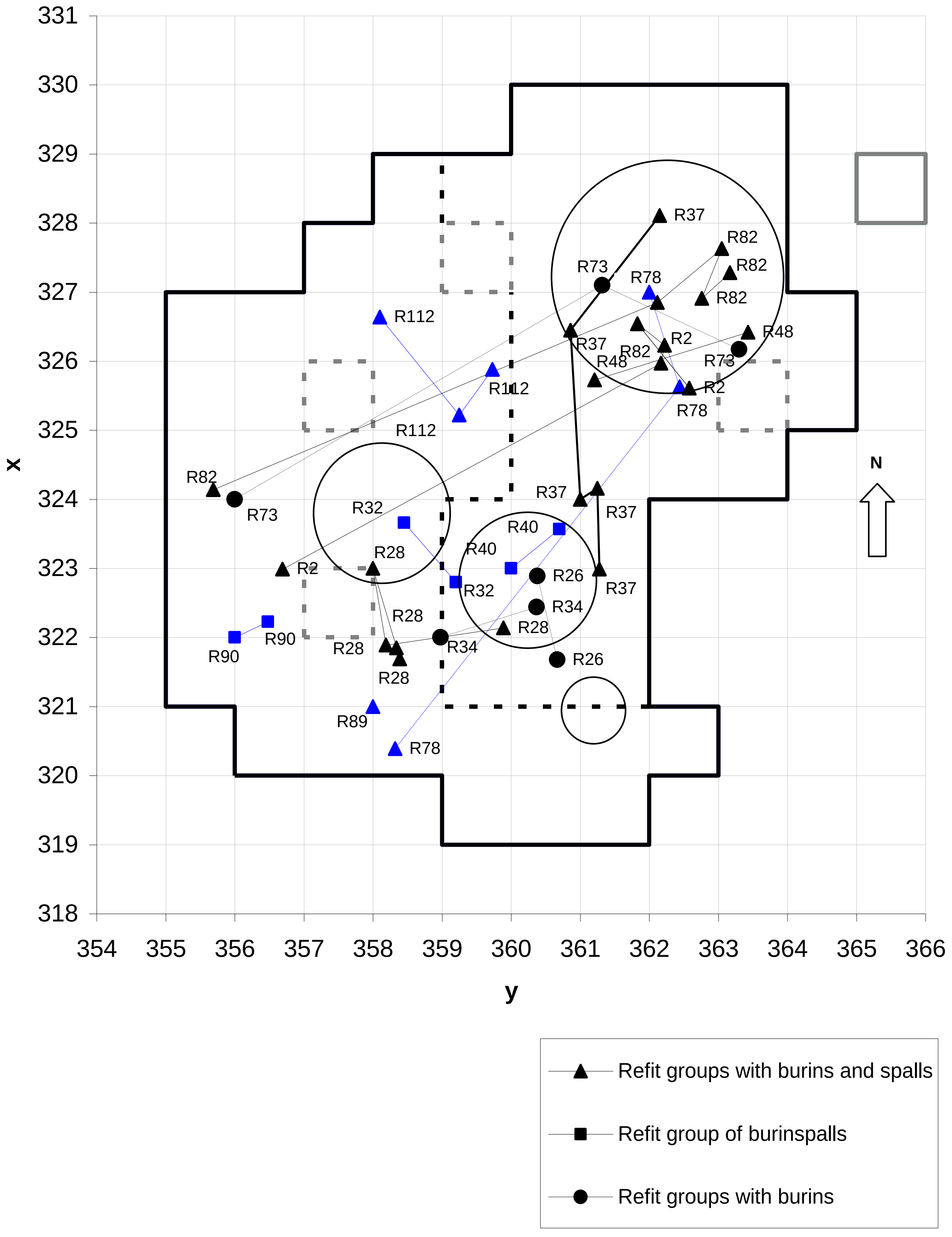


Figure 31: Burins and burin spall refit groups. Blue groups represent the refitted entities with uncertain break patterns and the black groups represent the refitted entities interpreted as intentionally broken.

Refit group 2 (Fig. 32) consists of the proximal and two medial segments of a long parallel-sided blade that has been burinated on the left side of the proximal end. The burin spall consists of three separate sections. All of the individual pieces except the proximal end show signs of edge retouch. It is, however, uncertain if the burination was directly responsible for the break between the proximal and the first medial section. The break between the first and second medial section of the blade is probably intentional. The burination and the break were conducted after the blade had been retouched and are probably part of a remodification of the piece.

Refit group 14 (Fig. 32) include two retouched medial sections and one retouched end. The end is much narrower than the medial sections and has retouch on all the outer edges and the entire ventral surface. The piece is heavily worn but shows some evidence of propeller wear which may indicate that it has been used as some sort of borer. Because of the heavy wear and retouch, it has not been possible to conclude precisely if it is the distal or the proximal end of the piece. The medial section refitted to the borer end shows a continuation of the retouch and the split between the pieces is likely accidental due to, use rather than intentional. However, the tip of the medial section shows some form of alternating retouch as well, and may have been used after the accidental splitting. The second medial section also has some retouch on the edges and is intentionally split from the other medial section but without further modification or visible evidence of use.

Refit group 26 (Fig. 32) is the proximal and medial section of a blade with one dorsal ridge. The proximal end has normal retouch covering all of the edges as well as the tip of the dorsal side on the proximal end. The break between the individual pieces is intentional and probably produced from the dorsal to the ventral side. The medial section shows evidence of a distal to proximal burination on the right dorsal edge produced after fracturing. On the opposite side the edge is retouched, but with a slight curve towards the break. When refitted, the medial section is narrower then the proximal. Either the left edge was retouched before the break and then retouched again after, making it narrower, or the left dorsal edge was also burinated and then retouched.

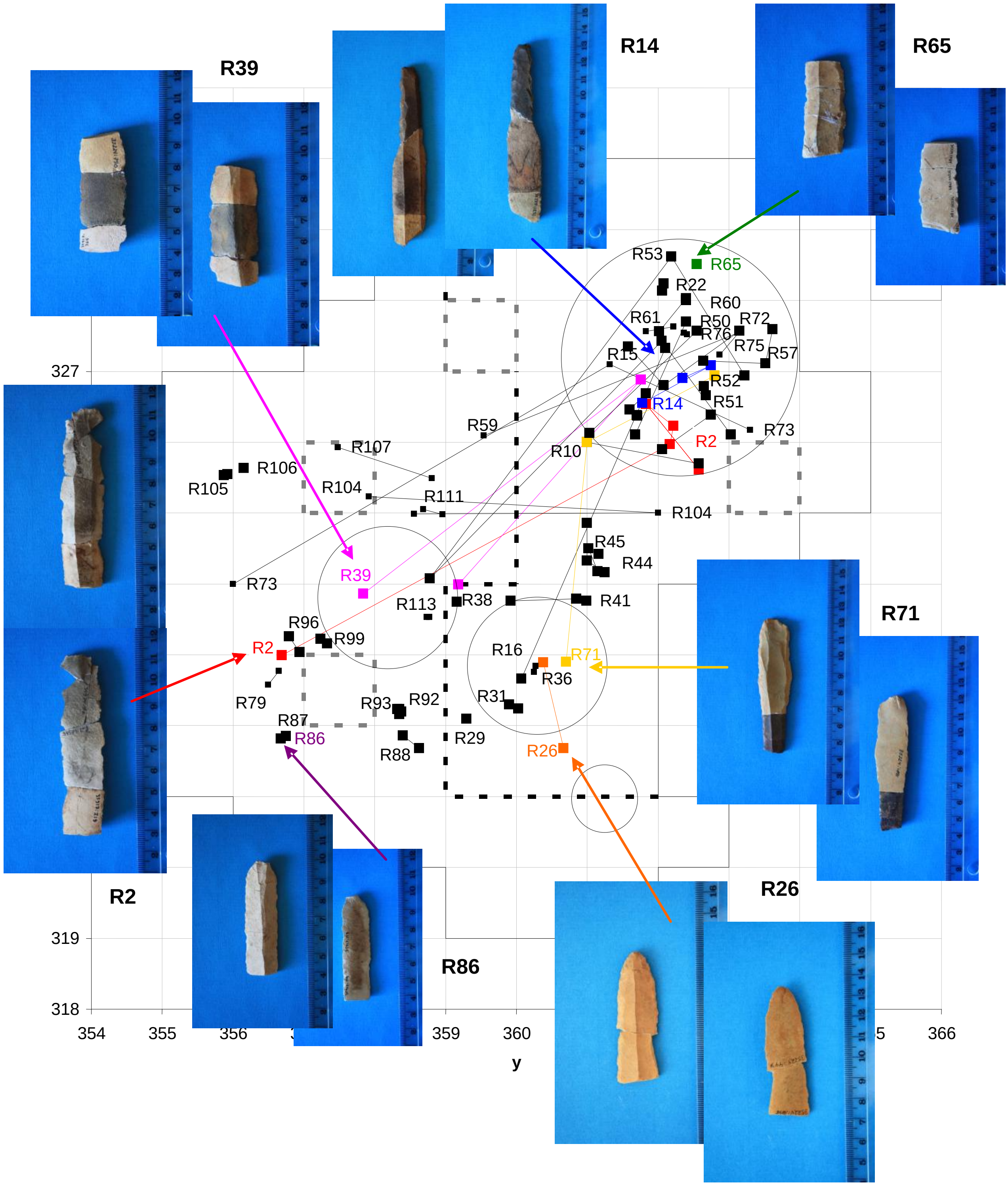


Figure 32: The distribution of retouched blades and burins with highlighted examples.

Refit group 28 is a retouched and burinated blade that has no original distal end but with burinations occurring from the remaining distal. There are two burin spalls refitted to the entity. The refitted entity is approximately 107 mm long 21 mm wide. The retouch is wide and continuous on both the left and right edges and the burinations are all produced subsequent to the retouch.

Refit group 39 (Fig. 32) consists of three medial sections of a blade. While the left edge is intentionally retouched, the right edge has irregular retouch that may be edge damage due to use or natural. All of the refitted individuals have a different colour and are heavily worn making the edges irregular and fractures difficult to determine. They are, however, probably intentional and most likely executed from the dorsal to the ventral side.

Refit group 65 (Fig. 32) is a refitted entity of 4 pieces, where three are medial blade sections with retouch and the fourth is an edge fragment. All were found together and have the same catalogue number. The refitted entity is naturally broken probably due to weathering or other post-depositional processes. The fractures are all uneven and coarse compared to the intentional breaks visible in other refit groups. The end fracture seems to be cleaner but without additional parts to refit it is difficult to determine if this is also natural.

Refit group 71 (Fig. 32) is a long proximal and two medial sections of a blade with fine retouch along both edges. The break between the proximal end and the first medial section is clearly intentional as the medial section shows a bulbar scar below the uppermost dorsal ridge. The break between the medial sections, on the other hand, could be natural.

Refit group 86 (Fig. 32) is a 61 mm long and 18 mm wide and constitutes a blade lacking the distal end. The pieces were found together and given the same catalogue number. The break between the proximal and medial end is natural. The blade is carefully retouched along the entire left dorsal edge, with some retouch on the ventral surface but unevenly on the opposite edge. The retouched is almost denticulated, but this is probably natural damage due to the thinness of the blade.

The end of the line: Abandoned cores and core fragments

The cores retrieved from the Sujala site are considered to be exhausted and, therefore, discarded. Nonetheless, they bear evidence of blade manufacture, as well as indication of why they were abandoned (Inizan et, al. 1999:59).

Refit group 85 constitutes a conically shaped core with a prepared platform, displaying what is likely to be the removal of a core tablet from the platform and negative scars of blade removals (Fig. 33). There is evidence of a removal terminating in a hinge at the core face. During the refitting study, two flakes were fitted to this hinge. The first terminates in a hinge and the second removal; probably an attempt to correct the first mishap, only makes the hinge deeper. Most likely, the core was abandoned due to this incident. This is shown in Figure 33, where the reduction sequence is illustrated and the individuals that make up the refitted entity are also plotted. Number 1 represents the first of the refitted flakes that were removed, number 2 the second and number 3 is where the exhausted core was retrieved from during excavation.

The medial core tablet, group 49, includes nine individual pieces (Fig. 34). Five of these are identified as core rejuvenation tablets, three as flakes and one as a trimming flake (Appendix 3). The raw material of this refitted entity is saturated with darker streaks that are evident on the dorsal and ventral sides and on the core face. There are four negative scars of medial sections of regular, parallel blade removals, measuring approximately 0, 6 mm across, which make up the core face. Unfortunately, there are no refits to these. Virtually without exception, the platform reduction was conducted by removing the core rejuvenation flakes from the core face and terminating them in a hinge or a step towards the centre of the platform. This was done alternately in the start, most likely by turning the core to strike from the opposite side of the platform, if necessary. There were no blade detachments during the platform reduction stage witnessed in group 49 in the pictures in Figure 34. While most of the platform rejuvenation flakes terminated in hinges, and only partly removed the platform, the last of the detachments can be considered a medial part of a core and a core tablet. This removal resulted in a complete rejuvenation of the platform. As the previous removals had hinged, and caused deep concavity, on the platform, the only possibility would be to remove a complete section of the core.

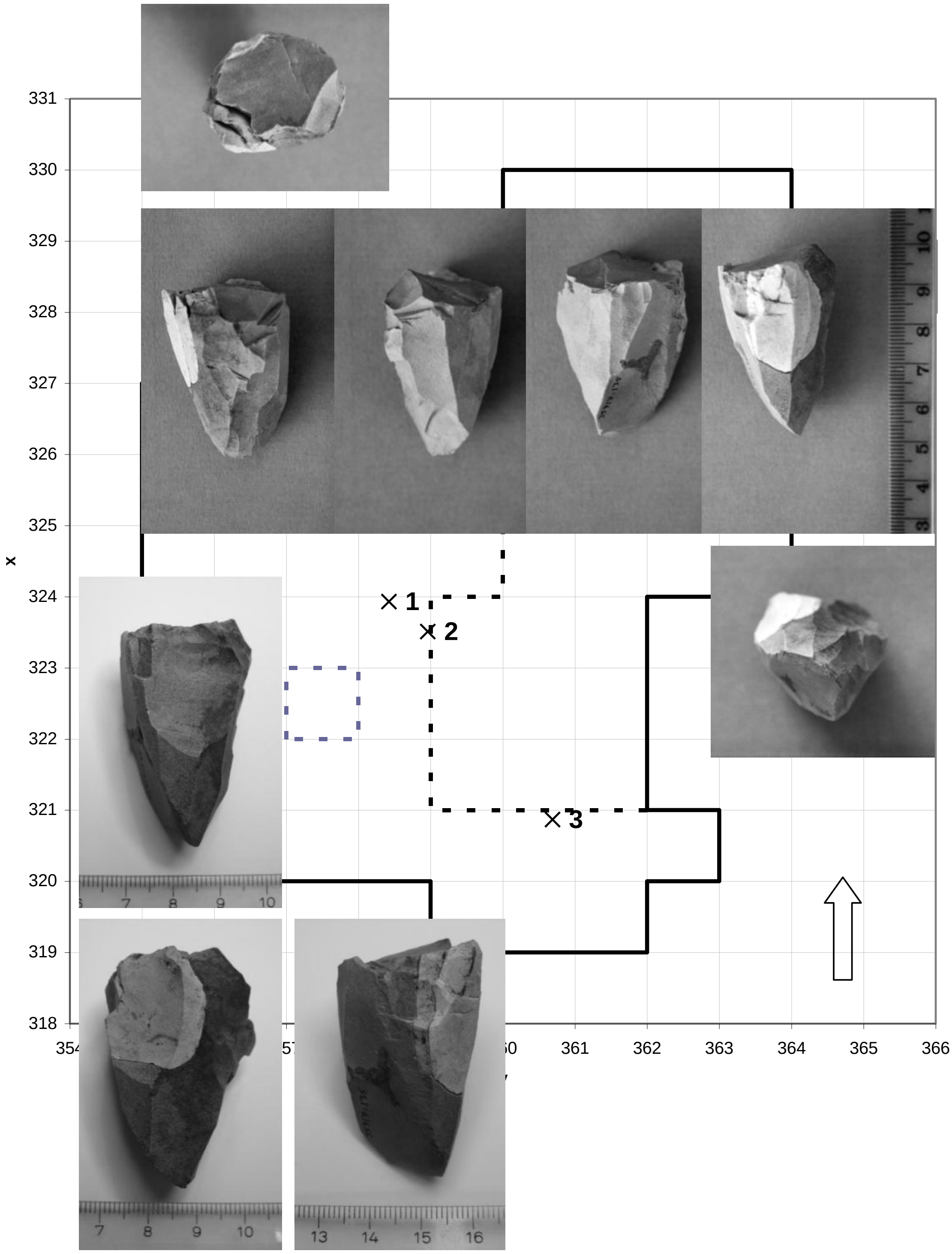


Figure 33: Refit group 85, conical core with two flakes refitted to the core face and the number representing the spatial placement of the individuals as discussed in the text.

