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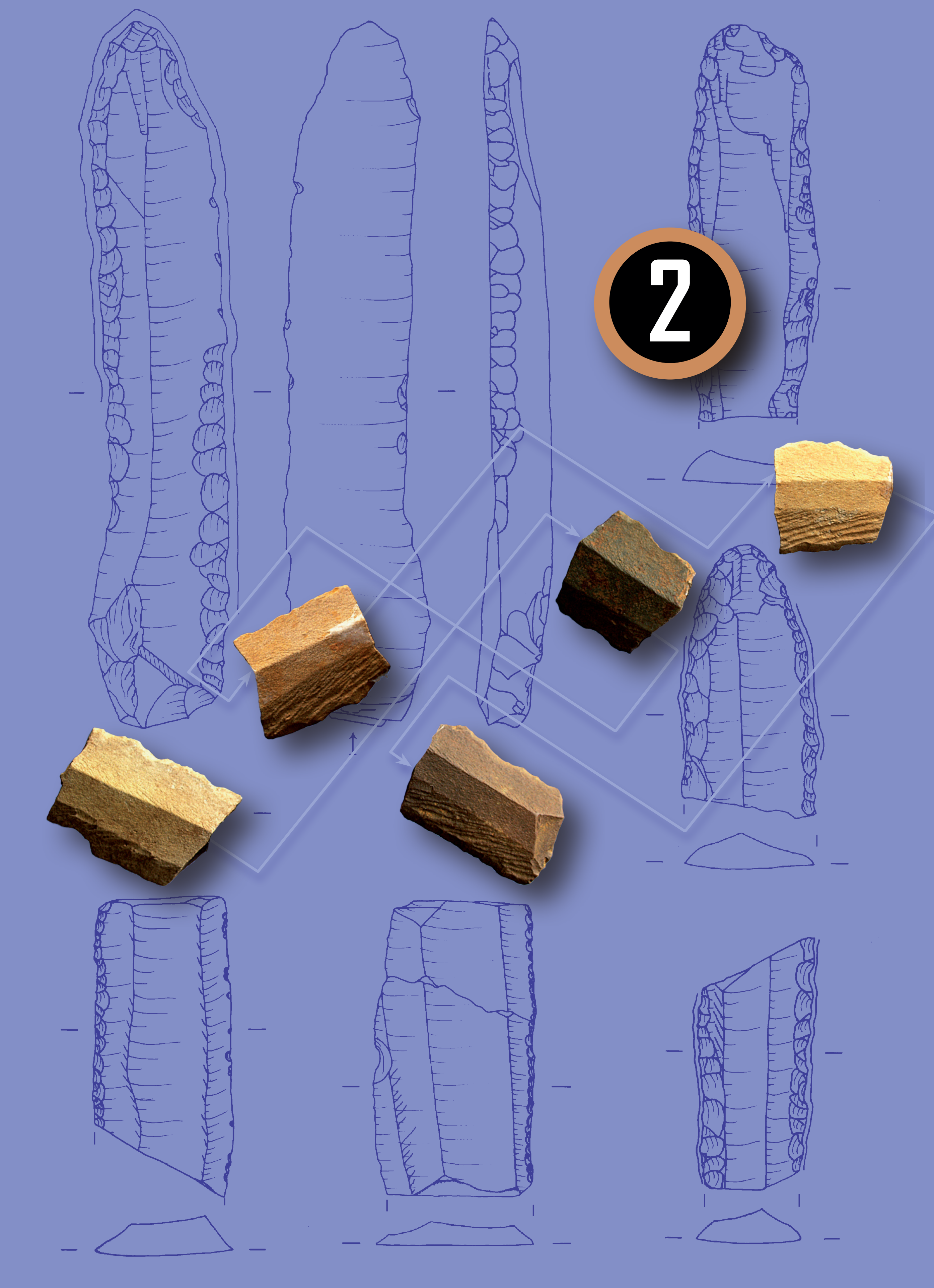
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Spatial Patterns of the Early Mesolithic Sujala Site, Utsjoki, Finnish Lapland

Jarmo Kankaanpää & Tuija Rankama

ABSTRACT This paper discusses the spatial features of the Early Mesolithic Sujala site in Utsjoki, Finnish Lapland. It begins with a short description of the site and its lithic assemblage. The lithic evidence supports an interpretation as a single-component site with clear associations with the Post-Swiderian assemblages of North-west Russia. The spatial analyses study the distribution of the finds, which form four distinct clusters. One of these is interpreted as a dwelling with evidence of indoor blade production. Outside activities include core reduction and dumping of debris in specific spots.

KEYWORDS

Early Mesolithic, Lapland, Post-Swiderian, lithics, spatial analysis, blade production, pressure technology.

Introduction

The Early Mesolithic Sujala site lies in Utsjoki Borough, northernmost Finnish Lapland (**Fig. 1**). The site was discovered by Tuija Rankama and Jarmo Kankaanpää during an archaeological survey of Lake Vetsijärvi in 2002 (Rankama & Kankaanpää 2005; Rankama 2005). Two find areas some 200 m apart were identified in test excavations carried out in 2004, and one of these areas (Area 2) was excavated by Kankaanpää and Rankama in 2005–2006 (**Fig. 2**). The total contiguous excavated area of Area 2 was 77 square metres, all confined within an 11 x 10 m square. A number of 1 x 1 m test pits were dug outside this area, but they produced no finds.

Figure 1. Location of the Sujala site.

Figure 2. The eastern half of the Sujala site, excavated in 2005; the -5 cm level looking south. The large floor stain lies left of the north arrow (centre). Yellow markers are at 1 m intervals. Photograph by J. Kankaanpää.

Structural features of the site were limited to a roundish area of stained earth some 2.5 m in diameter in the northern part of the excavation and a much smaller dark stain towards the centre. Both stains contained charcoal and burnt bone. The larger stain correlates with a cluster of lithic finds that exhibited clear signs of the "wall effect" (Grøn 1995:7) over nearly half of its circumference. In the wall effect, the density of finds drops suddenly along a linear – in this case curved – zone, indicating the presence of a barrier (**Fig. 2, Fig. 3**). This suggests that the feature probably represented the floor of a small, round dwelling some 3.5 m in diameter – possibly a tent, since no depression or bank was discernible. The matrix was hard-packed sand containing stones of various sizes. The distribution of the charcoal suggests that a fire burned in the centre of the presumed dwelling, but no evidence of a purpose-built stone hearth could be perceived. The smaller stain was probably a refuse pit, judging from the small size and relative depth. The rest of the finds formed a fan-shaped pattern extending south-west from the presumed dwelling and containing several concentrations as well as what looks like a "toss zone". This area will be referred to as the courtyard. The location of the courtyard finds suggests that the door of the presumed dwelling was also towards the south-west.

Lithic finds numbered 6387, weighing a total of 3074 grams, and the site also produced 40 charcoal samples and some 620 grams of burnt bone. Osteological analysis of the latter (Lahti 2006) has identified wild reindeer (*Rangifer tarandus sp.*) as the predominant species. Birds are represented by divers (*Gavia*). Fish are not present in the material. Judging by the very limited – albeit relatively dense – areal distribution of the finds, the site appears to have been a small, short-term campsite used by reindeer hunters. The diver bones suggest that the occupation spanned at least part of the open water period. The finds consist primarily of lithic artefacts and waste associated with a blade industry. Over 99% of the lithic finds are of a very fine-grained cherty material described by geologists as weakly metamorphosed sandstone (R. Kesola *pers. comm.* 2005; 2006; A. Siedlecka *pers. comm.* 2009) but referred to henceforth