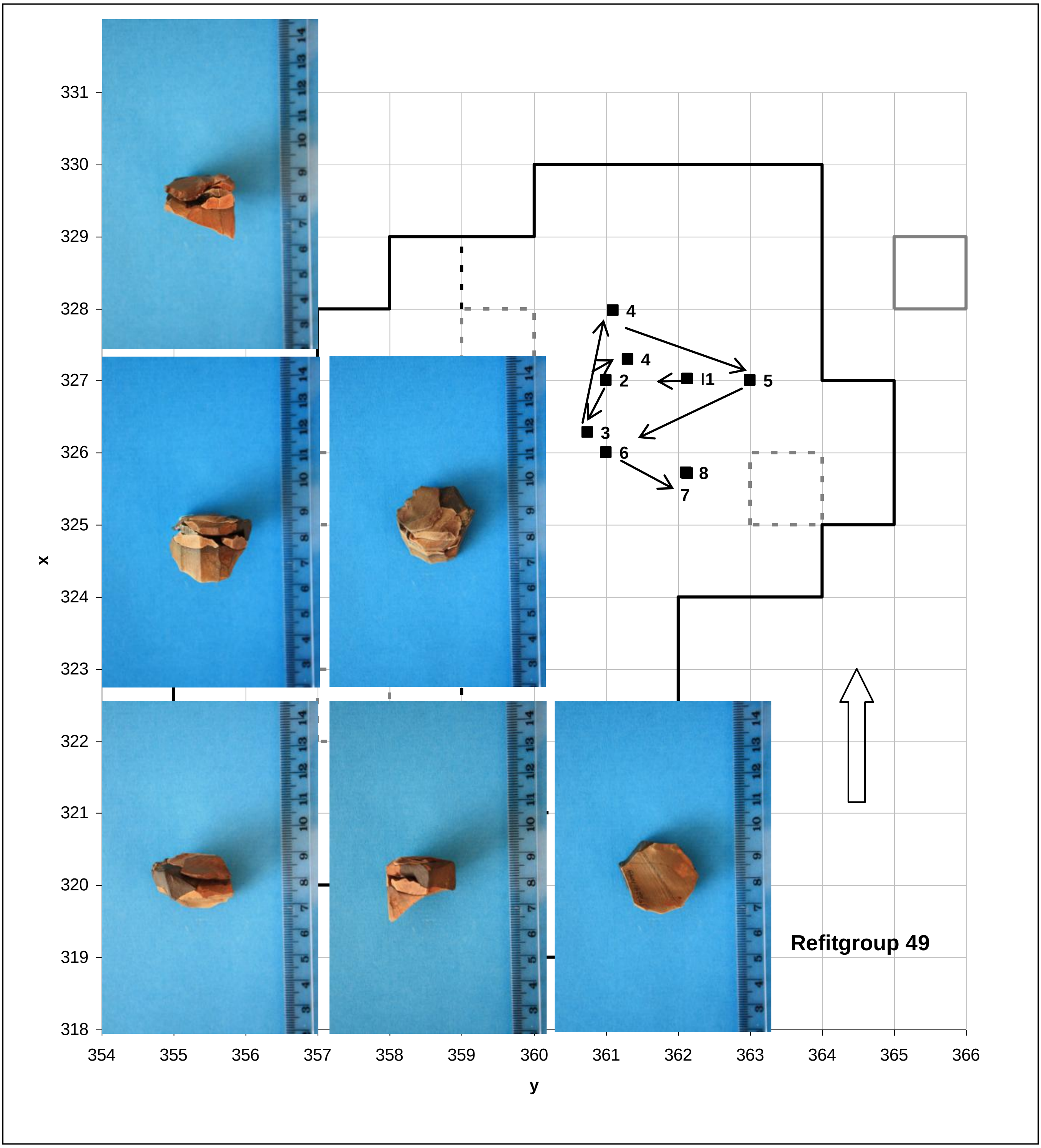


Figure 34: Reduction stages of refit group 49 seen in spatial distribution. The numbers represent the reduction stage as presented in the refitted entity.

Spatial organisation

In the taphonomic assessment, I concluded that the site shows evidence of a single occupation. Based on the vertical and horizontal refit connection lines, it was noted that some movement may not be attributed to intentional actions but rather be evidence of post-depositional disturbance. However, it was also stated that, even when taking post-depositional disturbance into account, there are convincing spatial patterns that could indicate intentional actions and organisation of the site. There are several refit lines connecting three of the four lithic clusters, and even though the fourth cluster is somewhat less convincing, they can be interpreted as evidence of intentional spatial organisation. With the *chaîne opératoire* in mind, the spatial distribution and organisation should be able to tell us if a specific part of a reduction sequences was executed at a particular area of the site. If so, there may be evidence of an activity area. There are four clusters of lithics at the Sujala site. Are they evidence of activity areas or are they concentrated waste areas? Can the results of refitting contribute to understand the relation between the four clusters and a possible intentional spatial organisation? To answer these research inquiries I will examine the distribution of refitted artefacts in connection with the already mentioned four lithic clusters (see Appendix 1 for main grid and Table 6 for statistics).

Lithic cluster 1:

The main cluster, excavated in 2005, is located in the northern part of the site and includes the larger dark area where burnt bone and charcoal was found (Appendix 1). Cluster 1 is approximately 3, 5 m across and is the most extensive of the clusters, but is not as dense as cluster 2 (Fig. 11). Many of the refitted retouched blade fragments are found within, or in close connection to this cluster (Fig. 33). This is also true for the burins (Fig. 35). The majority of the core fragment refits also derive from this area (Figs. 36 & 37).

Table 6: Individual refit group's category and numbers of groups associated with the different clusters as well as outside of these. Some of the groups are listed in more than one cluster. For details, see Appendix 2.

Refit groups	**Cluster 1**	**Cluster 2**	**Cluster 3**	**Cluster 4**	**Outside**
Core refit groups	2		2		1
Core tablet refit groups	8	1	5	1	3
Flake refit groups	2	2	3		2
Not retouched blade refit groups	7	2	3	1	15
Retouched blade refit groups	19	5	5		15
Burin refit groups	5	2	1		2
Burin spall refit groups		2	1		1
Fragments refit groups	1		1		1

Lithic cluster 2:

Cluster 2 was also excavated in 2005, has the highest density of all clusters (Fig. 11) and measured around 2 m across. The number of individual pieces was so high they were plotted in 15x15 and 20x20 cm groups. The majority of the finds from this cluster are trimming flakes and fragments. The refitted material from this cluster is presented by only one core tablet refit group (Fig. 37). While it contains more refitted retouched blades and burins than cluster 3, it also shares some refitted groups with cluster 1, such as R 71 (Fig. 34).

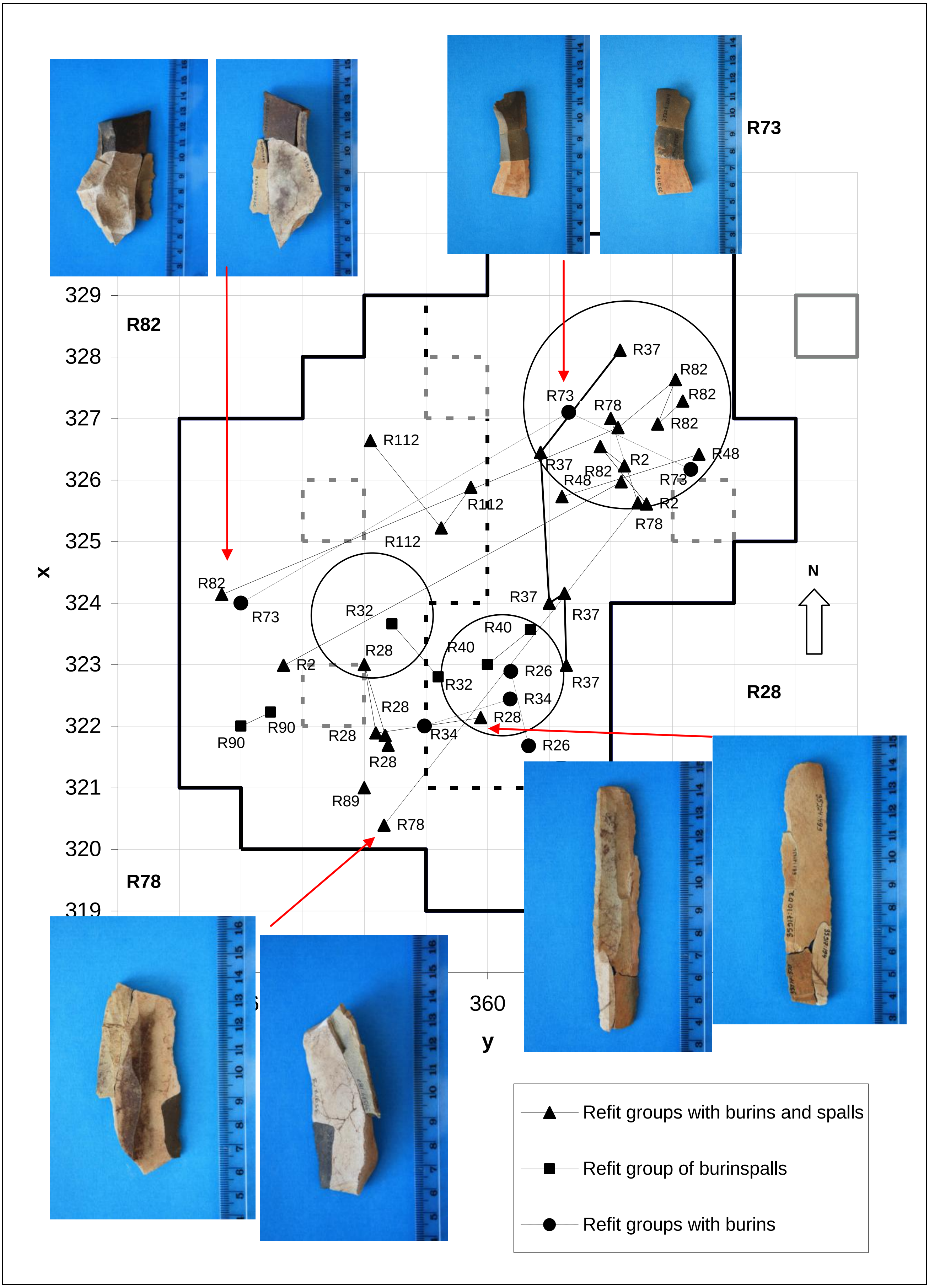


Figure 35: Spatial distribution of burins and burin spall refits in connection to the lithic clusters.

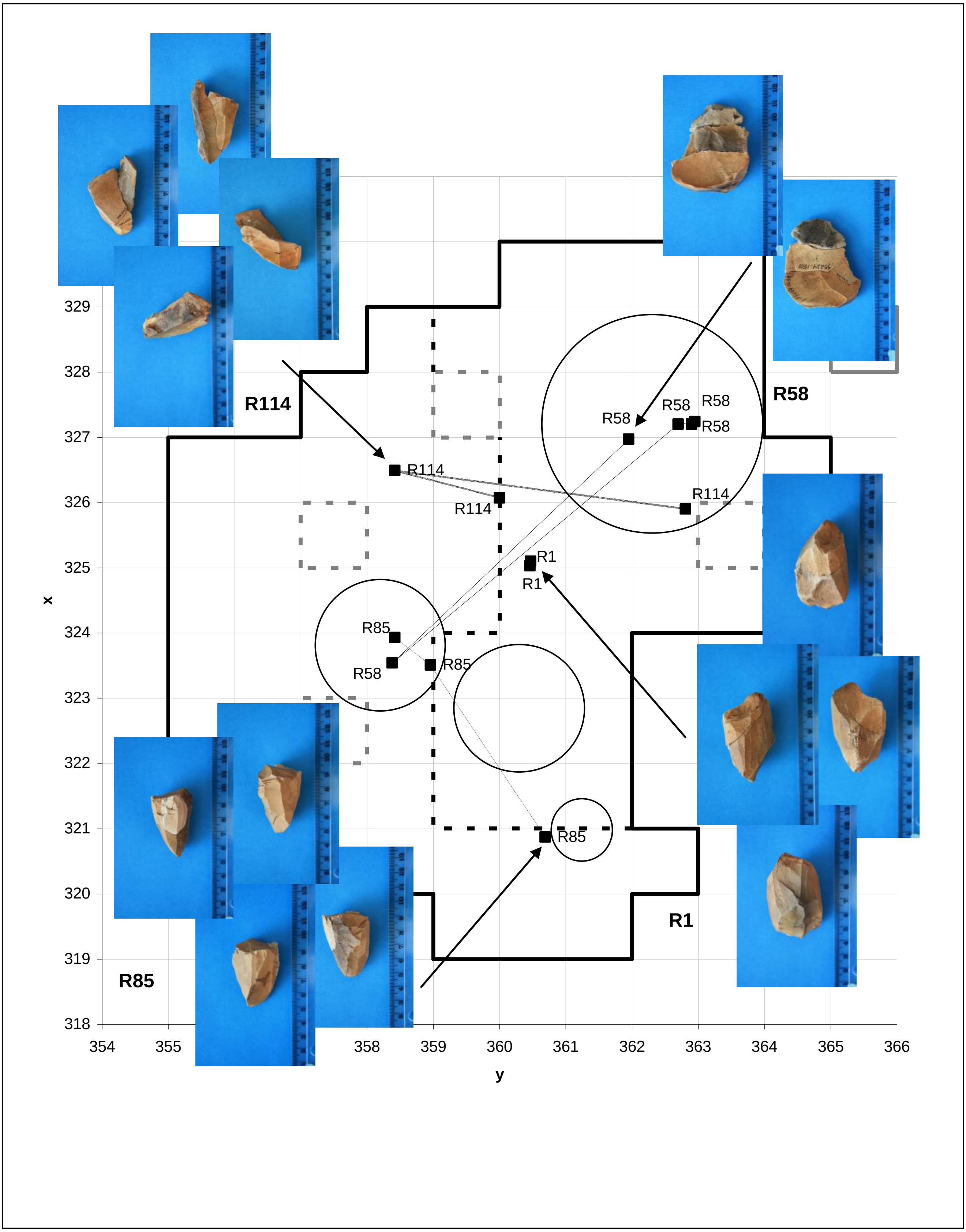


Figure 36: Spatial distribution of refitted core and core fragments and their relation to the four lithic clusters.

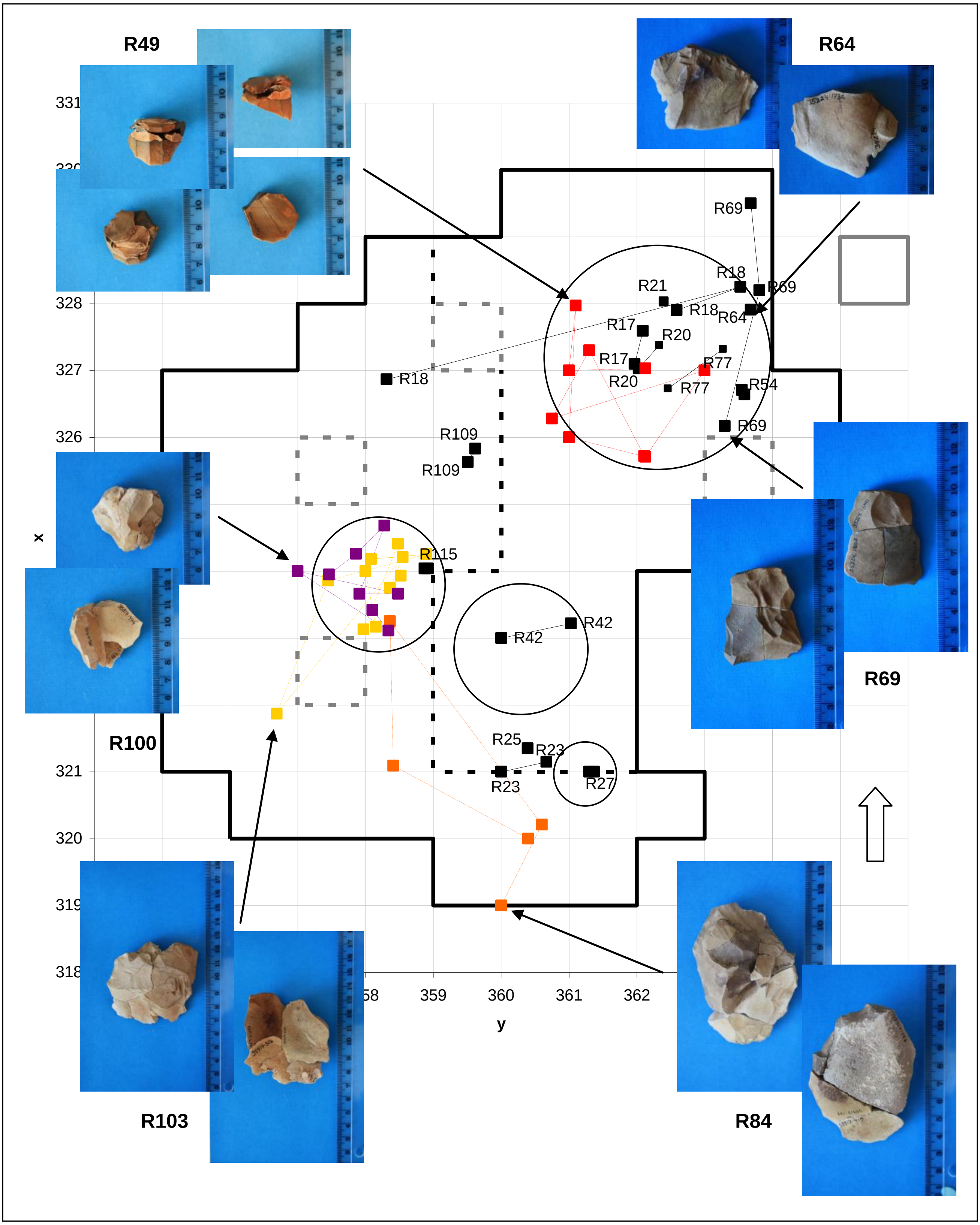


Figure 37: Spatial distribution of core tablets and reduction sequences and their relation to the four lithic clusters.

Lithic cluster 3:

When excavating in 2006 another high-density area was discovered, so close to cluster 2 that the connections between them were an immediate debate. The cluster is approximately 2 m in diameter and situated only 30 cm away from cluster 2 (see Appendix 1) Cluster 3 consisted of trimming flakes of 4 -5 mm, flakes, core tablets, smaller blades, blade fragments, burins and burin spalls. The colours in this cluster vary from black to white, and the smaller flakes and fragments are very thin and fragile. The refits from cluster 3 include extensive refit groups, R100 and R103, interpreted as core or core face preparation sequences (Fig. 37).

Lithic cluster 4:

The smallest of the clusters, is just less than 1 m across and consists of 155 pieces; most of them heavily weathered, worn and small in size. There were only two refits in this cluster and no evident refit lines to any of the other clusters. Seven *in situ* refits were possible, but as the fractures patterns are all natural, they were not added to the study. Except for two core tablets and some blade fragments the rest of the 155 pieces are all light in colour and heavily worn. Some of the pieces were worn to the extent that natural or intentional break patterns were difficult to determine, and several were, therefore, defined as uncertain. They are weathered to a porous texture, with a number of natural fractures and fissures. Overall, the 155 lithics are a mixture of all kinds of debris, from tiny flakes to bigger core tablets, flake fragments, blade fragments, hinged flakes, and long thin blades and flakes. The only refits from this cluster are R5 and R 27. Both of these are fragmented (Table 5 & Fig. 37).

Summary

To answer questions concerning whether the wide range of colour represented a single or multiple raw materials at this site it was first necessary to examine the refitted individual artefacts vertical and horizontal distribution. It was determined that this is a single material type; however, the colour versatility cannot be explained solely by their vertical distribution. There seems, however, to be some horizontal differences that can be partly related to the dark area that was detected in layer 2. However, it is my opinion that the answer to the colour variations may also be attributed to the raw material itself. This will be discussed further in the following chapter.

Based on the refits, the taphonomic assessment of the site is that this was a single occupation with subsequent disturbances from several post-depositional processes such as the vehicle road. The refitted individuals derive from all layers and the vertical distribution is not related to repeated occupations. There is a debatable possibility that disturbance is a result of scavenging or reuse, but to date, there is no evidence for this.

The technological processes observed through the results of the refitted analysis show that the initial phases of the knapping process are not present in the assemblage. The initial preparation of the blocks was done elsewhere, perhaps closer to the raw material source. There is no unused raw material or debris with outer crusts or cortex-like surfaces. Since the raw material source is unknown, questions concerning the raw material's natural appearance can, at this point, only be guessed at.

Results of analysis of the assemblage of the site suggest that blade production was the main goal of the technological processes although there is evidence in the refitted material of possible tools made from other types of detachments. Either these artefacts were products made of waste material during the reduction of the chert blocks into cores on the site, or they can be forms from the initial preparation of the chert blocks carried to the site from the raw material source.

The artefacts have been produced, modified, used and then either rejuvenated or re-modified for the same or a different purpose several times before discard. The modifications observed are retouch, intentional breaking of blades, and burinations. These modifications turn into re-modifications as artefacts are sometimes first retouched, used and then burinated and probably used again. There are many varieties of re-modifications as seen in the refitted material.

The abandoned cores and core fragments in the refitted material provide evidence of rejuvenation of the platforms being conducted until exhaustion. The refits on the core face suggest that detachments ending in hinges and steps were corrected, sometimes successfully. This was continued until the core is abandoned.

6 Interpretations based of the refitting analysis

Raw material

Geologist Reino Kesola of the Geological Survey of Finland has identified the raw material found at the Sujala site as silicified, weakly metamorphosed sandstone (Rankama & Kankaanpää 2007:48). The reason for using the term chert throughout this study, is that in the majority of the articles published on the Sujala site the raw material has been referred to as chert (see till example Rankama & Kankaanpää 2008: 888).

The majority of these pieces are of a beige colour, though several darker and lighter pieces do occur (Fig. 18). The refitting showed, as was expected, that the colours cannot be explained as a variation of raw materials. The refitting also showed that the colour variation has some horizontal differences but not vertical. The refitted group 53 (Fig. 21) shows that considerable colour variations can be found both within a refitted entity and within a single excavated 1x1 square meter of the same layer. In the following, I will discuss the raw material further and try to understand the cause of the colour variations.

The Sujala chert has not been found locally at Lake Vetsijärvi, or in its close proximity, nor is it a common raw material on Finnish early Mesolithic sites. Finnish geologists (see Rankama & Kankaanpää 2007:48-49) who have studied the Sujala assemblage also claim that this material cannot derive from the Fenno-Scandinavian shield and that the source is likely to be found on the Varanger peninsula (see Fig. 1) (Rankama & Kankaanpää 2008:888).

A material that superficially resembles the finds at Sujala is a chert found on several north Norwegian early Mesolithic sites around the Varangerfjord and in the Pasvik valley (Fig.1). Here Bryan Hood (1992a:122-126) refers to this as tuffaceous chert in his doctoral thesis on raw material in the north of Norway. Hood later (2006) argues that tuffaceous chert should be considered a silicified siltstone or tuff. The tuffaceous chert consists of a large range of colours; these are attributed to texture variations, weathering, and degree of silicification in the material. The non-weathered parts of the tuffaceous chert appear to be dark gray, while heavily weathered pieces seem to obtain a beige colour. In between, there are green, yellow/green and light grey nuances (Hood 1992a:126). The reason for this variation in colour is suggested to be the content of quartz in the individual pieces: high amounts of quartz results in less weathering. As with the Sujala material the tuffaceous chert can also contain various phenocrystals and other inclusions. Hood notes that this raw material is most abundant on archaeological sites in the Pasvik valley. Based on this and the raw material assessment, he suggests that the origin of the tuffaceous chert might be in the Pasvik Valley and in the south part of the Varanger area, towards the Finnish border, in the geological formation called the Petsamo group (Hood 1992a:122-126, 357).

If the raw material at the Sujala site is from the Varanger peninsula this could indicate contact between the coast and the interior. However, if the raw material is from the interior of the Pasvik valley, or south of Varanger towards the Finnish border, as Hood (1992a: 122-126) claims, the Sujala group may not have had coastal contact. Also, the source may not have been known to the Sujala inhabitants and they may have needed help in locating it. Regardless, a similar raw material is commonly used at the coastal sites on the Varanger Peninsula. In my opinion, neither of the above views on the unknown location of the raw material source excludes or verifies contact between the inland Sujala group and the coastal groups. If anything, a location of the raw material inland rather than on the coast casts interesting light on the use of the inland.

From the description, the tuffaceous chert appears to be, comparable to the raw material found at Sujala. The supposition that the raw material weathers due to content of quartz would explain the colour changes in the Sujala raw material, which are too significant to be attributed to post-depositional process. In chapter 5, I have argued that the colour differences are not due to separate raw materials and not restricted to a single block of material, as they can be very different within a single refitted entity. They are undetectable in the vertical distribution but are present in the horizontal. The darker refitted artefacts had a tendency to appear around the larger dark area in layer 2. It is possible that these pieces have also been coloured by the stained soil, but because this area also include several lighter pieces, I suggest that such staining cannot be regarded as the sole explanation for the darker colouring. The colour variations are probably a combination of several factors, where some may be post-depositional movement and incidents. Also different levels of deterioration in the individual pieces were observed. Finally, the colour variation of the raw material from Sujala could simply be due to the material itself and how it reacts to weathering based on its quartz content or that of other minerals.

There is no evidence that the origins of any of the potential sources are located within close vicinity of the Sujala site. This makes it reasonable to assume that the raw material was brought from the source to the site and not found locally. The Sujala material exhibits a wide range of colour, inclusions, and texture variations. The colours of the pieces range from white to almost black and the texture of the pieces can differ from fine to coarse. The whiter pieces tend to be more worn than the darker ones and, therefore, coarser in texture. This may be attributed to the degree of silicification in the raw material itself and how it reacts and changes in a post-depositional environment (Hood 2006). The Sujala material also contains pieces with hair thin, shiny streaks of quartz, sometimes geometrically precise, other times more uneven. The Sujala pieces are individually diverse to the degree that they can be mistaken for different raw materials. During the refitting study, it became clear how diverse, the appearance of the raw material may be within one refitted artefact.

This refitting study has proven that a conjoining of a lithic material can contribute to discussions concerning raw material. In northern Norwegian research it is common to separate chert categories on the basis different colours: darker coloured pieces are considered a separate raw material from lighter pieces (e.g. Blankholm 2004:45; Hesjedal et al 1996: 158). The cherts may, in fact, be different, but with a refitting study, it is possible to test these assumptions. Colour differences within the same raw material, proven by the means of refitting, are not uncommon, as exemplified by the rhyolite material found at Flatøy in Nordhordaland in Norway (Simpson 1996).

Behavioural

A *chaîne opératoire* analysis defines technology not as a static procedure based only on practicalities or physical needs but as a process littered with social meaning. The manner in which a technological process is prepared and executed can be interpreted as the very core of the people acting within the world. The skill to conduct a specific technology represents the skill to understand the cultural setting and world view in which the technology is embedded (Apel & Knutsson 2006:16) Technology is, therefore, always essentially about an aspect of human behaviour. *Practice* is a term that includes these social aspects; it recognises technological processes as more than the production of tools, it is a social meaningful material practice. I have chosen to use the notion of practice when interpreting the results from the technological analysis, based on an emphasis that technology is essentially social (Apel & Knutsson 2006:22; Dobres 2000: 162).

Technological practice

By analysing the refitted material, I have come to conclusions about the technological practice at the Sujala site. The *chaîne opératoire* include the acquisition of raw material as part of the production process for tools. There are uncertainties connected to this part of the technological practice at the site. Where the raw material came from, and how it appears in its natural condition, is not possible to determine. No unused raw material has been found at the site or significant evidence of preliminary core preparation. This could indicate that the raw material was prepared before it entered the site.

The main blank type produced at the site was blades. Blade production requires careful preparation and can seldom be directly applied to a raw material in its natural form. With this technique the platform is prepared to the desired shape for the intended use. Most commonly, a crested blade is constructed to prepare for blade removal. The crested blade is a characteristic flake of a blade technology process. The more careful the preparation for the crested blade is executed, the more regular the shape of the blades will become (Inizan et, al 1999: 73). There are few crested blades in the Sujala assemblage (Rankama & Kankaanpää 2007:51) and none in the refitted material. This could be evidence that this part of the preparations took place elsewhere. Blade debitage shows pre-planned features that point to an aim of continually producing blades or blade-like flakes from a core. This includes preparations and rejuvenations of the platform.

The lithic assemblage includes many flakes categorised as platform rejuvenation flakes or core tablets, which are evidence of ongoing platform modification. The cores from the Sujala site are conical in shape and they have evidence of hinged removals on the platforms. In the refitted material this process was executed even though no blades were removed (see R49, Fig 32).

The identification of use of the pressure technique on some of the blades has been mentioned earlier, but production of blades can also be done by using a hard or soft hammer, and a direct or indirect technique (Inizan et al, 1999:71). It is likely that several techniques were applied to the same core at different stages of the reduction. Perhaps one would start out with a hard hammer or a soft hammer and then apply pressure when the platform and the core face reached the acceptable shape. Pressure flaked cores can be conical as well as cylindrical, pyramid shaped or flat, and they should have regular and rectilinear arrises on the core face and cortical, plain or prepared platforms. The blades produced from pressure flaking are recognised from their parallel edges and rectilinear arrises, a constant thickness to all the sections of the blade, and the butt that will always be narrower than the maximum width (Pelegrin 2006:46). Another characteristic is the lip on the ventral side blade butt area that indicates a soft hammer technique. Pressure flaking requires tools like crutches or wedges and can be done by placing a core in a holding device, which might be the case with the Sujala pressure blades. Such devices have been experimentally reproduced and can be placed on the ground or in the hand. Pelegrin (2006) has done several experiments with pressure flaking methods.