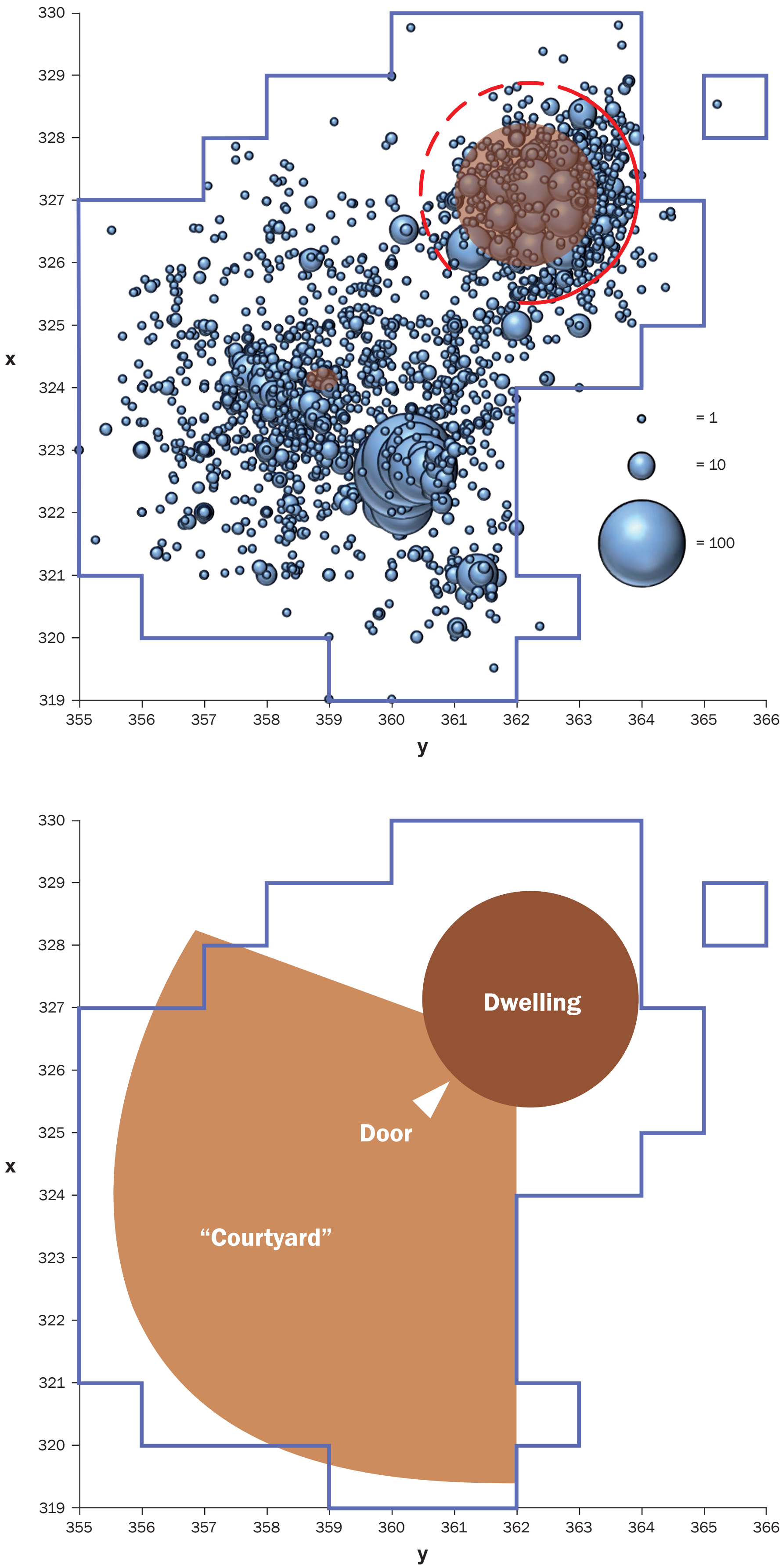

Figure 3. The distribution of chert artefacts in Area 2 at Sujala and the location of features mentioned in the text. The blue line marks the extent of the excavation, the blue bubbles the location and numbers of chert finds, and the dark roundel and oval the location of the stains with bone and charcoal. The continuous red line denotes the “wall effect” and the dotted red line the outline of the suggested dwelling. Grid in metres.

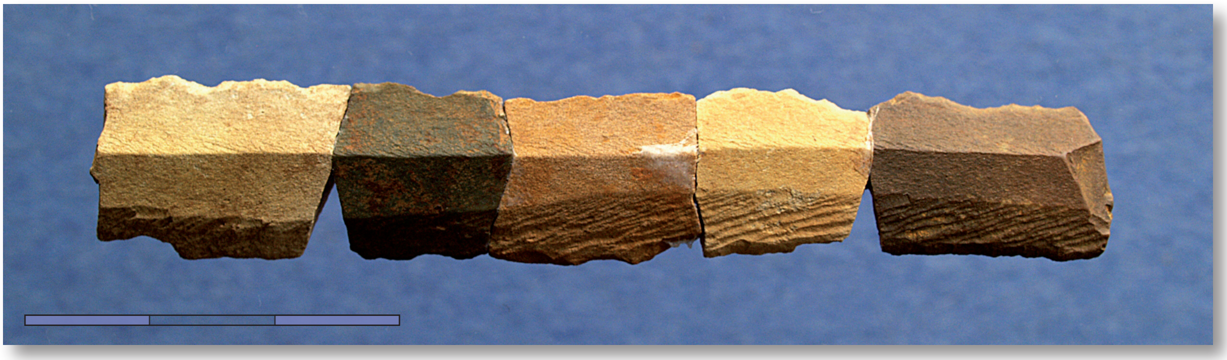

Figure 4. Refitted blade showing colour variation. Scale in centimetres. Refit by L. Koxvold, photograph by J. Kankaanpää. For the catalogue numbers of this and the subsequent artefact illustrations, see **Appendix**.

simply as "chert". The material is not local but probably derives from the Varanger Peninsula in Norwegian Finnmark, some 60–100 km north of the site. The material exhibits notable colour variation that is probably due to a combination of post-depositional oxidisation and ferrous staining (**Fig. 4**). Most pieces are shades of brown or green, but the original colour is nearly black while pieces that have been exposed on the surface for an extended period are nearly white. The colour appears to correlate roughly with find depth, the darkest pieces tending to be found in the deepest layers.

Five radiocarbon dates ranging from 8930 BP to 9265 BP place the site in the latter half of the ninth millennium calBC (**Fig. 5**; see also Rankama & Kankaanpää 2007). As will be presented below, the artefact types and blade technology exhibit affinities with the Post-Swiderian complex of northern/central Russia and the eastern Baltic rather than with the contemporaneous, Ahrensburg-derived Early Mesolithic occupation of the nearby coastal areas of Norwegian Finnmark. The discovery of the Sujala site thus revealed a previously unknown interface between two populations deriving from opposite ends of Early post-glacial continental Europe.

The aim of this article is to examine the spatial distribution of different classes of lithic finds at the Sujala site to see if they reflect discrete activity areas, and to attempt a preliminary interpretation as to how activities at the site relating to the production and use of lithic implements might be reconstructed. To this end, it is necessary to begin with a brief description of the general character of the finds.

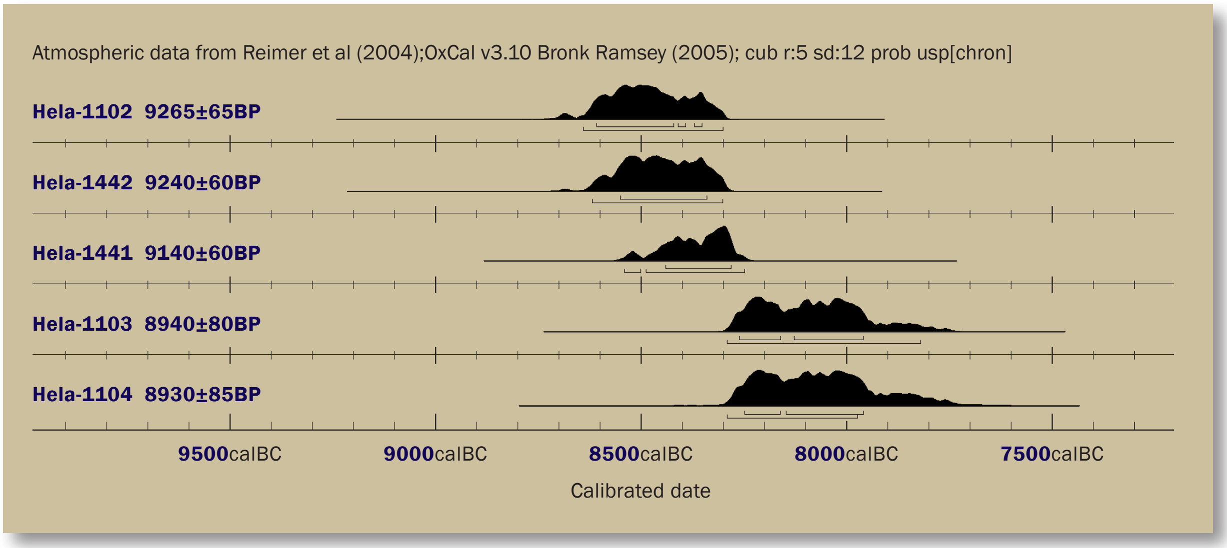

Figure 5. Oxcal calibration of Sujala radiocarbon dates. Hela-1102, 1141 and 1142 are on birch charcoal, Hela-1103 and 1104 are on burnt bone.

The general character of the assemblage

The Sujala lithic technology will not be discussed in detail here. Information on this topic may be found in earlier publications (Kankaanpää & Rankama 2009; Rankama & Kankaanpää 2007; 2008) and more will be published later. The data presented below are based on a number of analyses that have been described elsewhere (Rankama & Kankaanpää 2007).

Figure 6 shows the breakdown of the chert artefacts from Area 2 into categories and the number of pieces in each category.

These data can be condensed into a few technological units (**Fig. 7**). As the table indicates, the assemblage consists almost exclusively of the remains of blade and blade tool production. Most of the artefacts classified as flakes probably derive from platform rejuvenation but lack such diagnostic features that would allow their classification as core tablets. The large number of unclassified pieces consists of small, non-classifiable, fragments.

The absence of cortex or original outer surface indicates that the primary shaping of the cores did not take place at the site. There are some indications, such as the partial crest on the large blade in **Figure 11:a**, that initial core shaping involved forming a bifacial crest on a block of raw material. The standard core shape was the conical single-platform core, such as the one shown in **Figure 8**. The blade scars on three sides of the core are even and parallel-sided, suggesting the use of the pressure technique. The core base is flat (**Fig. 8:f**). Some core base fragments recovered from the site (Kankaanpää & Rankama 2009:Fig. 7.5:41–43) suggest that if the core base became too conical, it was habitually removed to reduce the danger of overshooting during blade detachment (cf. Binder 1984:82).

The striking platform of this core was shaped by radial detachments of core tablets with hinge terminations (**Fig. 8:e**). This was the standard for platform preparation at the site (**Fig. 9**). The deliberate use of hinge terminations in the core tablets was probably intended to prevent the tablets from overshooting and destroying the core angle at the opposite edge of the platform. This was not always successful (**Fig. 8:d**). The conical core type and especially the method of platform rejuvenation are among the key diagnostics of the Sujala blade tech-

Area 2 chert artefacts	2004–2006
Blade cores, incl. fragments	14
Tanged points, incl. fragments	47
Tanged point preforms, incl. fragments	2
Blades and blade fragments, unretouched	1739
Blades and blade fragments, retouched	401
Blade scrapers, incl. fragmentary	18
Blade burins, incl. fragmentary	45
Blade side scraper-burins	1
Blade borers/reamers	1
Blade inserts	2
Blade tools, unspecified	9
Microburins	1
Burin spalls incl. fragments	48
Burin spall implements	1
Piercers on a trimming blade	1
Core tablets	356
Burins on core tablet	1
Retouched core tablets	12
Core face rejuvenation blades/flakes	8
Core shaping blades/flakes	16
Core-edge trimming flakes, unretouched	1368
Core-edge trimming flakes, retouched	4
Blade-like flakes	4
Flakes, unretouched	142
Flake tools, retouched	12
Flake tools, other	1
Fragments, unretouched	2069
Fragments, retouched	18
Total	**6341**

Figure 6. Chert artefacts from Area 2 at Sujala.

Area 2 chert artefacts	2004–2006
Blade cores and core fragments	14
Blades and blade fragments, including implements	2266
Core trimming and rejuvenation debris and implements thereof	1766
Flakes and flake fragments, including implements	155
Burin spalls and implements thereof	49
Blade-like flakes	4
Unclassified fragments, unretouched and retouched	2087
Total	**6341**

Figure 7. Technological units within the Area 2 assemblage at Sujala.

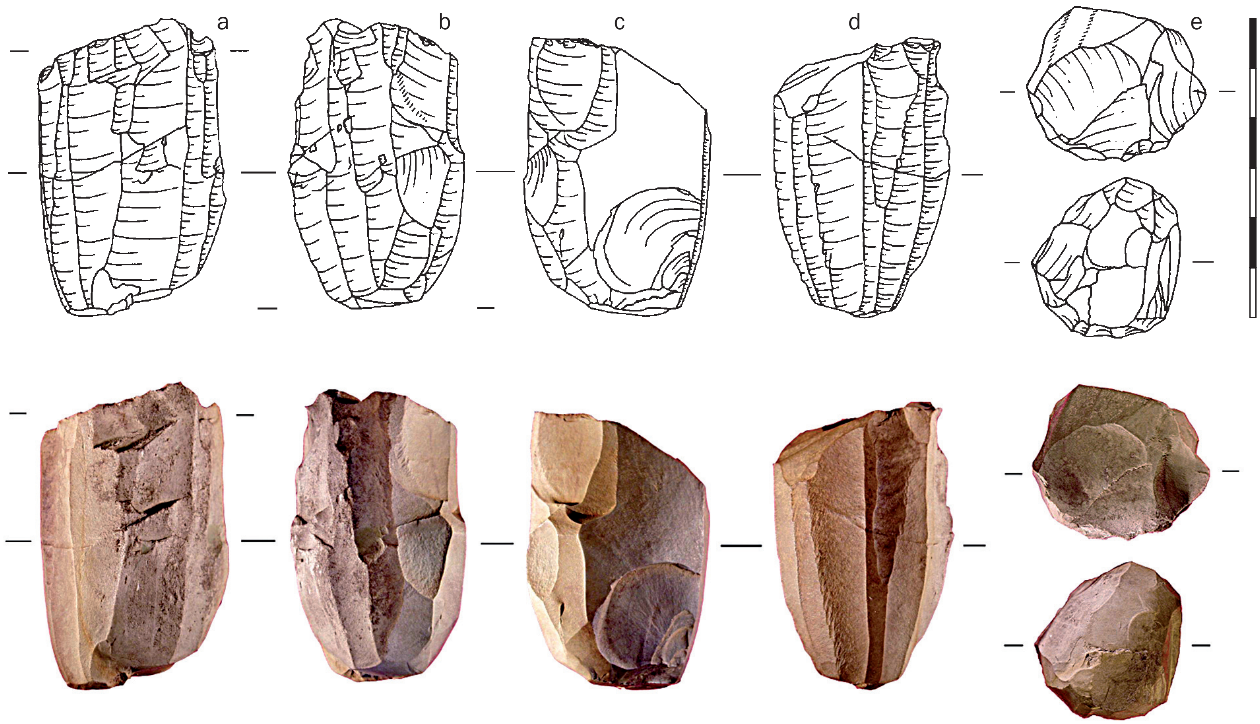

Figure 8. Blade core from Sujala. a-d) the four faces of the core; e) the striking platform; f) the base of the core. Scale in centimetres. Drawings by T. Rankama. Photographs by J. Kankaanpää.

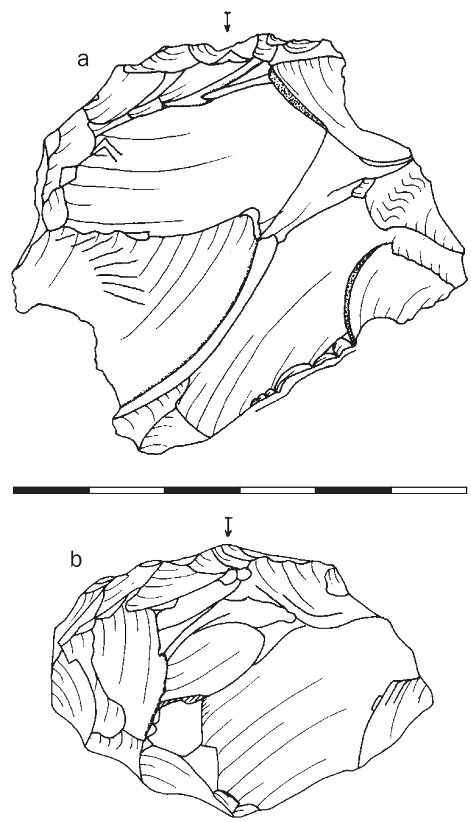

Figure 9. Core tablets from Sujala. Scale in centimetres. Drawings by T. Rankama.

nology. This method of platform rejuvenation is also a key feature that separates it from the blade technology prevalent in Scandinavia at the time of the Sujala occupation, where the platform was, as a rule, plain (Sørensen 2006:287; M. Sørensen *pers. comm.* 2009).

Special care was taken in preparing the platform for each blade removal. This resulted in a large number of core-edge trimming flakes (cf. **Fig. 6**). The careful preparation can be seen also in the blades (**Fig. 10**) which are extremely regular. The dorsal ridges and blade edges are straight and parallel. The proximal ends always have a lip on the ventral side, suggesting the use of a soft fabricator. The blades, thus, also bear strong evidence of the pressure technique, where the body weight was applied to the core with the help of a crutch or, in the case of the wider blades, a lever mechanism, the exact nature of which is as yet unknown (J. Pelegrin & M. Sørensen, *pers. comm.* 2009; see Inizan *et al.* 1999:Fig. 30; Pelegrin 1984).

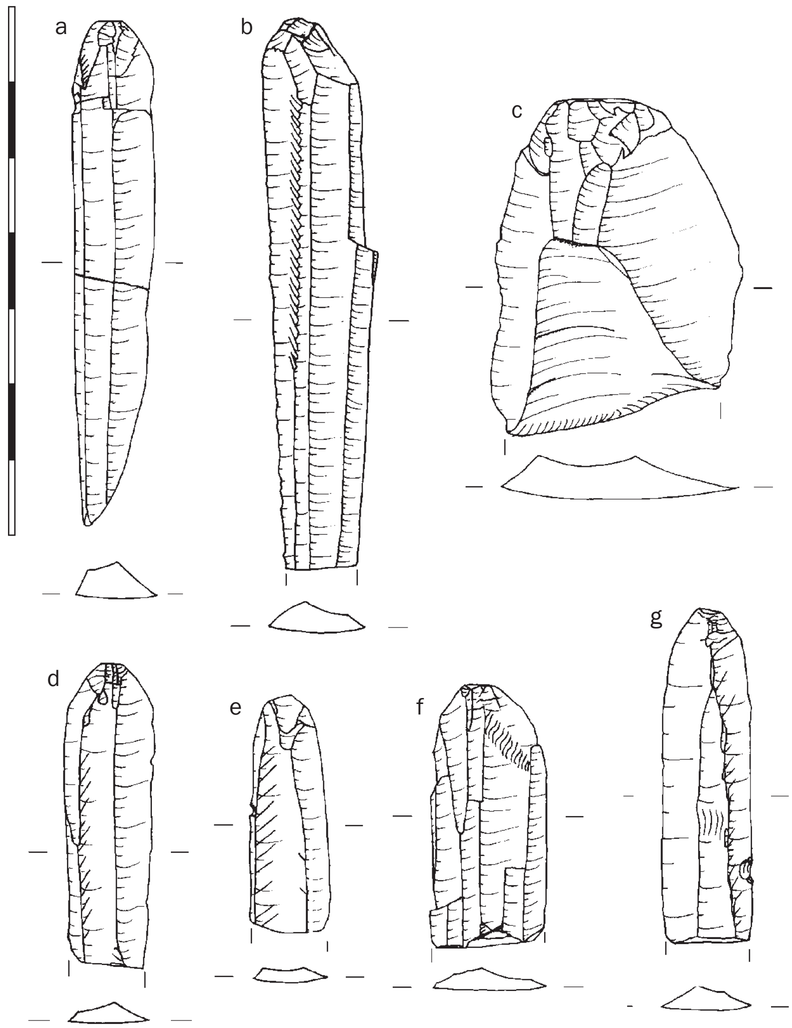

Figure 10. Complete blade and proximal fragments from Sujala. c) is a *languette* fracture. Scale in centimetres. Drawings by T. Rankama.

Most of the fragmentary blades shown in **Figure 10** are fairly narrow, but much wider ones, such as **Figure 10:c** (a *languette* fracture of a longer blade), also occur. In the measured proximal ends, blade widths range between 2.2 and 43.3 mm, with an average of 13.2 mm.

In addition to extremely regular edges and dorsal ridges, the blades also have a remarkably straight side profile (e.g., **Fig. 11:a**). Another common characteristic feature is semi-abrupt retouch that runs along the edges of the blades (**Fig. 11**). The retouched edges often show distinct signs of wear.

Another very typical feature of the Sujala assemblage is the manner of intentional snapping of the blades. The exact method of the snapping has yet to be ascertained. Although some diagonal unintentional snaps occur, most of the snaps are perpendicular to the long axis of the blade and may have been achieved by simply bending the blade against the edge of a hard surface. This often accidentally produces triangular edge fragments (M. Sørensen *pers. comm.* 2010), which are common in the Sujala assemblage.