The use of pressure technique, as seen in the Sujala lithic material, demands a set of skills and knowledge. Therefore, it is safe to assume that the technologies at the site are directed by skilled operators according to technological traditions. These traditions are, as presented in chapter 2 not found in Phase 1 or 2 of the northern Norwegian chronology or in the traditional Finnish Mesolithic chronologies. They are however, not uncommon in post-Swiderian related sites and cultures, including the Ristola site in southern Finland (Takala 2004: 117).

In the refitted material, 41 blade refits are discontinuously or completely retouched, semi-abruptly to the blade edges. The retouch varies from narrow to broad and scaled to sub-parallel. Semi-abrupt retouch is usually conducted by placing the blade on an anvil. A hard rock can be used as an anvil steadying a piece and can also be used for snapping of blades. The sectioning of blades that occur frequently in the refitted material is another interesting aspect of the technological process at the site. These breaks are not conducted by using the micro-burin technique, as the break surfaces then tend to be oblique rather than perpendicular to the axis of the blades. The breaks are not retouched and the production could be aimed at creating for instance side scrapers or inserts. The intentional sectioning of blades is, according to Kozlowski (2009:382), common throughout the entire north-eastern European techno complex (Kozlowski's name for post-swiderian cultures). How the sectioning is executed he does not explain. However, the use of sectioning found in the Sujala assemblage can, therefore, probably be attributed to the technological tradition of the post-Swiderian groups. To what degree these techniques are similar should be addressed in the future.

The burins are produced from whole blades as well as sectioned blade fragments. Since the burination technique is also applied to other blanks, it is reasonable to assume that tools were also made out of blanks not connected to the production of blades, the refitted material displays evidence of this. In the modifications and re-modifications of tools we observe evidence of a complicated *chaîne opératoire*. Tools are dynamic forms that can change shape and purpose before being discarded and, therefore, move in and out of use and production (Dobres & Hoffman 1994: 230; Edmonds 1990). It is tempting to suggest that the raw material economy was strict. However, with the number of hinged core rejuvenation flakes that are not further modified and just discarded, the economical sense may not have been applied to preparatory flakes, but rather to successful blades. A good blade could become a projectile point, a scraper, a burin, a knife or any of the other tools required, and therefore the selection of a blade blank was important.

Spatial organisation of the technological practice

It is reasonable to assume that there has been movement in the horizontal distribution of the Sujala assemblage due to the dirt road, as well as other post-depositional processes. However, since the site deposits are only approximately 15 cm deep and the refitted material does connect vertically as well as horizontally (Figs. 17, 19 & 20), and there are elements in the distribution of the refitted sequences suggesting that the site is relatively undisturbed (Fig. 37), I conclude that it is possible to discuss an intentional organisation at the Sujala site. During the excavation four find concentrations were discovered (Figs. 9 & 11). In the northern parts of the site, surrounded by a find cluster, a dark stained area was revealed. It contained burnt bone and charcoal and was interpreted as a hearth. Consequently, Rankama and Kankaanpää (2007: 48) suggested that the find cluster (cluster 1) and the hearth represented a living area. With these interpretations in mind, I have integrated the four find clusters when discussing the refitted assemblage’s spatial pattern.

The refitted material includes evidence of technological processes, and these can be traced in the spatial distribution. As presented in Chapter 5, there are observable differences between the four lithic clusters in regard to the sort of refitted material they contain (Table 6). Based on the results of the refitting study, I suggest that the Sujala site could be interpreted to contain two main areas, where one is mainly connected to *use* and the other mainly to *production and waste* (see Fig. 38).

Figure 38: Illustration of the suggested spatial organisation of the site based on interpretations of refitted artefacts and technological processes.

The suggested *use area* contains the hearth and lithic cluster 1. I base this suggestion on the notion that this area includes every type of lithic debris; the majority of the core fragments; most of the retouched blades and many of the burins (Table 6). This is consistent with what I would expect from an area were production is conducted, but were it is still not the primary action. This area represents activities connected to the utilization and appliance of tools rather than the production of them. Retouched artefacts and burins are modified dynamic objects, created to serve one or several specific tasks. When one of these artefacts was in need of rejuvenation, it would re-enter the *chaîne opératoire,* or production process, and be modified or re-modified. The retouched blades from the refitted assemblage in the *use are* do show connections with the rest of the site, but were mainly found in cluster 1 (Fig. 32). The connection lines of the retouched blades outside *use area* seem to disperse more generally around clusters 2 and 3, than directly within them (Fig. 32).

It is my opinion that even though knapping and modifications can have been conducted in the *use area*, there is evidence in the refitted material that these activities were mainly conducted within the suggested *production and waste area*. I base this on the observation of movement, of different artefact types and specific phases of a production processes, within the site.

While the reduction sequences of preparation flakes, rejuvenation flakes and core tablets where, in accordance with the refitted assemblage, found at one place, the tools seem to move between different areas of the site (see for example distribution differences between Fig. 32 & 37). Since the tools can be defined as dynamic artefacts moving in and out of the *chaîne opératoire* I interpret the spatial distribution of these as evidence of a continuous production process traceable in the spatial patterns of the site.

The refitted burins and their spatial distribution (Fig. 34) can be seen as evidence of a connection between cluster 1 and cluster 2, while less with cluster 3 (Fig. 34). Looking at the distribution of the intentionally sectioned blades within the burin refit groups it is again these two clusters (1 and 2) that seem to be involved (Fig. 31).

Intentional, uncertain and natural breaks can be found on both retouched and non-retouched blades in the refitted material. In the distribution, however, it is possible to detect some movement patterns. The intentionally sectioned blades, both retouched and non-retouched, with some exceptions, tend to include longer connection lines, interpreted as an indication that they have been intentionally moved. These are mainly connected with cluster 1 (Fig. 28). The uncertain break patterns (Fig. 29 left side) and the natural break patterns (Fig. 29 right side), on the other hand show only a few long connection lines, indicating less movement, which is to be expected if the break is caused by trampling or post-depositional disturbance. There may also have been some natural fracturing that can be attributed to use of the artefact. The connection lines of the refitted broken blades connect the *use area* with the *production and waste area* of the site.

The refitted knapping sequences seem to be restricted to the lithic find clusters. Also, they are mainly found within close proximity of each other as should be the case if it represents a knapping sequence, unless there are disturbances. I considered the lack of movement in the refitted sequences as evidence of production areas where either specific parts of the knapping was conducted, for example core preparations or as a work station for one knapper. There is, however, also the possibility that they can be evidence of cleaning and therefore be waste areas. Since it's not possible to rule this out I have included it in my interpretation of the spatial areas (Fig. 38).

The refitted material indicates that the *production and waste area* also include a general *knapping area* and a *modification and remodification area* (see Fig. 38). The *knapping area* is associated with cluster 3 where several of the refitted knapping sequences and flakes for core rejuvenation or preparation are found. The cluster also contains all of the artefact types and every part of the *chaîne opératoire* process seen in the refitted material. Cluster 2 includes the highest density of finds at the site. The majority of the artefacts here are trimming flakes. These observations together with the refitted lithic material may indicate resharpening, or modification as a primary task. As many of the refitted burins seem to move back and forth between cluster 1 and 2, cluster 2 may consequently be interpreted as a transformation area, where remodification places the object back into the *chaîne opératoire* and then eventually back to the use area.

The last cluster is still a mystery. It is not directly connected to the rest of the site through refit lines. The raw materials are the same as in the other areas, and so are the artefacts and technology. The cluster include of all kinds of debris, from flakes and blade fragments to core tablets. There is no apparent reason to consider it separate from the rest of the lithic assemblage, but spatially it is secluded. Perhaps it was a learning area, or a specific production that I cannot identify was conducted there, or perhaps it was a single knapper's area. Apart from these suggestions, I find it difficult to make an accurate interpretation for this cluster other than including it in the *production and waste area*.

7 Concluding remarks

The first section of this investigation was devoted to the presentation of arguments concerning post-Swiderian culture and a discussion of the implications of this term in relation to the early Mesolithic chronologies of northern Norway and Finland. The goal was to address the research histories and the archaeological setting, both prehistoric and as a discipline, in which the Sujala site in northern Finnish Lapland occurs. Questions regarding technology have also been addressed on the background of these contexts and understandings. My interpretation of the lithic assemblage and the site is based upon this framework, together with the method of refitting within the *chaîne opératoire* approach.

The Sujala site, together with the sites of Ristola and Saarenoja, is the only evidence, to date, of early Mesolithic blade production in what is present-day Finland. Technologically, it is very different from the Finnish early Mesolithic quartz assemblages. It also differs from the north-Norwegian early Mesolithic lithic assemblage's although a similar raw material may have been used. The Sujala site's technology most closely resembles that of the post-Swiderian cultures of the Baltic and north-western Russia. To what extent this connection goes beyond technological aspects is still uncertain. However, with regard to the current perception of the early settlements in northern Fennoscandia, geographically, the people inhabiting the Sujala site appear to have been a great distance from the presently known limits of the post-Swiderian.

The source of the main raw material used at the Sujala site is, to date, unknown. However, the results of the refitting have demonstrated that this raw material is highly responsive to components in the surrounding soil and thus produces a surprising degree of colour variations within what used to be one piece of lithic. I have compared the raw material found at the site with descriptions of the tuffaceous chert found at sites by the Varangerfjord and have found these to be very similar. The manner in which the tuffaceous cherts weather and change colour by the degree of silicification in different soil conditions, could also explain the condition of the Sujala cherts. Until further investigations are conducted the origin and source of the raw material found at Sujala remains unknown.

Based on the refitting study it is reasonable to suggest that the site was a single occupation and that the vertical distributions are a result of post-depositional movement rather than representing several occupation layers. It has also been argued that the initial shaping and preparation of the cores was done elsewhere, perhaps at the raw material source. The technological processes identified in the refitted material shows a careful preparation of the platforms and core faces, before as well as during the production of blades. The blades are regular with parallel sides and short, rounded butts. The refitted blades were intentionally broken, perpendicular to the axis of the removal. The breaks were most likely executed to section the blades for tool purposes and to produce arrow points, inserts and scrapers. Many of the refitted blades have fractures that are hard to assess, and some are clearly natural. These breaks probably occurred during use or trampling or as a consequence of post-depositional disturbances like the vehicle road. The modifications visible in the refitted material mainly consist of a semi-abrupt retouch to edges and sides of blades. The blades were clearly being altered for use. In the refitted material, I have observed burinations on both retouched and non-retouched blades, as well as other types of removals, sometimes occurring repeatedly on the same edge or elsewhere on the same piece. The refitted assemblage shows a large amount of re-modifications, suggesting that tools were a dynamic technological activity in the *chaîne opératoire*.

Based on the results of the spatial analysis and interpretation, I find that the refitted material shows differences concerning what kind of production debris and artefacts are held by the various find clusters. Consequently, I suggest a separation in regard to where the different technological processes were conducted. A possible site composition has been proposed in regard to a spatial organisation of the technological practice (Fig. 38). The suggested outline divides the site into two main areas, a *use area* in the northern part of the site and a *production and waste area* in the southern part. The *production area* further includes a general *knapping area* and a more specific *modification and re-modification area*.

The Sujala site is an excellent example that there is yet a great deal to be discovered. Results of the refitting analysis of this site, provides new angles to old discussions and questions how the northern most parts of Fennoscandia were initially occupied and where these people came from.

Literature

Andersen, B.

1980 *The Deglaciation of Norway after 10,000 B.P.* Boreas Vol. 9: 211-216.

Andersson, B.

1998 An Intra-site Study of Rågången 383, a Mesolithic Site in the interior of Sweden. In *Proceedings from the Third Flint Alternatives Conference at Uppsala, Sweden, October 18.20, 1996*, edited by Holm, L and K. Knutsson, pp. 23-38. Department of Archaeology and Ancient history, University of Uppsala, Uppsala.

1999 *Människan i Norrland under mesolitikum: En bearbetning av tre boplatser med hjälp av sammanfogning av avslag och bruksskadeanalys*. Arkeologiska studier vid Umeå Universitet No. 6. Department of Archaeology and Sami Studies, University of Umeå, Umeå.

Anundsen, K.

1996 The Physical Conditions of Earliest settlement during the Last Deglaciation in Norway. In *The earliest settlement of Scandinavia and its relationship with neighbouring areas,* edited by Larsson, L., pp. 207-219. Acta Archaeologica Lundensia 24. Almqvist & Wiksell International, Stockholm.

Apel, J. and K. Knutsson

2006 Skilled production and social Reproduction- an introduction to the subject. In *Skilled Production and Social Reproduction*, edited by Apel, J. and K. Knutsson, pp. 11-24. Societas Archaeologica Upsaliensis, Uppsala.

Ashton, N.

2004 The role of refitting in the British Lower Palaeolithic: a time for reflection. In *Lithics in Action: papers from the conference Lithic Studies in the Year 2000*, edited by Walker, E., F. Wenbam- Smith and F. Healey, pp. 57-64. Lithic Studies Society Occasional Paper No.8. Oxbow Books, Oxford.

Balin, T. B.

2000 Flintsammensætning- refitting- metodens muligheder og begrænsninger. In *Flintstudier*, edited by Eriksen, B. V. pp 101-126. Aarhus Universitetsforlag, Århus.

Barndon, R.

2002 *The Châine Opératoire approach, social change and modifications of the technological milieu*. Arkeologiske Skrifter No. 11. pp. 5-23. Arkeologisk Institutt, Bergen Museum, Bergen.

Bergman, I., A. Olofsson, G. Hörnberg, O. Zackrisson and E. Hellberg

2004 Deglaciation and Colonization: Pioneer settlements in Northern Fennoscandia. *Journal of World Prehistory*, Vol. 18, No. 2:155-177.

Bjerck, H. B.

1994 Nordsjøfastlandet og pionerbosetning i Norge. *Viking. Bind LVII*:25-58.

2008 Norwegian Mesolithic Trends: A Review. In *Mesolithic Europe*, edited by Bailey. G and P. Spikins, pp. 107-131. Cambridge University Press, Cambridge.

Blankholm, H.P.

2004 Earliest Mesolithic site in Northern Norway? A Reassessment of Sarnes B4. *Arctic Anthropology,* Vol. 41, No.1: 41-57.

Bodu, P., C. Karlin and S. Ploux
1990 Who's who? The Magdalenian flintknappers of Pincevent, France. In *The Big Puzzle. International Symposium on Refitting Stone Artefacts,* edited by Cziesla E., S. Eickhoff, N. Arts and D. Winter, pp. 143-163. Studies in Modern Archaeology Vol.1. Holos, Bonn.

Burov, G.
1999 "Postswiderian" of the European North-East. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 281-291. Maria Curie-Skłodowska University Press, Lublin.

Bøe, J. and A. Nummedal
1936 *Le Finnmarkien: les origines de la civilisation dans l'extrême-nord de l'Europe*. Institutt for sammenlignende kulturforskning, Oslo.

Cahen, D. L., H. Keeley and F. L. Van Noten
1979 Stone Tools, toolkit, and human behaviour in prehistory. *Current Anthropology*, Vol. 20, No.4: 661-683.

Cahen, D. and L. H. Keeley
1980 Not less than two, not more than three. *World Archaeology,* Vol. 12, No. 2: 166-180.

Carpelan, C.
1999 On the Postglacial Colonisation of Eastern Fennoscandia In *Dig it all- papers dedicated to Ari Siiriäinen,* edited by M. Huurre, pp.151-172. The Finnish Antiquarian Society, The Archaeological Society of Finland, Helsinki.

2004 Environment, Archaeology and Radiocarbon Dates- notes from the Inari region, Northern Finnish Lapland. In *Iskos 13 Early in the North*, Vol. 5, edited by Lavento, M., pp. 17-46. Finska fornminnesföreningen, Helsinki.