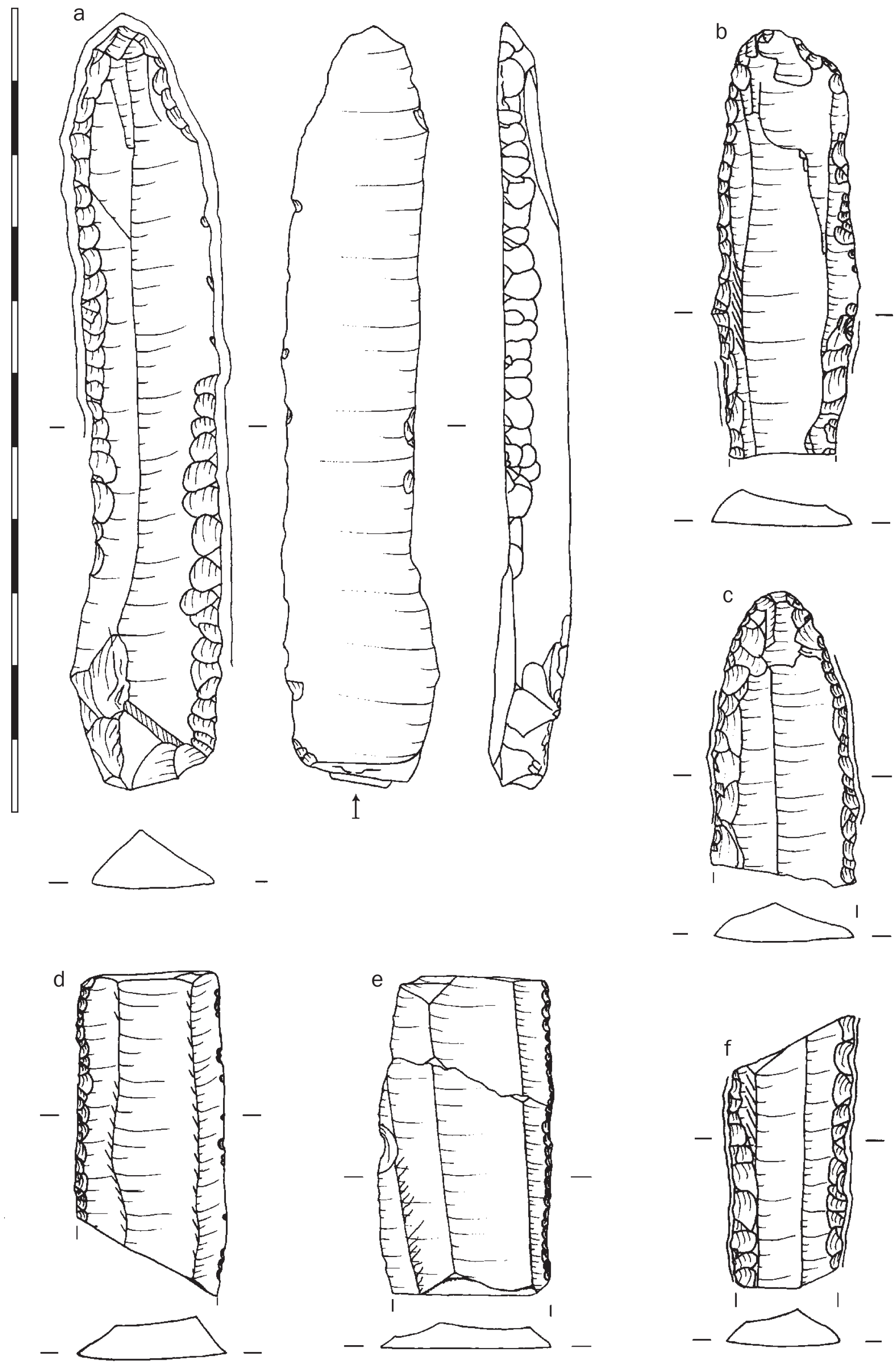

Figure 11. Edge-retouched blades from Sujala. Scale in centimetres. Drawings by T. Rankama.

There is no unequivocal evidence of the microburin technique,[1] and no microliths so common in western European blade assemblages occur. While the snapping at Sujala often took place after the retouching of the blade edges (**Fig. 12**), the snapped surfaces are never retouched. The only exceptions to this are the few scrapers. Instead of microliths, there are a large number of intentionally snapped short rectangular blade segments, the corners of which often show evidence of wear (**Fig. 13**).

The blades were used in several different ways. The irregular bilateral damage along the edges of some long blades, as well as use wear on the corners of snapped blades, indicate use without any secondary modification. On the other hand the retouch along the edges of many blades seems frequently to have been only the first step in their use life: often the tools were recycled and used again for a different function. This applies especially to

[1] The assemblage includes only one (accidental?) microburin.

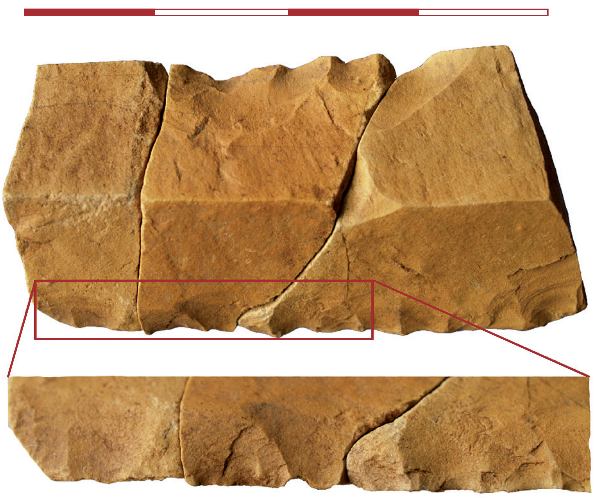

Figure 12. Snapped blade with retouched edges from Sujala. In the bottom picture the artefact has been tilted to show the retouch better. Scale in centimetres. Refit by S. Coulson. Photographs by J. Kankaanpää.

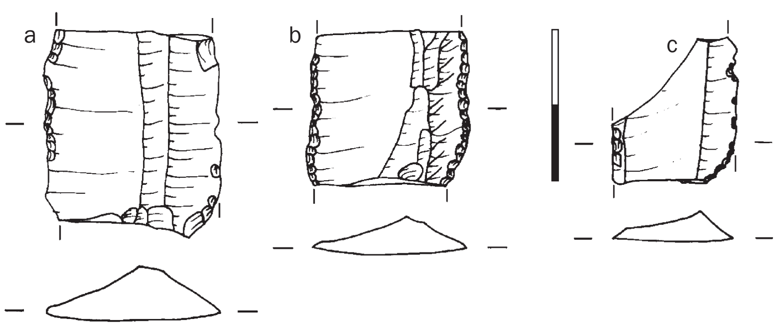

Figure 13. Short rectangular blade segments from Sujala. Scale in centimetres. Drawings by T. Rankama.

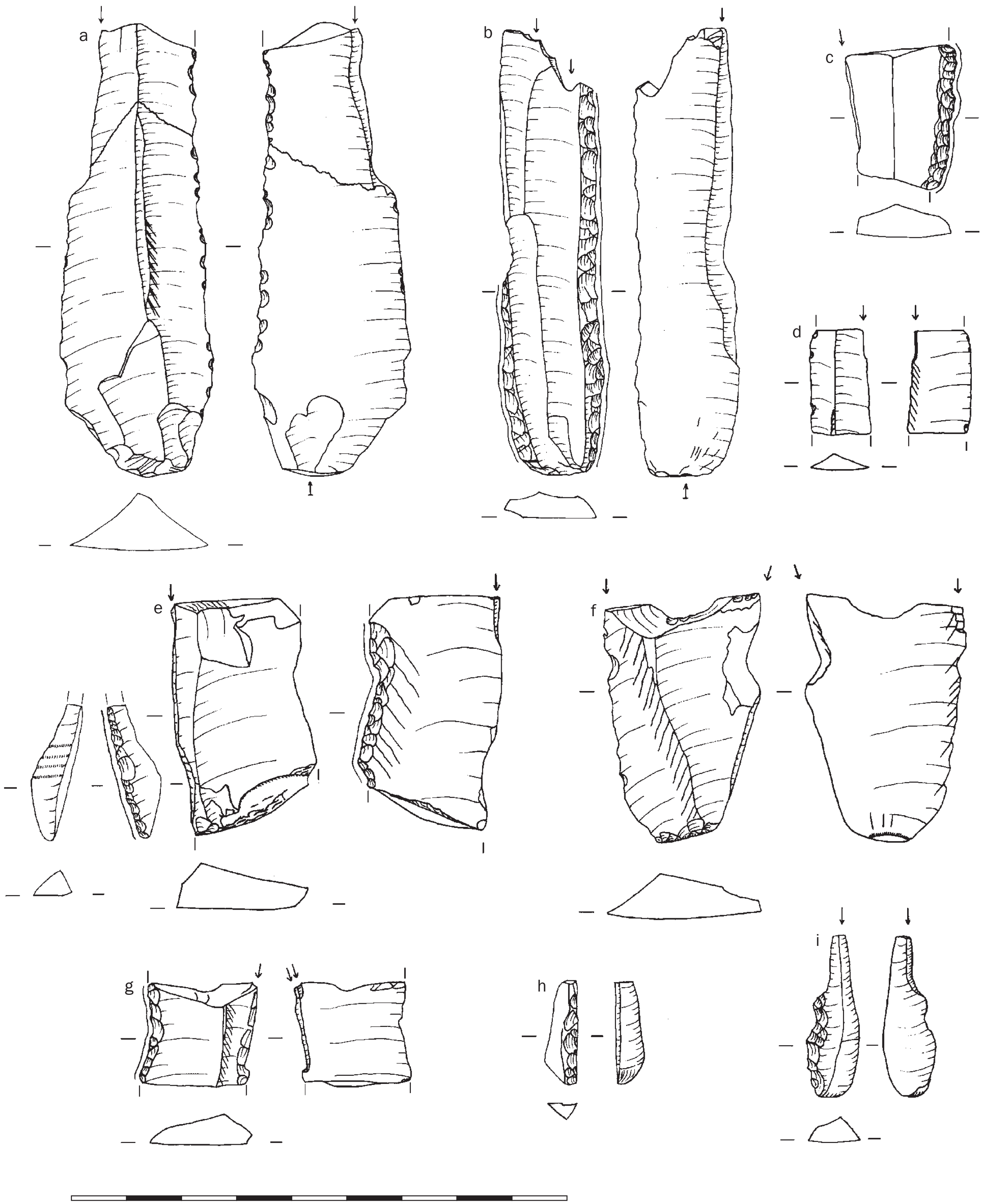

Figure 14. Burins and burin spalls from Sujala. Scale in centimetres. Drawings by T. Rankama.

the burins, which were usually manufactured from edge-retouched blades exhibiting use wear. Evidence of this can be seen both in the burins and in the burin spalls (**Fig. 14**). The burin in **Figure 14:a** has bilateral damage to one edge, suggesting use for sawing antler before burination (M. Zhilin *pers comm.* 2006). Some burins were rejuvenated several times (e.g., **Fig. 14:b**).