2008 On the history and recent studies of the "Antrea Net find". In *Iskos 16 Karelian Isthmus Stone Age Studies in 1998-2003,* edited by Lavento, M., pp. 88-127. The Finnish antiquarian society, Helsinki.

Collcutt, S. N., R. N. E. Barton and C. A. Bergman
1990 Refitting in context: A taphonomic case study from a Late Upper Paleolithic site in sands on Hengistbury Head, Dorset (Great Britain). In *The Big Puzzle International Symposium on Refitted Stone Artefacts Monrepos 1987,* edited by Cziesla, E., S. Eickhoff, N. Arts and D. Winter, pp. 219-235. Studies in Modern archaeology Vol. 1, Holos, Bonn.

Coulson, S. D.
1986 Refitted flint nodules from Songa, Telemark. In *Universitetets Oldsaksamlings Årbok 1984/1985*, pp. 17-22. Oldsakssamlingen, Oslo.

Cziesla, E.
1990 On Refitting of Stone Artefacts. In *The Big Puzzle International Symposium on Refitted Stone Artefacts Monrepos 1987,* edited by Cziesla, E., S. Eickhoff, N. Arts and D. Winter, pp. 9-44. Studies in Modern archaeology Vol. 1, Holos, Bonn.

Dibble, H. L., P. G. Chase, S. P. McPherron and A. Tuffreau
1997 Testing the reality of a "living floor" with Archaeological Data. *American Antiquity,* Vol. 62, No. 4: 629-651.

De Bie, M.
2007 Benefitting from Refitting in Intra-site Analysis: Lessons from Rekem (Belgium) In *Fitting rocks: Lithic Refitting Examined*, edited by Shurmans, U. and De Bie, M., pp. 31-44. BAR International Series 1596, Oxford.

Dobres, M-A.
2000 *Technology and Social Agency*. Blackwell Publishers Ltd, Oxford.

Dobres, M-A. and C. R. Hoffman
1994 Social Agency and the Dynamics of Prehistoric Technology. *Journal of Archaeological Method and Theory*, Vol 1, No.3: 211-258.

Dolukhanov, P.
2008 The Mesolithic of European Russia, Belarus and the Ukraine. In *Mesolithic Europe*, edited by Bailey, G. and P. Spikins, pp. 280-301. Cambridge University Press, Cambridge.

Dolukhanov, P., D. A. Subetto, Kh. A. Arslanov, N. N. Davydova, G. I. Zaitseva, E.N. Djinoridze, D. D. Kuznetsov, A. V. Ludikova, T. V. Sapelko, and A. Savelieva
2009 Baltic Sea and Ladoga Lake transgressions and early human migrations in North-western Russia. *Quaternary International* 203: 33–51.

Edmonds, M.
1990 Descriptions, Understanding and the Chaîne Opératoire. *Technology in the Humanities. Archaeological Review from Cambridge*, Vol. 9, No. 1: 55-71.

Eriksen, B. V.
2000 Chaîne Opèratoire.- den operative prosess og kunsten at tænke som en flinthugger. In *Flintstudier:en håndbog i systematiske analyser av flintinventar*, edited by Eriksen, B. V., pp. 37-51. Aarhus Universitetsforlag, Århus.

Fischer, A.
1990 A Late Paleolithic ”school” of flint knapping at Trollesgave, Denmark. Results from refitting. *Acta Archaeologica*, Vol. 60: 33-49.

Fuglestvedt, I.
2005 Contact and communication in Northern Europe 10 200 – 9 000 / 8 500 BP – a phenomenological approach to the connection between technology, skill and landscape. In *Pioneer settlements and colonization processes in the Barents region*, edited by Knutsson, H., pp. 79-96. Vuollerim Papers on Hunter-gatherer Archaeology, Vol.1. Vuollerim 6000 år, Vuollerim.

2007 The Ahrensburgian Galta 3 site in SW Norway- dating, technology and cultural affinity. *Acta Archaeologica*, Vol. 78, No. 2: 87-110.

2009 *Phenomenology and the Pioneer Settlement on the Western Scandinavian Peninsula*. Bricoleur Press, Lindome.

Grydeland, S. E.
2005 The pioneers of Finnmark- from the earliest coastal settlements to the encounter with the inland people of Northern Finland. In *Pioneer settlements and colonization processes in the Barents region*, edited by Knutsson, H., pp. 43-77. Vuollerim Papers on Hunter-gatherer Archaeology, Vol.1. Vuollerim 6000 år, Vuollerim.

Halinen, P.

2005 *Prehistoric hunters of the northernmost Lapland: settlement patterns and subsistence strategies.* Ph.D. dissertation, Iskos 14. The Finnish Antiquarian Society, Helsinki.

Halinen, P. and T. Mökkönen
2009 Between lake and sea- Stone Age settlement by the ancient Lake Ladoga on the Karelian Isthmus.
In *Fennoscandia archaeologica XXVI,* The Archaeological Society of Finland: Helsinki, pp. 107-132.

Halinen, P., O. Seitsonen, S. Seitsonen and K. Nordqvist
2008 Excavations at the Juoksemajärvi Westend Stone age dwelling site in 2002. In *Iskos 16 Karelian Isthmus Stone Age Studies in 1998-2003,* edited by Lavento, M., pp. 235-265. The Finnish antiquarian society, Helsinki.

Havas, H.
1999 *Innland uten landegrenser: bosetningsmodeller i det nordligste Finland og Norge i Perioden 9000-6000 BP.* Unpublished thesis, Institutt for arkeologi, Universitetet i Tromsø, Tromsø.

2002 Mobilitet i de første årtusener etter siste istid i det nordøstlige Grenselandet. Nasjonalgrensenes innvirkning på forskning. In *Flytting og forandring i Finnmarks fortid,* edited by Valen, G. J., K. Skavhaug, K. Schanche. Artikkelsamling fra museene i Finnmark, Alta.

Hesjedal, A., C. Damm, B. Olsen og I. Storli
1996 Arkeologi på Slettnes- Dokumentasjon av 11.000 års bosetning. *Tromsø Museums Skrifter XXVI,* Tromsø.

Hofman, J. L.
1992 Putting the Pieces Together: An Introduction To Refitting. In *Piecing Together the Past: Applications of Refitting Studies in Archaeology*, edited by Hofman , J. L. and J. G. Enloe, pp. 1-20. BAR International Series 578.

Hood, B.
1992a Prehistoric Foragers of the North Atlantic: Perspectives on Lithic Procurement and Social Complexity in the North Norwegian Stone Age and the Labrador Maritime Archaic. Unpublished Ph.D. dissertation, Department of Anthropology, University of Massachusetts, Amherst.

1992b Chert sources and distribution patterns in the stone age of West Finnmark, North Norway: A preliminary view. In *Acta Borealia,* Vol 9, No.2: 69-84.

2006 East Finmark. Electronic document, URL: http://uit.no/arkeologi/2601/18 [accessed January 23, 2011].

Ingold, T.
1990 Society, Nature and the Concept of Technology. In *Technology in the Humanities. Archaeological Review from Cambridge,* Vol. 9, No.1: 5-18.

Inizan, M. L., M. Reduron-Ballinger, H. Rouche and J. Tixier (editor)
1999 Technology and Terminology of the Knapped Stone: followed by a multilingual vocabulary Arabic,English,French,German,Greek,Italian, Portuguese,Spanish. In *Préhistoire de la pierre taillée Tome 5*. Translated by Féblot-Augustins, J., CREP, Nanterre.

Jaksland, L.

2001 *Vinterbrolokalitetene – en kronologisk sekvens fra mellom- og Senmesolitikum i Ås, Akershus*. Varia 52. Universitetets kulturhistoriske museer, Oldsaksamlingen, Oslo.

Jussila, T., A. Kriiska and T. Rostedt

2007 The Mesolithic Settlement in Ne Savo, Finland and the earliest settlement in the eastern Baltic Sea. In *Acta Archaeologica*, Vol. 78, No.2: 143-162.

2008 Joutseno Kuurmanpohja / Monnonmäki Saarenoja 2Kivikautisen asuinpaikan kaivaus Unpublished excavation report. Electronic document, Url: http://www.dlc.fi/~microlit/saarenoja09/Joutseno-Saarenoja-2_kaivaus-2008_v2_www-laatu.pdf [accessed January 23, 2011].

Jussila, T. and H. Matiskainen

2003 Mesolithic settlement during the Preborial period in Finland. In *Mesolithic on the Move: Papers presented at the Sixth International Conference on the Mesolithic of Europe, Stockholm 2000*, edited by Larsson L., H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund, pp. 664-670. Oxbow Books, Oxford.

Kankaanpää, J. and T. Rankama

2005 Early Mesolithic pioneers in Northern Finnish Lapland. In *Pioneer settlements and colonization processes in the Barents region*, edited by Knutsson, H., pp. 109-162. Vuollerim Papers on Hunter-gatherer Archaeology, Vol.1. Vuollerim 6000 år, Vuollerim.

2009 The Sujala site in Utsjoki: Post-Swiderian in northern Lapland? In *Mesolithic Horizons: papers presented at the seventh international conference on the Mesolithic in Europe, Belfast 2005*, edited by McCartan, S., W. Schulting, and P. Woodman, pp. 38-44. Oxbow books, Oxford.

Knutsson, K

1998 Convention and lithic analysis. In *Proceedings from the third flint alternatives conference at Uppsala, Sweden, October 18-20, 1996*, edited by Holm, L. and K. Knutsson. Occasional papers in Archaeology 16. Uppsala universitet, Institutionen för arkeologi och antik historia, Uppsala.

Koltsov, L. V. and M. Zhilin

1999 Tanged Point Cultures in the Upper Volga Basin. In: *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L. L. Zaliznyak, pp: 346-360. Maria Curie-Skłodowska University Press, Lublin.

Kozlowkis, S. K

1990 A survey of Early Holocene Cultures of the Western Part of the Russian Plain. In *The Mesolithic of Europe: papers presented at the third international symposium Edinburgh 1985*, edited by Bonsall, C., pp. 424-441. Department of Archaeology, University of Edinburgh, John Donald Publishers LTD, Edinburgh.

2009 *Thinking Mesolithic*. Oxbow Books, Oxford.

Kobusiewicz, M.

1999 Tanged Point Cultures of Greater Poland- 25 years from the first approach. In Tanged Points Cultures in Europe, edited by Kozłowski, S., J. Gurba and L. L. Zaliznyak, pp. 110-120. Maria Curie-Skłodowska University Press, Lublin.

2004 The problem of the Palaeolithic- Mesolithic transition on the Polish Plain: state of research. In *Hunters in a changing world- environment and archaeology of the Pleistocene-Holocene transition (ca 11000-9000 B.C.) in Northern Central Europe Workshop of the U.I.S.P.P.-commission XXXII at Greifswald in September 2002*, edited by Terberger, T and B.V. Eriksen, pp. 133-139. Verlag Marie Leidorf GmbH, Rahden.

Lahti, E-K.

2006 Utsjoki 226 Vetsijärvi 7 Sujala KM 35224: osteologinen analyysi 22.2.2006. Unpublished manuscript.

Lavento, M.

2008a Archaeological research in the Saimaa district and in the Karelian Isthmus in 1992-1999. In *Iskos 16 Karelian Isthmus: Stone age studies in 1998-2003*, edited by Lavento, M., pp. 26-45. The Finnish antiquarian Society, Helsinki.

2008b The Saimaa-Ladoga project- questions framing and strategies. In *Iskos 16 Karelian Isthmus: Stone age studies in 1998-2003*, edited by Lavento, M., pp. 46-70. The Finnish antiquarian Society, Helsinki.

Lemonnier, P.

1986 The Study of Material culture today: Toward an Anthropology of Technical Systems. In *Journal of Anthropological Archaeology* 5: 147-186.

Leroi-Gourhan, A.

1943 *L'Homme et la matière*. Evolution et techniques 1. Albin Michel, Paris.
1945 *Milieu et techniques.* Evolution et techniques 2. Albin Michel, Paris.

Lindgren, C.

2004 *Människor och kvarts: Sociala och teknologiska strategier under mesolitikum I östra Mellansverige*. Stockholm Studies in Archaeology, University of Stockholm, Stockholm.

Manninen, M. A.

2003 *Chaîne opératoire -analyysi ja kvartsi. Esimerkkinä kvartsiniskentäpaikka Utsjoki Leakšagoađejohka 3*. Unpublished MA-thesis. University of Helsinki, Institute of Cultural Research, Department of Archaeology, Helsinki.

2005 Problems in dating inland sites-lithics and the Mesolithic in Paistunturi, Northern Finnish Lapland. In *Pioneer settlements and colonization processes in the Barents region,* edited by Knutsson, H., pp. 29-42. Vuollerim Papers on Hunter-gatherer Archaeology, Vol.1. Vuollerim 6000 år, Vuollerim.

2009 Evidence of mobility between the coast and the inland region in the Mesolithic of northern Fennoscandia In *Mesolithic Horizons: papers presented at the seventh international conference on the Mesolithic in Europe, Belfast 2005*, edited by McCartan, S., W. Schulting, and P. Woodman, pp. 102-108. Oxbow books, Oxford.

Matiskainen, H.

1989a *Studies on the chronology, material culture and Subsistence economy of the Finnish Mesolithic, 10 000-6000 Bp Helsinki.*Iskos 8. The Finnish Antiquarian Society, Helsinki.

1989b The chronology of the Finnish Mesolithic. In *The Mesolithic of Europe: papers presented at the third international symposium Edinburgh 1985*, edited by Bonsall, C., pp. 379-390. Department of Archaeology, University of Edinburgh, John Donald Publishers LTD, Edinburgh.

1990 Mesolithic Subsistence in Finland. In *Contributions to the Mesolithic in Europe*, edited by Vermeersch, P. M. and P. Van Peer, pp. 211-214. Leuven University Press, Leuven.

1996 Discrepancies in Deglaciation chronology and the appearance of man in Finland. In *The earliest settlement of Scandinavia and its relationship with neighbouring areas*. Acta Archaeologica Lundensia 24, edited by Larsson, L., pp. 251-262. Almqvist & Wiksell International, Stockholm.

Miettinen, A., K. Sarmaja- Korjonen, E. Sonninen, H. Jungner, T. Lempiäinen, K. Ylikoski, J-P. Mäkiaho and C. Carpelan
2008 The Palaeoenvironment of the "Antrea Net Find". In *Iskos 16 Karelian Isthmus: Stone age studies in 1998-2003,* edited by Lavento, M., pp. 71-87. The Finnish antiquarian Society, Helsinki.

Morrow, T. M.
1996 Lithic Refitting and Archaeological Site Formation Processes. In *Stone Tools: Theoretical Insights into Human Prehistory,* edited by Odell, G. Plenum Press, New York.

Nummedal, A.
1975 Finnmarks-fundene - Utgitt I anledningen av 50 året for Komsakulturen oppdagelse In *Acta Borealia, B. Humaniora. No.15.* Tromsø Museum, Tromsø.

Odner, K.
1964 Erverv og Bosetning i Komsakulturen – Omrisset av en kulturs økonomi innenfor et begrenset geografisk område. In *Viking. Bind XXVIII:*117-128.

1966 Komsakulturen i Nesseby og Sør-Varanger. In *Tromsø museums skrifter Vol. XII.* Universitetsforlaget, Tromsø, Oslo, Bergen.

Olsen, B.
1994 *Bosetning og samfunn i Finnmarks forhistorie*. Universitetsforlaget, Oslo.

Oshibkina, S. V.
1999 Tangend Point Industries in the North-West of Russia. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 325-332. Maria Curie-Skłodowska University Press, Lublin.

Papaconstantinou, D.
2006 *Deconstructing context: a critical approach to archaeological practice.* Oxbow Books, Oxford.

Pelegrin, J.
1990 Prehistoric Lithic Technology: Some Aspects of Research. In *Technology in the Humanities. Archaeological Review from Cambridge,* Vol. 9, No.1: 116-125.

2006 Long blade technology in the Old World: an experimental approach and some archaeological results. In *Skilled Production and Social Reproduction,* edited by Apel, J. and Knutsson, K. pp. 37-68. Societas Archaeologica Upsaliensis, Uppsala.

Potekhina, I. D.
1999 Postswiderian Population of North-Eastern Europe as seen from the Anthropological data. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 333-336. Maria Curie-Skłodowska University Press, Lublin.

Rankama, T.

1996 *Prehistoric riverine adaptations in Subarctic Finnish Lapland: the Teno river drainage*. Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy. Brown University, Department of Anthropology. University of Michigan Dissertation Services. Ann Arbor.

2003 The Colonisation of Northernmost Finnish Lapland and the Inland Areas of Finnmark. In *Mesolithic on the Move: Papers presented at the Sixth International Conference on the Mesolithic of Europe, Stockholm 2000,* edited by Larsson L., H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund, pp. 37-47. Oxbow Books, Oxford.

2009 Quartz analysis of the Kaaraneskoski site, Lapland. In *Mesolithic Horizons: papers presented at the seventh international conference on the Mesolithic in Europe, Belfast 2005,* edited by McCartan, S., W. Schulting, and P. Woodman, pp. 813-819. Oxbow books, Oxford.

Rankama, T. and Kankaanpää, J.

2004 First Preboreal inland site in north Scandinavia discovered in Finnish Lapland. In *Antiquity,* Vol. 78, No. 301. Electronic document. Url: http://antiquity.ac.uk/ProjGall/rankama/index.html [accessed January 23, 2011].

2005 History and Prehistory of Lake Vetsijärvi. In *Quaternary studies in the northern and Arctic regions of Finland: Proceedings of the workshop organized within the Finnish National Committee for Quaternary Research (INQUA) Kilpisjärvi Biological Station, Finland, January 13-14th 2005,* edited by Antti, E., K.. Ojala, pp. 113-121. Geological Survey of Finland Special Paper 40 Esboo. Electronic document. Url: http://arkisto.gsf.fi/sp/SP40.pdf#page=115 [accessed January 23, 2011].

2006 Survey and excavation at Lake Vetsijärvi, Lapland. In *People, Material Culture and Environment in the North, Proceedings of the 22nd Nordic Archaeological Conference, University of Oulu, 18-23 August 2004,* edited by Herva, V. P., pp. 103-119. Studia Humaniora ouluensia 1, Gummerus Kirjapaino OY. Electronic document. Url: http://herkules.oulu.fi/isbn9514281411/isbn9514281411.pdf [accessed January 23, 2011].

2007 The earliest post-glacial inland settlement of Lapland. In *Kamennyy vek Evropeyskogo Severa,* edited by Volokitin A.V., V. N. Karmanov and P. J. Pavlov, pp. 44-65. Russian Academy of Science, Ural Branch, Komi Scientific Centre, Institute of Language, Literature and History, Syktyvkar.

2008 Eastern arrivals in post-glacial Lapland: The Sujala site 10.000 cal BP. In *Antiquity* 82: 884-889. Electronic document. Url: http://antiquity.ac.uk/Ant/082/0884/ant0820884.pdf [accessed January 23, 2011].

Räihälä, O.

1999 Mesolithic settlement on the river Emäjoki, North-East Finland. In *Dig it all: papers dedicated to Ari Siiriäinen,* edited by Huurre, M. P., pp. 201-218.The Finnish Antiquarian Society, The Archaeological Society of Finland, Helsinki.

Saarnisto, M.

2008 Emergence history of the Karelian Isthmus. In *Iskos 16 Karelian Isthmus: Stone age studies in 1998-2003,* edited by Lavento, M., pp. 128-139. The Finnish antiquarian Society, Helsinki.

Schaller- Åhrberg, E.

1990 Refitting as a Method to Separate Mixed sites: A Test with Unexpected Results. In *The Big Puzzle. International Symposium on Refitting Stone Artefacts*, edited by Cziesla E., S.

Eickhoff, N. Arts and D. Winter, pp. 611-622. Studies in Modern Archaeology Vol.1. Holos, Bonn.

Schlanger, N.
1996 Understanding Levallois: Lithic Technology and Cognitive Archaeology. *Cambridge Archaeological Journal* 6:231-254.

Schulz, H-P.
1990 On the Mesolithic Quartz Industry in Finland. In *Studies in the Material Culture of Peoples of eastern and northern Europe: papers presented at the Finnish-Soviet Archaeological Symposium 10-16 may 1988*, edited by Edgren, T., pp. 7-24. Iskos 9. Suomen Muinausmustoyhdistys, Helsinki.

Shumkin, V.
2006 Initial colonization of the Arctic zone. *Comptes rendus palevol* 5:319-322.

Shurmans, U. and M. De Bie.
2007 Introduction. In *Fitting rocks: Lithic Refitting Examined*, edited by Shurmans, U. and M. De Bie, pp. 1-5. BAR International Series 1596, Oxford.

Shurmans, U.
2007 Refitting in the old and new worlds. In *Fitting rocks: Lithic Refitting Examined*, edited by Shurmans, U. and M. De Bie, pp. 7-23. BAR International Series 1596, Oxford.

Siemaszko, J.
1999 Tanged Points in the basin of Lega and Elk Rivers. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 186-193. Maria Curie-Skłodowska University Press, Lublin.

Siiriäinen, A.
1974 *Studies related to Shore displacement and Stone Age Technology in Finland. Stencil No.10.*
The University of Helsinki Department of Archaeology, Helsinki.

Simpson, D. N.
1996 Aspects of Weathering of Rhyolite and Typological and Technological Considerations of this Material Based on the Results of Refitting. *Norwegian Archaeological Review*. Vol 29, No.2: 79-87.

Skar, B. and S. D. Coulson
1986 Evidence of Behaviour from Refitting: A Case Study. *Norwegian Archaeological Review*. Vol. 19, No. 2: 90-102.

1989 A Case Study of Rørmyr II: a Norwegian Early Mesolithic Site. In *The Mesolithic of Europe: papers presented at the third international symposium Edinburgh 1985*, edited by Bonsall, C., pp. 351-361. Department of Archaeology, University of Edinburgh, John Donald Publishers LTD, Edinburgh.

Skourtopoulou, K.
2006 Questioning spatial contexts: The contribution of lithic studies as analytical and interpretative bodies of data. In *Deconstructing Context- A critical approach to Archaeological Practice*, edited by Papaconstantinou, D., pp. 50-78. Oxbow books, Oxford.

Sorokin, A.

1999 Neighbours of the Butovo Culture on the Upper Volga and Oka Rivers. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 311-317. Maria Curie-Skłodowska University Press, Lublin.

Sulgostowska, Z.
1999 Final Palaeolithic Masovian Cycle and Mesolithic Kunda Culture Relations. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L.L. Zaliznyak, pp. 85-92. Maria Curie-Skłodowska University Press, Lublin.

Sørensen, M.
2006 Rethinking the lithic blade definition: towards a dynamic understanding. In *Skilled Production and Social Reproduction*, edited by Apel, J. and K. Knutsson, pp. 277-297. Societas Archaeologica Upsaliensis, Uppsala.

Takala, H.
2004 *The Ristola site in Lahti and the earliest postglacial settlement of south Finland*. Lahti city museum, Turku.

2009 The flint collection from the Ristola site in Lahti and the cultural contacts of the earliest postglacial settlement of southern Finland. In *Mesolithic Horizons: papers presented at the seventh international conference on the Mesolithic in Europe, Belfast 2005,* edited by McCartan, S., W. Schulting, and P. Woodman, pp. 31-37. Oxbow books, Oxford.

Thommessen, T.
1996 The Early settlement of Northern Norway. In *The earliest settlement of Scandinavia and its relationship with neighbouring areas*. Acta Archaeologica Lundensia 24, edited by Larsson, L., pp. 235-240. Almqvist & Wiksell International, Stockholm.

Tikkanen, M.
2006 Glacial and postglacial history of the Baltic Sea and Finland. In *Finland - land of mires. The Finnish Environment 23*, edited by Lindholm, T. and R. Heikkilä, pp. 59-67. Finnish Environment Institute, Helsinki.

Timofeev, V. I., G. I. Zaitseva, M. Lavento, P. Dolukhanov and P. Halinen
2004 The Radiocarbon datings of the Stone Age – Early metal period on the Karelian Isthmus. In *GEOCHRONOMETRIA Journal on Methods and Applications of Absolute Chronology* 23: 93-99.

Villa, P.
1982 Conjoinable pieces and site formation processes. *American Antiquity* 47(2): 277-290.

Volokitin, A.
2005 Some peculiarities of colonization of the European north-east in Mesolithic. In *Pioneer settlements and colonization processes in the Barents region,* edited by Knutsson, H., pp. 11-27. Vuollerim Papers on Hunter-gatherer Archaeology, Vol.1. Vuollerim 6000 år, Vuollerim.

Woodman, P.
1993 The Komsa Culture. A Re-examination of its Position in the Stone Age of Finnmark. *Acta Archaeologica* 63: 57-76.

1999 The Early Postglacial Settlement of Arctic Europe. In *Den Bogen Spannen… Festschrift Für Bernhard Gramsch Zum 65. Geburstag*. edited by Cziesla, E. T. Kersting and S. Pratsch, pp. 297-312. Beier & Beran Archäologische Fachliteratur, Weissbach.

Zaliznyak, L.

1999 Tanged Point Cultures in the Western Part of Eastern Europe. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L. L. Zaliznyak, pp. 202-218. Maria Curie-Skłodowska University Press, Lublin.

Zhilin, M.

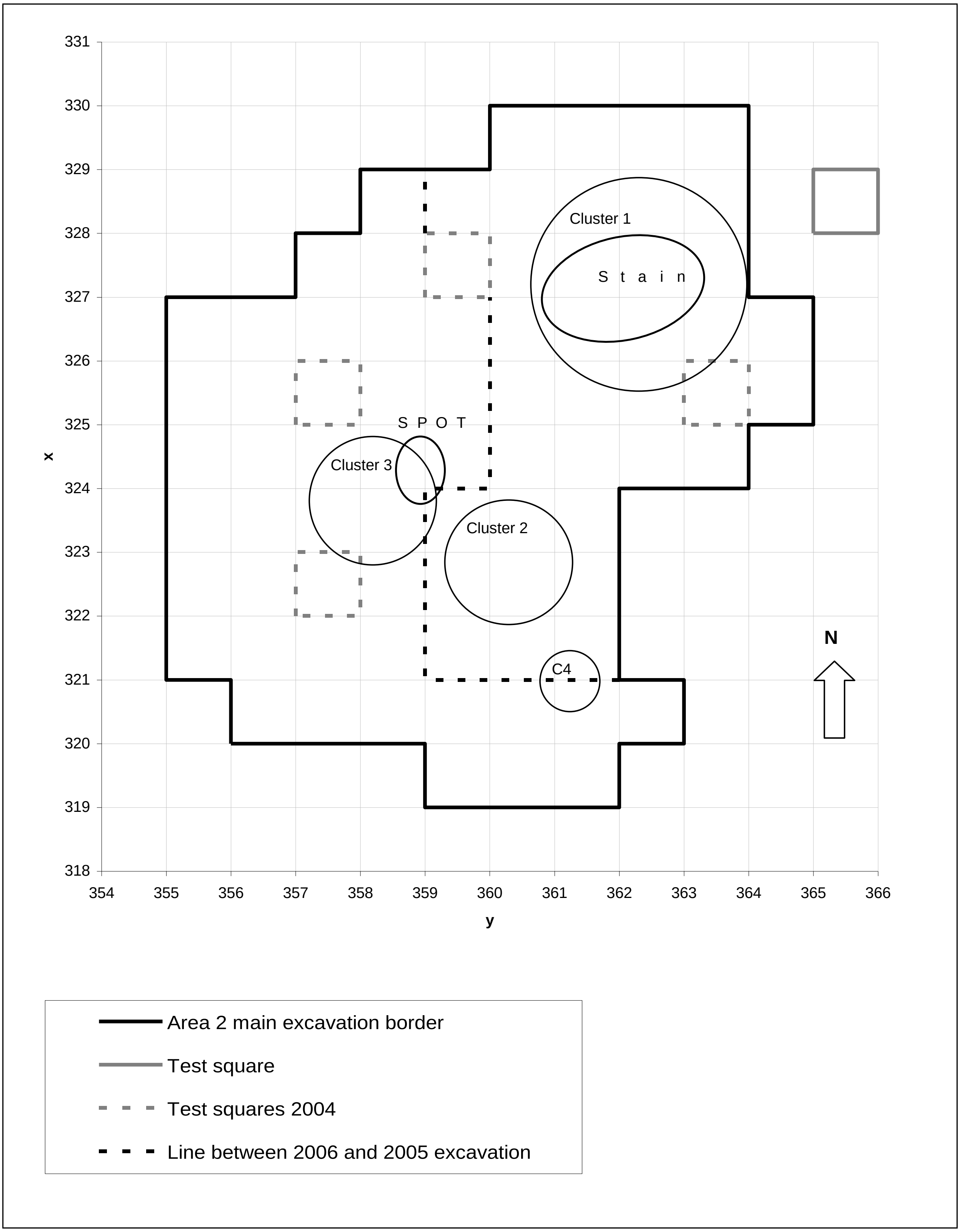
1996 The Western parts of Russia in the late Palaeolithic – Early Mesolithic. In *The earliest settlement of Scandinavia and its relationship with neighbouring areas*. Acta Archaeologica Lundensia 24, edited by Larsson, L., pp. 273-284. Almqvist & Wiksell International, Stockholm.

1999 New Mesolithic peat sites on the Upper Volga. In *Tanged Points Cultures in Europe*, edited by Kozłowski, S., J. Gurba and L. L. Zaliznyak, pp. 295-310. Maria Curie-Skłodowska University Press, Lublin.

Zvelebil, M.

2008 Innovating Hunter-Gatherers: The Mesolithic in the Baltic. In *Mesolithic Europe*, edited by Bailey, G. and P. Spikins, pp. 18-59. Cambridge University Press, Cambridge.

Appendix 1: Grid of excavation area 2 with cluster borders and location of dark stain and spot.



Appendix 2: Detailed table of refitted groups in connection to the four lithic clusters

Cluster name	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Outside
Core refit groups	R58,R14		R58,R85		R1,
Core tablet refit groups	R17,R18,R20,R21, R49,R64,R69,R77	R42	R84,R97,R100, R103,R115	R27	R23,R25,R109
Flake refit groups	R67,R55	R 35,R55	R55,R97,R100		R43, R47,
Not retouched blade refit groups	R11,R13,R19,R56, R62,R66,R74	R30,R33	R81,R101,R110	R5	R3,R4,R6,R7, R8,R9,R12, R24,R46,R70, R80,R83,R91, R94,R95
Retouched blade refit groups	R2,R10,R14,R15, R16,R22,R39,R50, R51,R53,R59,R60, R61,R65,R71,R72, R73,R75,R76	R16,R31, R36,R41,R71	R38,R39,R53, R99,R113		R29,R44,R45, R79,R86,R87, R88,R92,R93, R96,R104,R105, R106,R107,R111
Burin refit groups	R37,R48,R73,R78 R82	R28,R34	R28		R89,R112
Burin spall refit groups		R32,R40	R32		R90
Fragments refit groups	R63		R102		R108

Some groups are present in more then one cluster and some are categorized as both flakes and core tablets and are therefore presented twice.