The end scrapers are a small and varied group of artefacts with little in common (**Fig. 15**). They include a couple of unusual-looking stemmed scrapers, one where the stem has been shaped by retouch that shows signs of wear (**Fig. 15:a**), and another where the stem has been shaped by burin blows (**Fig. 15:b**).

All of the arrowheads (**Fig. 16**) were manufactured according to the same basic plan. They are all tanged and the ventral side of their tip has invasive retouch from both edges meeting at the centre. They are aligned in the same direction as the blade, with the tang at the proximal and the tip at the distal end of the blade. The alignment follows the main dorsal ridge of the blade. The preform (**Fig. 16:h**) suggests that tip retouch was the first stage of point manufacture. The tang is diamond shaped with either bifacial or unifacial retouch, depending on the original shape of the blade.

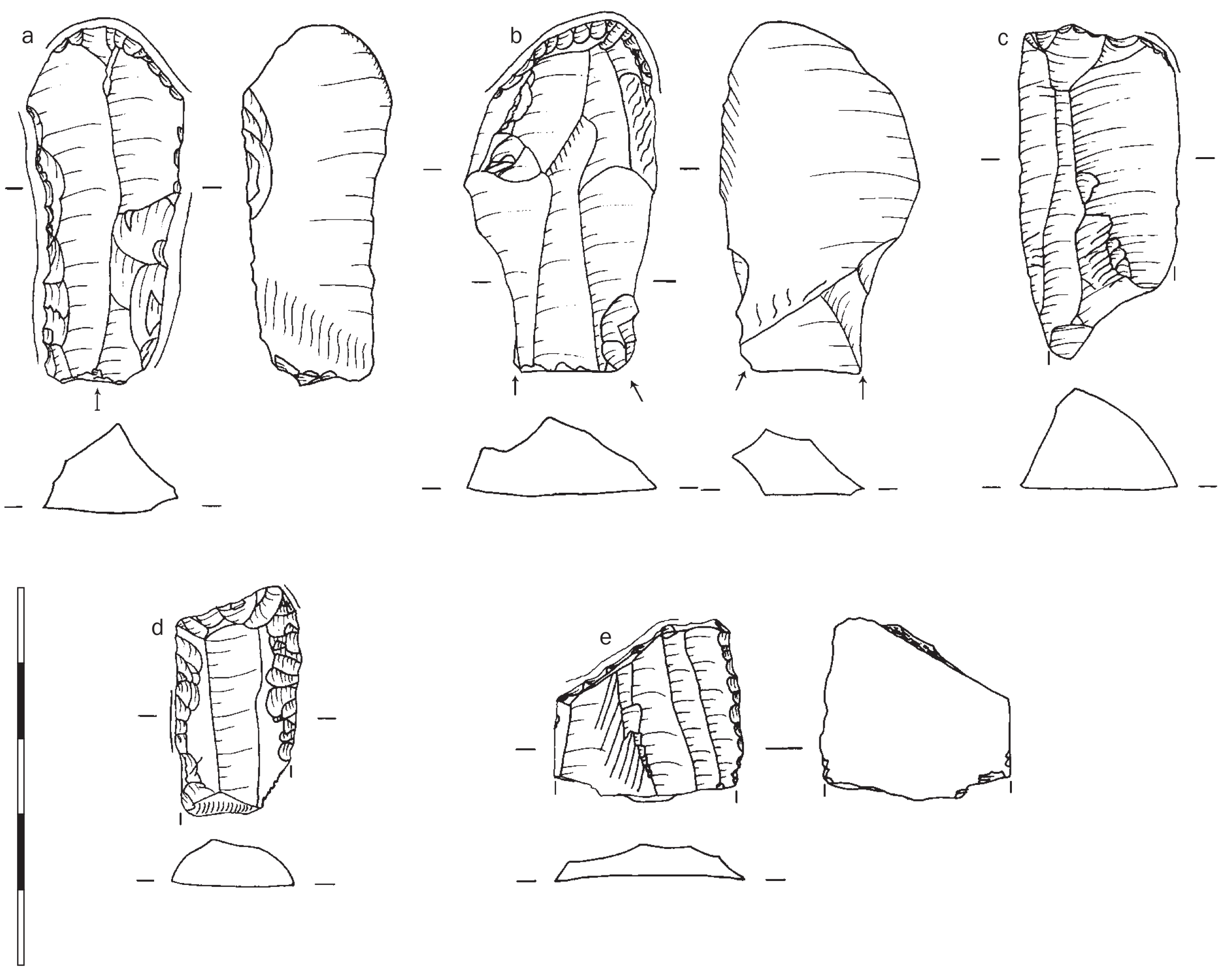

Figure 15. Scrapers from Sujala. Scale in centimetres. Drawings by T. Rankama.

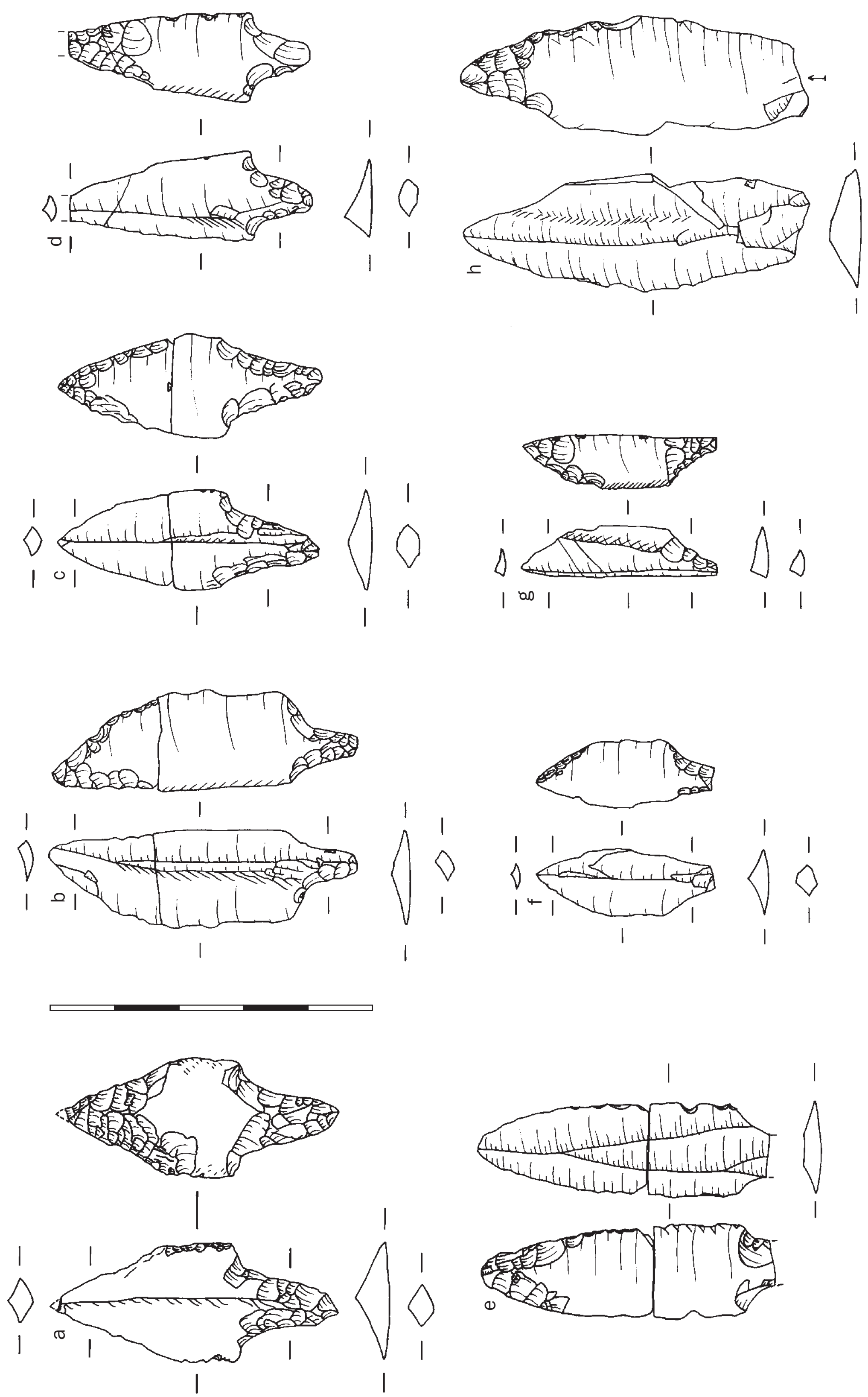

Figure 16. Tanged points (a–g) and a preform (h) from Sujala. Scale in centimetres. Drawings by T. Rankama.