Appendix 3: Table of all refit groups

Refit group ID= Number given to the group sorted after main piece catalogue number.
ID in group= Letter given to individual pieces within refit groups to identify their position within the group in map.
Catalogue ID = KM (Kansellio Museo) + year number (34574 (2004) 35224 (2005) 35917 (2006) + individual piece number (example 172).
C-Layer = Catalogue layer, Layer 1 in 2004 and 2005 equals layers 1+2 in 2006, Layers 2a and 2b equals layers 3 and 4 in 2006.

Refit group ID	Catalogue ID		Y	X	C-Layer	Retouc	Raw material	Type	Fragment type	Fractures type	Colour	General Category
R1	KM 34574	172	360,47	325,10	Surface		Chert	Blade core fragment		Frost	Light Brown	Core
R1	KM 35224	987	360,46	325,03	1		Chert	Blade core fragment		Frost	Light Brown	Core
R2	KM 34574	199	361,83	326,54	Surface		Chert	Blade fragment	Proximal	Uncertain	Grey	Blade
R2	KM 34574	186	362,58	325,61	Surface	Retouc	Chert	Blade fragment	Medial		Grey	Blade
R2	KM 34574	198	361,83	326,54	Surface	Retouc	Chert	Blade fragment/burin spall	Medial		Grey	Blade
R2	KM 34574	196	362,22	326,23	Surface	Retouc	Chert	Blade fragments/burin	Medial/Distal		Grey	Blade
R2	KM 34574	193	362,17	325,97	Surface	Retouc	Chert	Blade fragment	Medial	Intentional	Grey	Blade
R2	KM 35917	219	356,69	322,99	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R3	KM 34574	222	357,87	322,38	1		Chert	Blade fragment	Proximal	Natural	Light Brown	Blade
R3	KM 34574	250	357,00	322,00	1		Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R4	KM 34574	223	357,15	322,39	1		Other	Blade fragment / tool	Proximal	Uncertain		Blade
R4	KM 34574	219	357,49	322,19	1		Other	Blade fragment / tool	Medial	Uncertain		Blade
R5	KM 35224	5	360,96	321,20	0		Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R5	KM 35224	13	361,07	321,11	0		Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R6	KM 35224	6	360,57	321,30	0		Chert	Blade fragment	Medial	Uncertain	White/Grey	Blade

R7	KM 35224	108	359,00	323,00	0		Chert	Blade fragment	Medial	Natural	Red Brown	Blade
R8	KM 35224	161	361,43	324,26	0		Chert	Blade fragment	Proximal	Uncertain	Light Brown	Blade
R8	KM 35224	162	361,55	324,38	0		Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R9	KM 35224	176	360,09	325,11	0		Chert	Blade fragment	Medial	Uncertain	Red Brown	Blade
R9	KM 35224	177	360,00	325,00	0		Chert	Blade fragment	Medial	Uncertain	Red Brown	Blade
R10	KM 35224	194	362,58	325,70	0	Retouc	Chert	Blade fragment	Medial	Uncertain	Beige/White	Blade
R10	KM 35224	246	361,00	326,00	0	Retouc	Chert	Blade fragment	Distal	Uncertain	Beige/White	Blade
R11	KM 35224	195	362,33	325,71	0		Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R11	KM 35224	931	360,30	324,26	1		Chert	Fragment / blade fragment	Medial	Intentional	Dark Brown	Blade
R12	KM 35224	204	362,00	325,00	0		Chert	Blade fragment /fragment	Medial	Uncertain	Dark Brown	Blade
R12	KM 35224	188	361,00	325,00	0		Chert	Fragment	Medial	Uncertain	Dark Brown	Fragment
R12	KM 35224	180	361,41	325,18	0		Chert	Blade fragment /fragment	Medial/Distal	Uncertain	Dark Brown	Blade
R13	KM 35224	208	362,00	325,00	0		Chert	Blade fragment	Proximal	Uncertain	Beige/Grey	Blade
R13	KM 35224	202	362,50	325,84	0		Chert	Blade fragment	Medial/Distal	Uncertain	Beige/Grey	Blade
R14	KM 35224	232	361,78	326,55	0	Retouc	Chert	Blade fragment/tool/borer	Uncertain	Accidental	Dark Brown	Blade
R14	KM 35224	148	362,75	327,08	1	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade
R14	KM 35224	123	362,35	326,90	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R15	KM 35224	236	361,83	326,69	0	Retouc	Chert	Blade fragment	Distal	Intentional	Red Brown	Blade
R15	KM 35224	111	361,60	326,46	1	Retouc	Chert	Blade fragment	Medial	Intentional	Red Brown	Blade
R15	KM 35224	229	361,70	326,38	0		Chert	Blade fragment	Medial	Intentional	Red Brown	Blade
R15	KM 35224	228	361,71	326,37	0		Chert	Blade fragment	Medial	Intentional	Red Brown	Blade

R16	KM 35224	360	362,10	327,33	0	Retouc	Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R16	KM 35224	61	360,07	322,66	0	Retouc	Chert	Blade fragment	Medial	Intentional	Red Brown	Blade
R17	KM 35224	371	362,09	327,59	0		Chert	Core tablet fragment	Proximal		Brown	Core tablet
R17	KM 35224	316	361,97	327,10	0		Chert	Core tablet fragment	Distal		Brown	Core tablet
R18	KM 35224	379	362,59	327,90	0		Chert	Fragment			Light Brown	Fragment
R18	KM 35224	415	363,53	328,25	0		Chert	Core tablet			Light Brown	Core tablet
R18	KM 35917	809	358,31	326,87	1		Chert	Fragment			Light Brown	Fragment
R19	KM 35224	382	362,00	327,00	0		Chert	Blade fragments	Medial	Natural	Red Brown	Blade
R19	KM 35224	370	362,09	327,59	0		Chert	Blade fragment	Medial	Natural	Red Brown	Blade
R20	KM 35224	383	362,00	327,00	0		Chert	Core tablet fragment			Light Brown	Core tablet
R20	KM 35224	362	362,33	327,38	0		Chert	Core tablet			Light Brown	Core tablet
R21	KM 35224	405	362,40	328,03	0		Chert	Core tablet			Light Brown	Core tablet
R21	KM 35224	406	362,40	328,03	0		Chert	Core tablet fragment			Light Brown	Core tablet
R22	KM 35224	408	362,06	328,14	0		Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R22	KM 35224	410	362,08	328,24	0	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R23	KM 35224	441	360,67	321,15	1		Chert	Core tablet			Beige/Grey	Core tablet
R23	KM 35224	456	360,00	321,00	1		Chert	Core tablet			Beige/Grey	Core tablet
R24	KM 35224	444	360,15	321,33	1		Chert	Blade fragments	Medial, broken	Natural	Beige/Grey	Blade
R25	KM 35224	445	360,39	321,35	1		Chert	Core tablets			Light Brown	Core tablet
R26	KM 35224	447	360,67	321,68	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Light Brown	Blade
R26	KM 35224	184	360,38	322,89	2a	Retouc	Chert	Blade fragment/tool	Medial with burin	Intentional	Light Brown	Blade

R27	KM 35224	461	361,30	321,00	1		Chert	Core tablet fragment			Light Brown	Core tablet
R27	KM 35224	467	361,37	321,00	1		Chert	Core tablet fragment			Light Brown	Core tablet
R28	KM 35224	499	359,89	322,14	1	Retouc	Chert	Blade burin	Proximal		Light Brown	Burin
R28	KM 35917	194	358,19	321,89	1	Retouc	Chert	Burin spall			Beige/White	Burin spall
R28	KM 35917	510	358,00	323,00	1	Retouc	Chert	Blade burin			Brown	Burin
R28	KM 35917	189	358,39	321,69	1	Retouc	Chert	Burin spall	Medial		Light Brown	Burin spall
R28	KM 35917	100	358,34	321,85	3	Retouc	Chert	Burin spall	Proximal		Light Brown	Burin spall
R29	KM 35224	505	359,30	322,10	1	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R30	KM 35224	514	359,90	322,10	1		Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R30	KM 35224	521	359,20	322,20	1		Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R31	KM 35224	527	359,90	322,30	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Beige/White	Blade
R31	KM 35224	580	360,03	322,24	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R32	KM 35224	541	359,20	322,80	1	Retouc	Chert	Burin spalls	Proximal and Distal		White/Grey	Burin spall
R32	KM 35917	473	358,45	323,66	1	Retouc	Chert	Burin spall	Medial		White/Grey	Burin spall
R33	KM 35224	553	359,70	322,90	1		Chert	Blade fragment		Uncertain	White/Grey	Blade
R33	KM 35917	830	359,64	320,19	2		Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R34	KM 35224	600	360,37	322,44	1		Other	Blade burin	Proximal			Burin
R34	KM 35917	220	358,98	322,00	1	Retouc	Other	Blade fragment	Distal			Blade
R35	KM 35224	641	360,16	322,67	1		Chert	Trimming flakes			Light Brown	Flakes
R36	KM 35224	652	360,25	322,76	1		Chert	Blade fragment	Medial		Red Brown	Blade
R36	KM 35224	673	360,27	322,84	1	Retouc	Chert	Blade fragment	Distal		Red Brown	Blade

R37	KM 35224	750	361,28	322,99	1		Other	Blade fragment/burin	Medial			Burin
R37	KM 35224	952	361,25	324,16	1		Other	Blade fragment/burin spall	Medial			Burin spall
R37	KM 35224	976	361,00	324,00	1		Other	Blade fragment/burin spall	Medial			Burin spall
R37	KM 35224	107	360,86	326,45	1		Other	Blade fragment/burin spall	Medial			Burin spall
R37	KM 35224	176	362,15	328,11	1		Other	Blade fragment/burin spall	Medial			Burin spall
R38	KM 35224	779	359,16	323,75	1	Retouc	Chert	Blade fragments	Medial	Natural	Beige/Grey	Blade
R39	KM 35224	790	359,18	323,99	1	Retouc	Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R39	KM 34574	202	361,76	326,88	Surface	Retouc	Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R39	KM 35917	365	357,84	323,86	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R40	KM 35224	833	360,70	323,57	1		Chert	Burin spall	Distal		Light Brown	Burin spall
R40	KM 35224	871	360,00	323,00	1		Chert	Burin spall	Medial		Light Brown	Burin spall
R41	KM 35224	852	360,99	323,76	1	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R41	KM 35224	853	360,85	323,79	1	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R41	KM 35224	99	359,92	323,76	0		Chert	Fragment		Natural	Light Brown	Fragment
R42	KM 35224	873	360,00	323,00	1		Chert	Core tablet			Beige/Grey	Core tablet
R42	KM 35224	881	361,03	323,22	1		Chert	Core tablet			Beige/Grey	Core tablet
R43	KM 35224	895	361,70	323,56	1		Chert	Flake			Beige/White	Flake
R43	KM 35224	100	361,03	325,10	1		Chert	Flake			Beige/White	Flake
R44	KM 35224	950	361,25	324,16	1	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade
R44	KM 35224	958	361,00	324,33	1	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade
R44	KM 35224	969	361,00	324,86	1	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade

R45	KM 35224	960	361,16	324,42	1		Chert	Blade fragments	Medial	Intentional	Beige/Grey	Blade
R45	KM 35224	192	361,02	324,50	2a		Chert	Blade fragment	Medial	Intentional	Beige/Grey	Blade
R45	KM 35224	955	361,15	324,18	1		Chert	Blade fragment	Distal	Intentional	Beige/Grey	Blade
R46	KM 35224	971	361,86	324,87	1		Chert	Blade fragment	Distal	Natural	Red Brown	Blade
R46	KM 35224	962	361,88	324,47	1		Chert	Blade fragment	Medial	Natural	Red Brown	Blade
R47	KM 35224	979	362,49	324,14	1	Retouc	Chert	Bladelike flakes	Proximal/ Medial		Beige/Grey	Flake
R48	KM 35224	101	361,21	325,73	1	Retouc	Chert	Blade burin	Medial		Light Brown	Burin
R48	KM 35224	133	363,43	326,42	1		Chert	Burin spall	Distal		Light Brown	Burin spall
R49	KM 35224	104	362,11	325,72	1		Chert	Core tablet/Core fragment			Light Brown/Grey	Core
R49	KM 35224	115	361,00	326,00	1		Chert	Core tablet			White/Grey	Core tablet
R49	KM 35224	104	362,13	325,71	1		Chert	Flake			Brown	Flake
R49	KM 35224	396	363,00	327,00	0		Chert	Trimming flakes			Grey	Flakes
R49	KM 35224	144	361,10	327,97	1		Chert	Core tablet			Brown	Core tablet
R49	KM 35224	205	361,30	327,30	2a		Chert	Core tablet fragment			Dark Brown	Core tablet
R49	KM 35224	212	360,75	326,28	0		Chert	Flake			Light Brown	Flake
R49	KM 35224	146	361,00	327,00	1		Chert	Core tablet			White/Grey	Core tablet
R49	KM 35224	148	362,13	327,03	1		Chert	Flake			Light Brown	Flake
R50	KM 35224	109	361,68	326,11	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Brown	Blade
R50	KM 35224	208	362,40	327,70	2a	Retouc	Chert	Blade fragment	Distal	Uncertain	Dark Brown	Blade
R51	KM 35224	119	362,75	326,39	1	Retouc	Chert	Blade fragments	Medial	Uncertain	Brown	Blade
R51	KM 35224	106	362,06	325,90	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Dark Brown	Blade

R52	KM 35224	120	362,68	326,66	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Brown	Blade
R52	KM 35224	122	362,65	326,79	1		Chert	Blade fragment	Medial	Intentional	Brown	Blade
R53	KM 35224	130	363,03	326,11	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R53	KM 35224	151	362,05	327,43	1	Retouc	Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R53	KM 35917	645	358,78	324,08	1	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade
R53	KM 35224	178	362,19	328,62	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R53	KM 35224	138	363,22	326,94	1	Retouc	Chert	Blade fragment	Distal	Intentional	Dark Brown	Blade
R54	KM 35224	135	363,59	326,64	1		Chert	Fragment /core tablet		Accidental	Beige/Grey	Fragment
R54	KM 35224	136	363,55	326,71	1		Chert	Trimming flake/ core tablet		Accidental	Beige/Grey	Core tablet
R55	KM 35224	138	363,48	326,85	1		Chert	Blade like flake			Beige/Grey	Flake
R55	KM 35224	549	359,70	322,90	1		Chert	Blade like flake			Brown/Green	Flake
R55	KM 35917	871	358,71	323,75	2		Chert	Blade like flake			Beige/Grey	Flake
R55	KM 34574	249	357,00	322,00	1		Chert	Blade like flake			Beige/White	Flake
R56	KM 35224	142	361,51	327,25	1		Chert	Blade fragment	Distal	Intentional	Red Brown	Blade
R56	KM 35224	142	361,08	327,25	1		Chert	Blade fragment	Medial	Intentional	Red Brown	Blade
R57	KM 35224	149	362,64	327,15	1	Retouc	Chert	Blade fragment	Proximal	Natural	Dark Brown	Blade
R57	KM 35224	211	363,52	327,11	2a	Retouc	Chert	Blade fragment	Medial	Natural	Brown	Blade
R57	KM 35224	170	363,62	327,59	1	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R58	KM 35224	149	362,90	327,20	1		Chert	Blade core fragment			Light Brown	Core
R58	KM 35224	150	362,95	327,24	1		Chert	Fragment			Light Brown	Fragment
R58	KM 35224	354	362,70	327,20	0		Chert	Fragment			Light Brown	Fragment

R58	KM 35917	866	358,38	323,54	2		Chert	Fragment			Light Brown	Fragment
R58	KM 34574	205	361,95	326,97	Surface		Chert	Core tablet			Beige/Grey	Core tablet
R59	KM 35224	149	362,87	327,23	1	Retouc	Chert	Blade fragment	Medial/ Proximal	Uncertain	Dark Brown	Blade
R59	KM 35224	169	363,14	327,55	1		Chert	Blade fragment	Medial	Uncertain	Brown	Blade
R59	KM 35917	812	359,54	326,09	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R60	KM 35224	153	362,02	327,56	1	Retouc	Chert	Blade fragment	Proximal	Uncertain	Dark Brown	Blade
R60	KM 35224	404	362,40	328,03	0	Retouc	Chert	Blade fragment	Medial	Uncertain	Beige/Grey	Blade
R60	KM 35224	403	362,40	328,00	0		Chert	Blade fragments	Medial	Uncertain	Beige/Grey	Blade
R61	KM 35224	153	362,22	327,63	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Dark Brown	Blade
R61	KM 35224	143	361,83	327,56	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/Grey	Blade
R62	KM 35224	157	362,00	327,00	1		Chert	Blade fragments	Medial	Natural	Red Brown	Blade
R63	KM 35224	166	363,09	327,28	1		Chert	Fragment/ Core tablets			Brown	Fragment
R64	KM 35224	173	363,68	327,91	1		Chert	Core tablets			Beige/Grey	Core tablet
R65	KM 35224	178	362,55	328,51	1	Retouc	Chert	Blade fragments	Medial	Natural	Beige/Grey	Blade
R66	KM 35224	180	363,63	328,07	1		Chert	Blade fragments	Medial	Natural	Red Brown	Blade
R67	KM 35224	182	363,05	328,41	1		Chert	Blade like flake			Beige/Grey	Flake
R68	KM 35224	183	363,79	328,92	1		Chert	Flake			Beige/Brown	Flake
R68	KM 35224	183	363,79	328,92	1		Chert	Fragments			Beige/Brown	Fragment
R68	KM 35224	183	363,79	328,92	1		Chert	Fragment			Beige/Brown	Fragment
R68	KM 35224	183	363,00	328,00	1		Chert	Fragments			Beige/Brown	Fragment
R69	KM 35224	184	363,68	329,50	1		Chert	Core tablet	Proximal		Brown	Core tablet

R69	KM 35224	180	363,81	328,20	1		Chert	Fragment/ Core tablet	Distal		Dark Brown	Fragment
R69	KM 35224	201	363,30	326,17	2a		Chert	Fragment/ Core tablet	Distal		Brown	Fragment
R70	KM 35224	184	361,82	321,92	2a		Chert	Blade fragment	Proximal	Uncertain	Beige/Light Brown	Blade
R70	KM 35224	854	360,85	323,79	1		Chert	Blade fragment	Medial	Uncertain	Beige/Light Brown	Blade
R71	KM 35224	189	360,70	322,90	2a	Retouc	Chert	Blade fragment	Proximal	Intentional	Beige/Light Brown	Blade
R71	KM 35224	115	361,00	326,00	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Dark Brown	Blade
R71	KM 35224	123	362,80	326,94	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Dark Brown	Blade
R72	KM 35224	194	361,03	326,13	2a	Retouc	Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R72	KM 35224	208	362,55	327,57	2a	Retouc	Chert	Blade fragment	Medial	Uncertain	Dark Brown	Blade
R73	KM 35224	201	363,30	326,17	2a	Retouc	Chert	Blade fragment	Medial	Intentional	Brown	Blade
R73	KM 35224	141	361,32	327,10	1	Retouc	Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R73	KM 35917	538	356,00	324,00	1	Retouc	Chert	Blade burin	Medial	Intentional	Light Brown	Burin
R74	KM 35224	213	361,82	326,49	2b		Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R74	KM 35224	223	361,27	326,23	0		Chert	Blade fragment	Medial	Intentional	Brown	Blade
R74	KM 35224	184	363,63	329,82	1		Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R75	KM 35224	222	361,58	327,35	2b	Retouc	Chert	Blade fragment	Proximal	Intentional	Dark Brown	Blade
R75	KM 35224	122	362,08	326,80	1		Chert	Fragment	Medial edge	Intentional	Dark Brown	Fragment
R75	KM 35224	170	363,15	327,57	1	Retouc	Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R76	KM 35224	226	362,41	327,52	2b	Retouc	Chert	Blade fragment	Medial	Uncertain	Red Brown	Blade
R76	KM 35224	226	362,37	327,54	2b	Retouc	Chert	Blade fragment	Distal	Uncertain	Red Brown	Blade
R77	KM 35224	229	363,27	327,32	2b		Chert	Core tablet			Dark Brown	Core tablet

R77	KM 35224	216	362,46	326,73	2b		Chert	Core tablet			Dark Brown	Core tablet
R78	KM 35917	3	358,32	320,39	0		Chert	Blade burin			White/Grey	Burin
R78	KM 34574	187	362,44	325,63	Surface	Retouc	Chert	Burin spall			Dark Brown	Burin spall
R78	KM 35224	226	362,00	327,00	2b		Chert	Burin spall			White/Grey	Burin spall
R79	KM 35917	13	356,65	322,77	0	Retouc	Chert	Blade fragment	Medial	Uncertain	Beige/White	Blade
R79	KM 35917	12	356,50	322,58	0	Retouc	Chert	Blade fragment	Medial	Uncertain	Beige/White	Blade
R80	KM 35917	29	355,98	323,44	0		Chert	Blade fragment	Proximal	Natural	Beige/White	Blade
R80	KM 35917	31	356,04	323,44	0		Chert	Blade fragment	Medial	Natural	Beige/White	Blade
R80	KM 35917	30	355,98	323,44	0		Chert	Blade fragment	Medial	Natural	Beige/White	Blade
R81	KM 35917	37	358,65	323,25	0		Chert	Blade fragments	Medial	Natural	Beige/White	Blade
R82	KM 35917	54	355,69	324,14	0		Chert	Burin			Beige/White	Burin
R82	KM 35224	122	362,12	326,85	1		Chert	Burin			Dark Brown	Burin
R82	KM 35224	170	363,05	327,63	1		Chert	Burin spall			Brown	Burin spall
R82	KM 35224	123	362,76	326,91	1	Retouc	Chert	Burin spall	Medial		Light Brown	Burin spall
R82	KM 35224	166	363,17	327,28	1	Retouc	Chert	Burin spall	Distal		Light Brown	Burin spall
R83	KM 35917	74	359,54	324,43	0		Chert	Blade fragment	Medial	Natural	Red Brown	Blade
R83	KM 35917	75	359,71	324,48	0		Chert	Blade fragment	Medial	Natural	Red Brown	Blade
R84	KM 35917	126	360,40	320,00	1		Chert	Core tablet and potlid			Beige/Grey	Core tablet
R84	KM 35917	177	358,41	321,09	1		Chert	Core tablet			Light Brown	Core tablet
R84	KM 35917	419	358,36	323,25	1		Chert	Fragment			Light Brown	Fragment
R84	KM 35917	6	360,60	320,21	0		Chert	Core tablet			Light Brown	Core tablet

R84	KM 35917	2	360,00	319,00	0		Chert	Fragment			Light Brown	Fragment
R85	KM 35917	135	360,69	320,87	1		Chert	Blade Core			Light Brown/Grey	Core
R85	KM 35917	48	358,96	323,51	0		Chert	Flake			White/Grey	Flake
R85	KM 35917	504	358,42	323,93	1		Chert	Flake			White/Grey	Flake
R86	KM 35917	159	356,68	321,82	1	Retouc	Chert	Blade fragments	Proximal and medial	Broken in situ	White/Grey	Blade
R87	KM 35917	160	356,75	321,85	1	Retouc	Chert	Blade fragments	Proximal and medial	Broken in situ	White/Grey	Blade
R88	KM 35917	192	358,40	321,86	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Beige/White	Blade
R88	KM 35917	187	358,63	321,68	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R89	KM 35917	202	358,00	321,00	1		Chert	Blade burin and spall	Medial		Beige/White	Burin
R90	KM 35917	209	356,48	322,23	1		Chert	Burin spalls	Proximal		Beige/White	Burin spall
R90	KM 35917	842	356,00	322,00	2		Chert	Burin spall	Medial		Beige/White	Burin spall
R91	KM 35917	222	358,46	322,04	1		Chert	Blade fragments	Medial	Natural	Light Brown	Blade
R92	KM 35917	233	358,35	322,16	1		Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R92	KM 35917	235	358,38	322,20	1	Retouc	Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R93	KM 35917	236	358,32	322,23	1	Retouc	Chert	Blade fragment	Proximal	Uncertain	White/Grey	Blade
R93	KM 35917	237	358,35	322,23	1	Retouc	Chert	Blade fragment	Medial	Uncertain	White/Grey	Blade
R94	KM 35917	241	358,25	322,48	1		Chert	Blade fragment	Proximal	Natural	Light Brown	Blade
R94	KM 35917	242	358,20	322,50	1		Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R95	KM 35917	287	356,94	323,04	1		Chert	Blade fragment	Proximal	Uncertain	Light Brown	Blade
R95	KM 35917	289	356,90	323,06	1		Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R96	KM 35917	288	356,94	323,04	1	Retouc	Chert	Blade fragment	Medial	Intentional	White/Grey	Blade

R96	KM 35917	293	356,79	323,26	1	Retouc	Chert	Blade fragment	Medial	Intentional	White/Grey	Blade
R97	KM 35917	306	357,97	323,13	1		Chert	Flake			Beige/White	Flake
R97	KM 35917	507	358,11	323,97	1		Chert	Fragment			Light Brown	Fragment
R97	KM 35917	514	358,00	323,00	1		Chert	Core tablet			Light Brown	Core tablet
R97	KM 35917	668	358,08	324,18	1		Chert	Trimming flake			Light Brown	Flake
R97	KM 35917	490	358,35	323,86	1		Chert	Trimming flake			Light Brown	Flake
R98	KM 35917	309	357,52	323,17	1		Chert	Fragment			Light Brown	Fragment
R98	KM 35917	318	357,23	323,31	1		Chert	Fragment			Light Brown	Fragment
R99	KM 35917	314	357,24	323,22	1	Retouc	Chert	Blade fragment	Proximal	Intentional	Light Brown/Beige	Blade
R99	KM 35917	308	357,33	323,16	1	Retouc	Chert	Blade fragments	Medial	Intentional	White/Grey	Blade
R100	KM 35917	434	358,10	323,42	1		Chert	Flake			Light Brown	Flake
R100	KM 35917	397	358,34	323,11	1		Chert	Flake			Light Brown	Flake
R100	KM 35917	630	357,00	324,00	1		Chert	Flake			Light Brown	Flake
R100	KM 35917	474	358,48	323,66	1		Chert	Core tablet			Light Brown	Core tablet
R100	KM 35917	339	357,91	323,66	1		Chert	Core tablet			Light Brown	Core tablet
R100	KM 35917	709	358,28	324,68	1		Chert	Blade like flake			Light Brown	Flake
R100	KM 35917	581	357,86	324,26	1		Chert	Blade like flake			Light Brown	Flake
R100	KM 35917	374	357,46	323,95	1		Chert	Core tablet			Light Brown	Core tablet
R101	KM 35917	655	358,80	324,13	1		Chert	Blade fragment	Proximal	Uncertain	Red Brown	Blade
R101	KM 35917	697	358,88	324,38	1		Chert	Blade fragment	Medial	Uncertain	Red Brown	Blade
R102	KM 35917	659	358,72	324,15	1		Chert	Fragment			Light Brown	Fragment

R102	KM 35917	664	358,68	324,17	1		Chert	Fragment			Light Brown	Fragment
R103	KM 35917	687	358,90	324,25	1		Chert	Potlid			White/Grey	Fragment
R103	KM 35917	161	356,69	321,87	1		Chert	Core tablet			Light Brown	Core tablet
R103	KM 35917	363	357,45	323,86	1		Chert	Core tablet			Beige/White	Core tablet
R103	KM 35917	686	358,90	324,25	1		Chert	Core tablet			Beige/White	Core tablet
R103	KM 35917	506	358,52	323,93	1		Chert	Flake			Beige/White	Flake
R103	KM 35917	699	358,48	324,41	1		Chert	Fragment			Light Brown	Fragment
R103	KM 35917	674	358,55	324,21	1		Chert	Core tablet			Light Brown	Core tablet
R103	KM 35917	479	358,36	323,75	1		Chert	Flake			Beige/White	Flake
R103	KM 35917	409	358,15	323,17	1		Chert	Fragment			Beige/White	Fragment
R103	KM 35917	726	358,00	324,00	1		Chert	Trimming flake			White/Grey	Flake
R103	KM 35917	667	358,08	324,18	1		Chert	Core tablet			Beige/White	Core tablet
R104	KM 35917	722	358,56	324,99	1	Retouc	Chert	Blade fragment	Medial	Intentional	Beige/White	Blade
R104	KM 35224	203	362,00	325,00	0	Retouc	Chert	Blade fragment	Medial	Intentional	Dark Brown	Blade
R104	KM 34574	256	357,92	325,23	1	Retouc	Chert	Blade fragment	Medial	Intentional	Light Brown	Blade
R105	KM 35917	749	355,87	325,53	1		Chert	Blade fragment	Proximal	Uncertain	Beige/White	Blade
R105	KM 35917	750	355,92	325,55	1	Retouc	Chert	Blade fragment	Distal	Uncertain	Beige/White	Blade
R106	KM 35917	759	356,15	325,63	1	Retouc	Chert	Blade fragment	Proximal	Intentional ?	Beige/White	Blade
R107	KM 35917	773	358,81	325,49	1	Retouc	Chert	Blade fragment	Medial	Uncertain	Beige/White	Blade
R107	KM 34574	263	357,48	325,93	1		Chert	Blade fragment	Distal	Uncertain	Beige/White	Blade
R108	KM 35917	788	359,77	325,56	1		Chert	Fragment			Light Brown	Fragment

R108	KM 35917	786	359,77	325,56	1		Chert	Fragment			Light Brown	Fragment
R109	KM 35917	795	359,62	325,83	1		Chert	Core tablet/ fragment			Red Brown	Core tablet
R109	KM 35917	792	359,51	325,63	1		Chert	Core tablet/ fragment			Red Brown	Core tablet
R110	KM 35917	896	358,89	324,14	2		Chert	Blade fragment	Proximal		Brown	Blade
R110	KM 35917	634	358,15	324,01	1		Chert	Blade fragment	Medial		Beige/White	Blade
R111	KM 35917	922	358,96	324,98	2		Chert	Blade fragment	Medial	Uncertain	Light Brown	Blade
R111	KM 35917	769	358,69	325,05	1	Retouc	Chert	Blade fragment	Medial	Uncertain	White/Grey	Blade
R112	KM 35917	985	358,10	326,64	2	Retouc	Chert	Blade fragment	Medial		Light Brown	Blade
R112	KM 35917	783	359,25	325,22	1		Chert	Blade burin	Medial		Light Brown	Burin
R112	KM 35917	110	359,73	325,88	0	Retouc	Chert	Burin spall			White/Grey	Burin spall
R113	KM 35917	101	358,77	323,53	3		Chert	Blade fragment	Proximal	Natural	Light Brown	Blade
R113	KM 35917	107	358,74	323,53	4	Retouc	Chert	Blade fragment	Medial	Natural	Light Brown	Blade
R114	KM 35917	107	360,00	326,07	3		Chert	Distal end of blade core			Light Brown	Core
R114	KM 35917	806	358,42	326,49	1		Chert	Core tablet			Light Brown	Core tablet
R114	KM 35224	106	362,81	325,90	1		Chert	Plunge from core			Beige/Grey	Core
R115	KM 35917	108	358,87	324,04	4		Chert	Core tablet			Brown	Core tablet
R115	KM 35917	108	358,92	324,04	4		Chert	Core tablet fragment			Brown	Core tablet