Summary

The results of the analyses of the Sujala lithic assemblage indicate on-site blade production from cores that were apparently produced elsewhere and brought to the site ready-shaped. The amount of raw material carried to the site was considerable – the recovered material weighs 3074 grams and represents only a part of the whole, since a range of artefacts will have been carried away from the site when leaving. The blades were used as tools either with or without secondary modification. Recycling of used and retouched blades was common. The amount of core reduction, the varied tool kit, and the substantial evidence of tool use indicate that the site does not represent a hunter's overnight visit but rather a camp site of some duration used by a small group that included skilled chert knappers, visiting the area in pursuit of reindeer and waterfowl.

The type of arrowhead, the pressure technology, the method of platform rejuvenation, the method of snapping the blades, and the absence of the microburin technique are among the characteristics that indicate that the people who left this assemblage at the Sujala site had an origin east or south-east of Finland. The closest parallels to the assemblage can be found among the Post-Swiderian complexes of north-western Russia, especially assemblages of the Butovo culture, the centre of which lies in the Moscow region (e.g., Koltsov & Zhilin 1999; Sorokin 1981; Žilin 2006).The Sujala population, thus, was not related to the Early Mesolithic "Komsa" inhabitants of the north Norwegian coast, who are believed to have originated in north-western Europe (Bjerck 1994; Fuglestvedt 1999; Grydeland 2005; Olsen 1994; Sandmo 1986) and whose blade technology differed from theirs in almost every respect (see Woodman 1993; 1999). Since the Sujala raw material indicates contacts with the coastal sphere, this situation produces the potential for communication and exchange of ideas between two Early Mesolithic populations of completely different origins: an interface with intriguing possibilities for further research.

The spatial analysis

During excavation, the provenance of all finds was recorded manually: horizontally to within the nearest centimetre for individual finds and within a radius of five centimetres for clusters, vertically by 2.5 cm or 5 cm (2005, spit 1) artificial layer. In some cases, dense concentrations of small finds were excavated in 20 x 20 cm squares and sieved with a 2 mm sieve. All excavated soil was put through a 4 mm sieve to catch unnoticed finds. In order to retrieve small bone fragments, all excavated soil from the large dark stain was put through a 2 mm sieve, spit 1 in 50 x 50 cm quadrates (quarter-squares) and spits 2a and 2b in 20 x 20 cm squares, and this also produced quite a number of exceedingly small (<0.02 g) chert artefacts. No clear stratigraphy was observed. Maximum find depth was c. 20 centimetres, with the majority (>99%) of lithic finds deriving from the top 10 centimetres. The site is interpreted as a single-component (in all likelihood a single-event) site on the basis of site structure, the radiocarbon dates, and the uniformity and uniqueness of the lithic assemblage. The vertical distribution, such as there is, has presumably been produced by trampling and natural turbation (primarily cryoturbation and root action, possibly also rodent burrowing) and is thus practically useless as a chronological indicator. It might be suspected that the finds closest to the surface have suffered more post-depositional displacement than the deeper ones, especially by traffic along the track that now runs across the site. However, a comparison of the find scatters of the different layers shows no clear evidence of this, nor do the observed clusters show any correlation with the topographical features of the site (natural depressions, wheel ruts, etc.). The spatial analyses presented below therefore combine all excavation layers on the assumption that any post-depositional misplacement will have resulted primarily in unstructured "noise" rather than in a structured skewing of the spatial patterns. This assumption is supported by the very clear differences in the distributions of the various find categories, as may be observed below.

Sujala Area 2 is, so far, the only site in northern Scandinavia with this type of lithic assemblage to be fully excavated. Since it apparently contains only one dwelling with associated features, spatial analyses cannot as of yet look for recurring patterns as suggested by, e.g., Grøn (1995:10). Instead, one is limited to searching for patterns within a single case, and conclusions will consequently be less secure with no guarantee of general applicability.

Weight grams	Total finds	% of total	Sieve finds	% of class	No prov.	"Accepted" finds
≤0.1	3612	57.0	93	2.6	1	3518
0.11 – 0.99	1891	29.8	422	22.3	3	1466
1.0 – 9.9	772	12.2	41	4.3	0	731
10.0 ≤	66	1.0	0	0.0	1	65
total	**6341**		**556**	**8.8**	**5**	**5780**

Figure 17. Percentages of chert weight classes in total finds as compared to finds from 4 mm sieve.

The assemblage from Sujala Area 2 can be divided into four finds categories: chert, other lithic materials, burnt bone, and charcoal. There are several reasons for dividing the lithics into chert and other materials. First, it is specifically the chert that renders the site unique in Finland. Artefacts made from a similar raw material have been found in a number of other archaeological sites in northern Finnish Lapland, but these finds are limited to very small numbers or to individual pieces in assemblages dominated by quartz. The chert at Sujala also forms a technological unit: all identified chert derives from a blade industry of a very specific type, of which Sujala represents the first published reduction site in Finland[2]. Comparable end products, including pressure blades and Post-Swiderian style arrowpoints made from imported flint, are known from, e.g., the Ristola site in Lahti and the Saarenoja 2 site in Joutseno, but in much smaller numbers (see Takala 2004:101–102, 106; Jussila 2001; Jussila & Matiskainen 2003). Finally, chert forms the great majority of the Sujala finds, 6341 pieces or over 99% of all lithic finds from Area 2. The remaining lithic finds from Sujala Area 2 – 46 pieces in all – consist primarily of quartz. With the exception of a single conical quartz blade core, they do not display any unique traits, nor do they differ to any notable degree from the quartz artefacts that characterize most Finnish Stone Age and Early Metal Age sites. Though the distribution pattern suggests that these lithics belong to the same occupation as the chert, the fact that quartz is ubiquitous in the Finnish Stone Age while the Sujala chert is practically unique nevertheless renders it prudent to treat the chert and the other lithics as separate categories.

In the following spatial analysis, the total Area 2 chert assemblage of 6341 pieces is considered when calculating expected values, but for obvious reasons finds whose provenance is known only to the square metre (i.e., full-square sieve finds, total: 556 pieces) and finds of unknown original provenance (back dirt finds and unplotted surface finds, total: 5 pieces) are not included in the actual clusters or the outlier group used in the cluster analysis (see below). The remaining "accepted" finds total 5780 pieces or some 91% of all chert finds. Leaving out full-square sieve finds might naturally be thought to have a skewing effect on the results since one would expect sieve finds to consist primarily of small objects, the larger ones being more readily noticed during trowelling. However, the reality is not quite that straightforward. If all finds are divided into four weight classes[3], ≤0.1 g, 0.11–0.99 g, 1–9.9 g, and ≥10 g (**Fig. 17**), it may be noted that the class with the largest proportion of full-square sieve finds is not the smallest class but the second-smallest, the 422 sieve finds in the 0.11–0.99 g class accounting for 22.3% of all finds in that size group and no less than 75.9% of all sieve finds.

[2] Further excavation in 2009 at the Saarenoja 2 site has also produced evidence of on-site core reduction (Aivar Kriiska *pers. comm.* 2009), but the results were still unpublished when this article went to press and precise data was thus unavailable.

[3] Only separately catalogued finds were weighed individually. For this calculation, finds catalogued – and thus also weighed – as multiple-find units (e.g., all trimming flakes from a 20 x 20 x 2.5 cm square) were assigned an "average" weight derived by dividing the total weight of the unit by the total number of finds. Since the actual weights of the individual pieces in grouped finds vary, the "averaging" system tends to introduce a slight skew towards the small end of the weight scale since some heavier-than-average members of grouped finds would probably actually belong to the next higher weight group.

Type	All finds A2	% of total	Sieve finds	% of category	% of expected
Unidentified fragment	2069	32.6	143	6.9	78.8
Blade/blade segment	1739	27.4	210	12.1	137.7
Core trimming flake	1368	21.6	99	7.2	82.5
Retouched blade/seg-ment	401	6.3	40	10.0	113.8
Core tablet	356	5.6	34	9.6	108.9
Flake	167	2.6	10	6.0	68.3
Other tools	176	2.8	10	5.7	64.8
Other waste	65	1.0	10	15.4	175.5
totals	**6341**	**100.0**	**556**	**8.8**	**100.0**

Figure 18. Percentage of 4 mm sieve finds as compared to all finds in different chert find categories.

The picture is similar when looking at the tendencies of different find groups to be found in the sieve (**Fig. 18**; the groups will be discussed later).

The "% of expected" column shows the proportion (as per cent) of sieve finds in each category as compared to the average proportion of sieve finds in all categories (=8.8%). If this figure were close to 100% in all groups, the effect of sieving could be said to be random, i.e., statistically meaningless. This is obviously not the case. Out of the four largest find categories, the smallest find types – unidentified fragments and core trimming flakes – are in fact underrepresented in the sieve finds, while the larger types – retouched and unretouched blade segments – are overrepresented (**Fig. 18**). One possible explanation is that the smallest finds were so small that they would have slipped through the 4 mm mesh of the large sieve employed at the back dirt pile. However, it should be noted that locations where clusters of very small finds and/or bone were observed (and which produced the majority of the very small finds) were first sieved in small sections with a 2 mm mesh kitchen sieve, and consequently there would have been nothing left to be caught in the larger sieve. The finds recovered with the 2 mm sieve actually complement the 4 mm sieve finds: 1084 pieces or 30% of the smallest size class (<0.1 mm) came from the 2 mm sieve while the figures for the next two size groups falls to 4.5% and 1.7% respectively (**Fig. 19**). The number of 2 mm sieve finds in the smallest category may seem very high – nearly a third of the whole size class – but it should be noted that excavating concentrations of small finds directly into the sieve in small blocks was employed intentionally as an excavation tactic when it became clear that recovering these finds by regular trowel-and-tweezers excavation would take an inordinate amount of time. The small size of the blocks (usually 20 x 20 cm in 5 cm or 2.5 cm spits) also means that find provenance is known to within c. 10 cm, which is within the accuracy limit used in the present distribution analysis. 2 mm sieve finds are consequently included in the "accepted" category. The aforementioned 2 mm sieve finds from the 50 x 50 cm Spit 1 quadrates in the area of the large stain/dwelling are also included, since the quadrates all fall completely within Cluster 1.

Weight g	Finds, 2 mm mesh	% of total	Finds, 4 mm mesh	% of total	Combined sieve finds	% of total
≤0.1	1084	30.0	93	2.6	1177	32.6
0.11 – 0.99	86	4.5	422	22.3	508	26.9
1.0 – 9.9	13	1.7	41	5.3	54	7.0
10.0 ≤	0	0	0	0	0	0
totals	**1183**		**556**		**1739**	**27.4**

Figure 19. Chert finds from 2 mm mesh sieve and 4 mm mesh sieve as per cent of total finds.

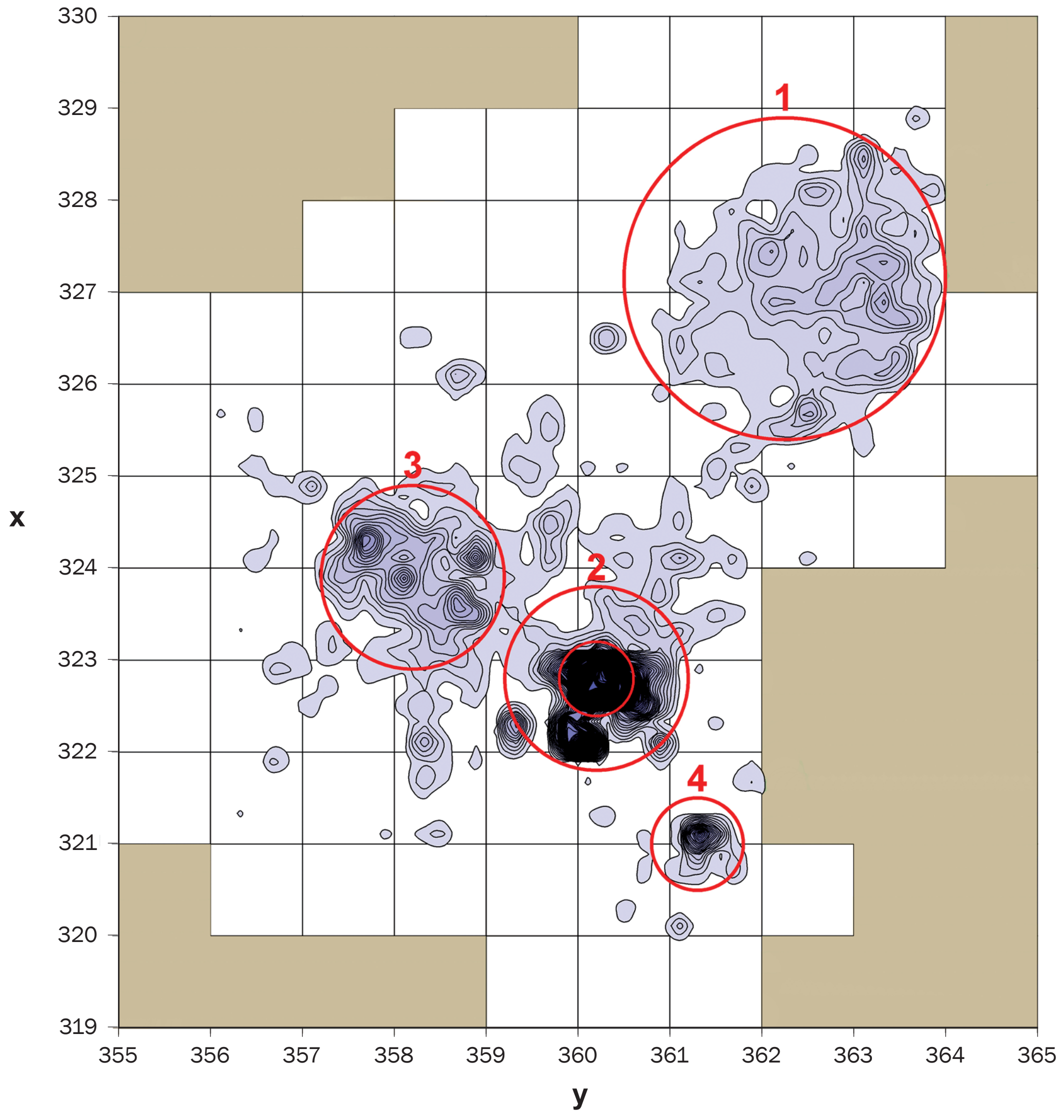

Figure 20. Sujala excavation grid with chert find density (grid 20 cm, curve interval 2; grey = unexcavated) and sampled clusters (red). Only finds with location accuracy to 10 cm or less are included, hence the sieve finds from the 50 x 50 cm quadrates in Cluster 1 are not shown.

Plotting the chert finds as a density map based on a 20 cm grid (**Fig. 20**) reveals three major concentrations and one minor one. One major concentration, hereafter referred to as Cluster 1, corresponds to the large bone-and-charcoal stain interpreted as a dwelling floor, near the north-eastern corner of the excavation. A second major concentration, Cluster 2, is located slightly south of the middle. The third major concentration, Cluster 3, lies immediately north-west of this. A smaller concentration, Cluster 4, lies in the southern part of the excavation. Several smaller clusters can also be distinguished, but most of them appear to be "appendages" of clusters 2 and 3.

In order to facilitate sampling, circular cluster boundaries were placed "by eye" to cover the perceived distinct clusters. The symmetric shape of the sampling areas was chosen in order to allow filtering of the find catalogue using a simple trigonometric formula; the actual clusters, of course, are more or less irregular. Chert finds numbers from the clusters are presented in **Fig. 21**. Altogether, the four sampled clusters accounted for 4773 chert artefacts or nearly 83% of all "accepted" chert finds, the remaining 1007 finds (17%) with accurate provenance data lying outside the clusters.

Type	Area 2 total		Cluster 1		Cluster 2		Cl. 2 80 cm		Cluster 3		Cluster 4		Outside	
	nr.	%	nr.	% exp.	nr.	% exp.	nr.	% exp.	nr.	% exp.	nr.	% exp.	nr.	% exp.
Fragment	2069	32.6	416	87.2	1038	126.6	789	129.5	216	98.4	54	131.3	202	61.5
Blade	1739	27.4	426	106.2	514	74.6	341	66.6	182	98.6	33	95.5	371	134.3
Trimming flake	1368	21.6	208	65.9	801	147.8	649	**161.1**	167	115.0	7	**25.8**	86	**39.6**
Retouched blade	401	6.3	155	**167.6**	26	**16.4**	7	**5.9**	28	65.8	3	**37.6**	148	**232.4**
Core tablet	356	5.6	108	131.6	93	65.9	67	63.9	33	87.3	23	**325.1**	65	115.0
Flake	167	2.6	66	**171.4**	15	**22.7**	7	**14.2**	19	107.2	5	**150.7**	52	**196.1**
Other tools	176	2.8	62	**152.8**	18	**25.8**	4	**7.7**	20	107.1	1	**28.6**	64	**229.0**
Other waste	65	1.0	21	140.1	7	**27.2**	3	**15.7**	8	116.0	0	**0.0**	19	**184.1**
sum/% of total	**6341**	**100.0**	**1462**	**23.1**	**2512**	**39.6**	**1867**	**29.4**	**673**	**10.6**	**126**	**2.0**	**1007**	**15.9**

Figure 21. Total number and percentage of different categories of chert finds from Area 2 compared to size of categories in different clusters as percent of expected values.

The question arises, whether the find concentrations represent specific activities and thus reflect the structure of the site and the behaviour of its occupants. One method of studying this is through a statistical analysis of the contents of the clusters.

For the purpose of this analysis, the finds were divided into eight find classes: 1) unidentified fragments, 2) blades and blade segments, 3) core trimming flakes, 4) retouched blades and blade segments, 5) core tablets, 6) other flakes, 7) other tools (burins, scrapers, tanged points, retouched flakes and other retouched tools, and tools identified by wear), and 8) other waste (burin spalls, cores, core fragments, and core preparation/rejuvenation blades and flakes). The actual numbers of finds in these classes in each cluster were compared to the "expected" numbers based on the volumes of the total classes as compared to the total number of finds using a contingency table; in other words, the relative sizes of the classes in the individual samples were evaluated *vis-á-vis* their proportions in the complete assemblage. The results are presented in **Figure 21** as per cent of the expected figure, thus giving an indication of which classes are overrepresented and which underrepresented in each cluster. Percentages differing more than 10% from the total mean are shown in red (more than average) or blue (less than average); percentages more than 50% over or under the mean are in boldface.

The results are suggestive. In Cluster 1, consisting of the finds from the presumed dwelling, the percentages show exactly the opposite tendency as those of Cluster 2, the largest "courtyard" cluster. The difference is particularly noticeable in the numbers of retouched blade segments, other tools, and flakes, which are much higher than expected in Cluster 1 (168%, 153%, and 171%, respectively) and much lower than expected in Cluster 2 (16%, 26%, and 23%, respectively). The difference is even more pronounced when only the central 0.8 metres of Cluster 2 are considered, the figures here being 6%, 8%, and 14%, respectively. The same applies – though to a slightly lesser degree – also to blade segments, core tablets, and other waste, which are slightly to moderately high in Cluster 1 (106%, 132%, and 140%) and clearly low in cluster 2 (75%, 66%, and 27%). With unidentified fragments and core trimming flakes, the situation is reversed; both are slightly low in Cluster 1 (87% and 66%) and high in Cluster 2 (127% and 148%, respectively). Again, the figures for the central area of Cluster 2 are even higher (130% and 161%).

We cannot say that Cluster 2 is the full negative of Cluster 1 since the majority of finds from both clusters (72% for Cluster 1 and no less than 94% for Cluster 2) consists of unidentified fragments, blade segments, and trimming flakes, albeit in different proportions. Nevertheless, the impression is that Cluster 2 consists primarily of core reduction waste, a large part of which was probably dumped in the vicinity of 322.80/360.30 in one single event and may have originated from the area of Cluster 1, in other words, from inside the dwelling. One reason for assuming dumping rather than primary core reduction is that the concentration is so small in area – in our experience, fly-off from normal core trimming would have formed a larger pattern.

The fact that most of the finds belonging to the categories that are "underrepresented" in the dwelling (as represented by Cluster 1) and "overrepresented" in the courtyard (as represented by Cluster 2), i.e., unidentified fragments and core trimming flakes, are on average very small in size and weight, runs counter to the common observation that it is specifically the small waste that remains in the house while the large waste (>4 cm) tends to get cleaned out (e.g., Grøn 1995:5; 1998:12). However, it is possible that the core reduction indoors took place on a skin apron or rug that was then shaken out outside. Another reason for presuming an apron is the fact that the "outdoors" concentrations of core reduction waste did not contain any burnt bone or charcoal, both of which were abundant in the matrix of Cluster 1. Flecks of bone and charcoal would inevitably have accompanied waste swept or shovelled directly off the floor, and swept or shovelled it would have been, as it is quite unthinkable that anyone would have taken the trouble to pick up the hundreds of minuscule trimming flakes individually by hand.

It is of course also possible that the reduction itself was carried out in the courtyard, but that would not explain the presence of a higher-than-expected number of core tablets in the "indoors" Cluster 1 and a corresponding lower-than-expected number of core tablets in Cluster 2. It would be convenient to presume that the explanation lies simply in the fragments and trimming flakes having been collected from one location and deposited in the other. However, it is rather difficult to imagine why (considering that both core tablets and trimming flakes are produced by the same operation, i.e., core reduction) specifically the small debitage would have been thrown out and the large debitage left lying on the floor. One possible explanation would be that the larger pieces were intentionally saved for use as, or for working into, tools. A preliminary classification of the collection for cataloguing purposes suggests that core tablet tools were in fact part of the toolkit although they were not very common; so far, eleven retouched core tablet tools and one core tablet tool with use wear have been identified.

The extremely dense and localized cluster lying within a 40 cm radius of the centre of Cluster 2 suggests a single event. Total finds from this area number 1867 or some 32% of all "accepted" finds from Area 2. However, this cluster contained only eleven retouched tools: seven retouched blade segments, two retouched fragments, one blade sidescraper/burin, and one blade burin. It contained neither tanged points nor endscrapers. Particularly the low number of retouched blade segments is statistically highly significant since it represents only 6% of the expected value, which would have been 117. The four "other tools", the retouched fragments and scrapers, are also highly significant as a group since the expected value was 52. The fact that the cluster has high values for unidentified fragments and core trimming flakes (130% and 161%, respectively) and low values for everything else strongly suggests that it consists primarily of debitage from one or several episodes of core reduction rather than from the general cleaning of a living or working floor, which could be expected to also contain depleted and broken tools, fragments of broken and mended weapons, etc..

Cluster 3 differs from Cluster 2 in not having a strong central concentration. The distribution rather resembles Cluster 1, but there are no signs suggestive of a dwelling, i.e., no staining, burnt bone, charcoal, or other evidence of fire. The cluster also appears to thin out evenly at the edges, without evidence of the wall effect (vide Figure 3). The presence of both waste and various tools suggests it was a "general purpose" activity site that was probably used recurrently for diverse tasks including tool making and tool use. The statistics do not support its use as a dump in the manner of Cluster 2.

Cluster 4 is problematic. The very high number of core tablets is partly illusory because some are fragmentary and have been refitted; the true number is 16. This, nevertheless, is still c. 2.4 times the expected number (6.7). The figure for trimming flakes should also be corrected down to 5, since three are fragments of a single flake. Even with these corrections, however, the figures are odd. The high number of core tablets as compared to the very low number of trimming flakes suggests platform shaping, but there are also a respectable number of blades – in fact, over six times the number of trimming flakes. The number of trimming flakes as compared to fragments is also very small, which is curious because these two classes tend to co-vary in the other clusters. The cluster obviously represents some kind of selection, but if so, it is difficult to understand why the number of unusable fragments is so high. All of the fragments are very small, under 0.2 grams by weight, so they clearly are pure waste.

The finds that remain outside the four clusters also present interesting statistics. As with Cluster 1, unidentified fragments and trimming flakes are under-represented, while blade segments and core tablets are moderately, and retouched blade segments, flakes, other tools and other waste strongly, overrepresented. This result, combined with the tendency of core reduction waste to concentrate in the clusters, suggests that core reduction and tool making were carried out in limited, fixed locations while other lithics-related activities such as tool use and maintenance were less localized.

Discussion and conclusions

The above analysis of the spatial distribution of the chert finds from the Sujala site suggests that based on the distribution of trimming flakes, basic core reduction (i.e., blade production) appears to have been carried out primarily in two locations: inside the presumed dwelling (Cluster 1) and in the courtyard (Cluster 2). However, the complementary asymmetry as regards the proportions of core tablets to other core reduction waste in these two locations renders it more likely that a major part of the reduction debris in the courtyard was originally derived from inside the dwelling, which still retained the largest number of core tablets. An apron or rug could have been used to catch the small debris, which was subsequently dumped outside, most of it in the middle of Cluster 2. The tight cluster of the dump site (central Cluster 2) indicates that the debris was not simply tossed out but carefully poured from the apron/rug.

The distribution of finds in the courtyard suggests that the door of the dwelling was to the south-west. Thus, the dump site would have been almost directly in front of the door at a distance of 3–4 metres. As regards the use of the "inside" space, there is a tendency for lithic finds (particularly flakes, blades, and core tablets) to cluster towards the south-eastern side of the dwelling, i.e., to the right of the door when going in. This tendency is not shared by the bone or charcoal, both of which cluster around the centre. The apparent "skewed" distribution of the lithics may be related to an age and/or gender-determined ordering of the inside space, as found with many historical hunter-gatherers (e.g., Itkonen 1948:184).

Judging by the distribution, the fashioning, use, and maintenance of chert tools were carried out primarily in the dwelling and in the area of Cluster 3 but also in various non-specific locations around the site. Which of these three categories the distribution reflects requires more detailed study.

Cluster 4 may represent an episode of core shaping since the relative number of core tablets is abnormally high. However, the extremely low number of trimming flakes as compared to core tablets, blades, and fragments is difficult to explain. The high number of very small fragments speaks against a selection by size.

The floor of the dwelling was not regularly cleaned out, judging by the fact that there are no traces of a concentration of debris, charcoal, or bone at or directly outside the presumed door, although the small "rubbish pit" may suggest a single cleaning event where the debris was carefully buried for some unknown reason. Lithic debris not caught by the apron/rug remained on the floor. The distribution also does not support a sweeping or scraping of the floor towards the walls, as the bone and charcoal cluster towards the centre. Non-cleaning of the floor suggests a covering of branches, which would also necessitate the use of an apron or rug for core reduction in order to retain the blades themselves. Branch or twig flooring is well documented from many historical subarctic hunter-gatherer cultures (e.g., Itkonen 1948 :184) and has been identified in, e.g., the submerged Møllegabet II Late Mesolithic site in Denmark (Grøn *in press*).

It might be wondered why an operation as precise as blade manufacture should be performed inside a presumably rather badly lit dwelling rather than outside, considering that the site was probably inhabited during the warmer season. The first calm, warm day at Vetsijärvi provided the answer: insects. Mosquitoes and blood-sucking black flies abound in Lapland, as elsewhere in the tundra and taiga zone. They are particularly numerous near water, where they lay their eggs. As any northern archaeologist will know, black flies are particularly pesky because they attack your face the moment you put your head down. The best way to avoid them is to be inside, preferably with a smudge fire to keep the mosquitoes at bay as well. Though the use of smudge fires for keeping insects away from both people and animals is well documented ethnographically, it has generally been ignored in the archaeological literature, where smudge fires – when mentioned at all – are usually connected to pottery making or skin tanning (e.g., Binford 1967; but see Grøn *in press*).

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Appendix List of catalogue numbers of the artefacts shown in the illustrations

Figure 4. KM 35224:1306+1381+1513+1787
KM 35917:645

Figure 8. KM 34574:204

Figure 9. a) KM 35224:2245
b) KM 35224:377

Figure 10. a) KM 35917:749+750
b) KM 35224:2135
c) KM 35224:448
d) KM 35917:756
e) KM 35917:655
f) KM 35227:1013
g) KM 35917:832

Figure 11. a) KM 35917:404
b) KM 35224:1891
c) KM 35224:447
d) KM 35224:1065
e) KM 35224:779
f) KM 35224:2085

Figure 12. KM 35224:950+958+969

Figure 13. a) KM 34574:20
b) KM 34574:258
c) KM 34574:201

Figure 14. a) KM 35224:600
b) KM 35224:499
c) KM 35224:1845
d) KM 35224:1330
e) KM 35224:1011+1337
f) KM 35224:1782
g) KM 35224:1122
h) KM 35224:446
i) KM35224:220

Figure 15. a) KM 35917:208
b) KM 35917:967
c) KM 35224:172
d) KM 35224:348
e) KM 35224:332

Figure 16. a) KM 34574:296
b) KM 35224:861+35917:705
c) KM 35917:989
d) KM 35917:827
e) KM 35224:427+438
f) KM 35917:11
g) KM 35917:181
h) KM 35224:191