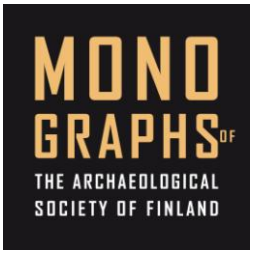


**Few and Far between – an Archive Survey of Finnish Blade Finds**

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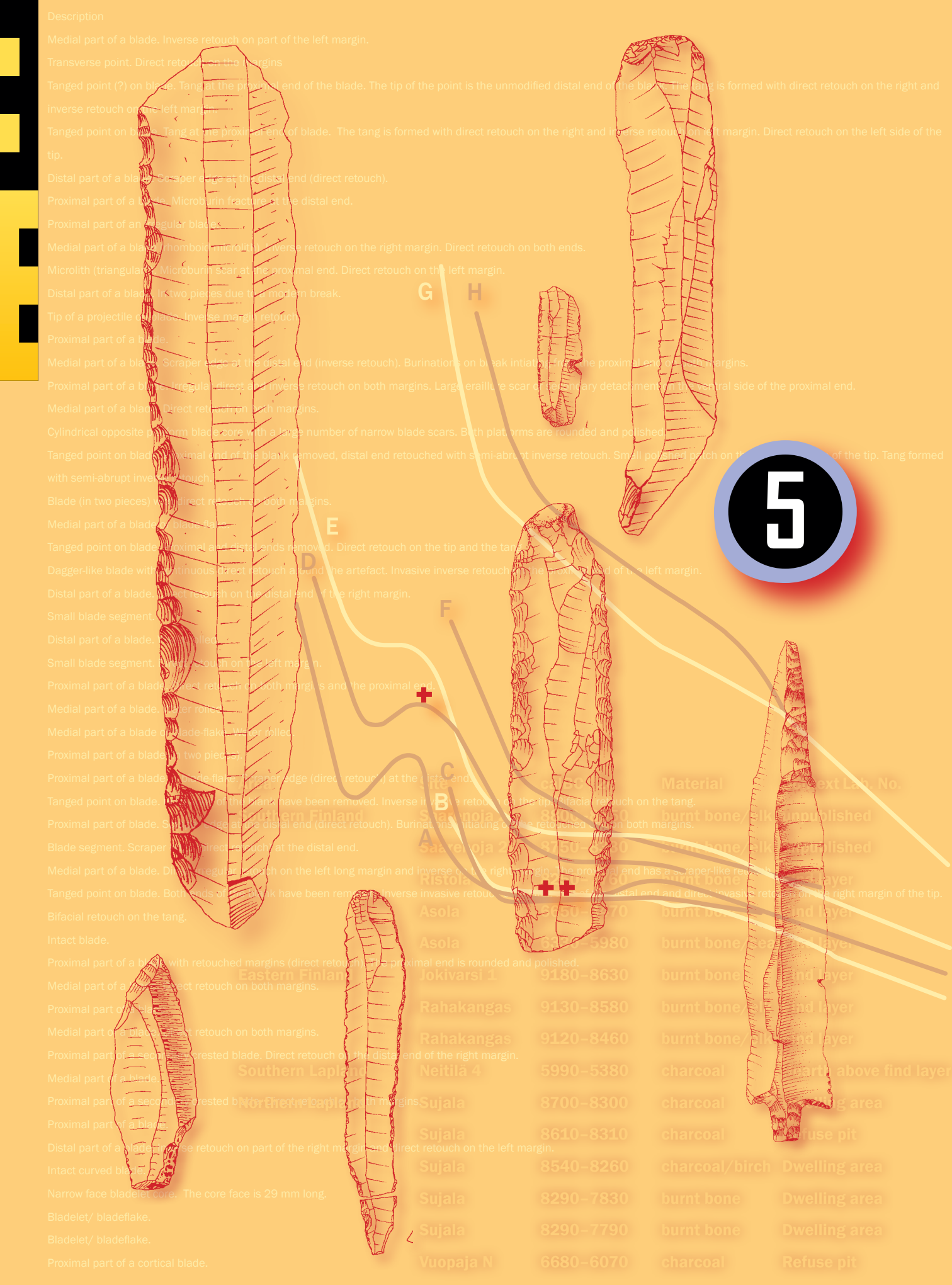



Description

Medial part of a blade. Inverse retouch on part of the left margin.

Transverse point. Direct retouch on the margins

Tanged point (?) on blade. Tang at the proximal end of the blade. The tip of the point is the unmodified distal end of the blade. The tang is formed with direct retouch on the right and inverse retouch on the left margin.

Tanged point on blade. Tang at the proximal end of blade. The tang is formed with direct retouch on the right and inverse retouch on left margin. Direct retouch on the left side of the tip.

Distal part of a blade. Scraper edge at the distal end (direct retouch).

Proximal part of a blade. Microburin fracture at the distal end.

Proximal part of an irregular blade.

Medial part of a blade. Rhomboid microlith. Inverse retouch on the right margin. Direct retouch on both ends.

Microlith (triangular). Microburin scar at the proximal end. Direct retouch on the left margin.

Distal part of a blade. In two pieces due to modern break.

Tip of a projectile or blade. Inverse marginal retouch.

Proximal part of a blade.

Medial part of a blade. Scraper edge at the distal end (inverse retouch). Burinations on break initiated from the proximal ends of the margins.

Proximal part of a blade. Irregular direct and inverse retouch on both margins. Large eraillure scar or accidental detachment scar on the dorsal side of the proximal end.

Medial part of a blade. Direct retouch on both margins.

Cylindrical opposite platform blade core with a large number of narrow blade scars. Both platforms are rounded and polished.

Tanged point on blade. Proximal end of the blank removed, distal end retouched with semi-abrupt inverse retouch. Small polished notch on the left side of the tip. Tang formed with semi-abrupt inverse retouch.

Blade (in two pieces) with direct retouch on both margins.

Medial part of a blade or bladelike flake.

Tanged point on blade. Proximal and distal ends removed. Direct retouch on the tip and the tang.

Dagger-like blade with continuous direct retouch around the artefact. Invasive inverse retouch on the proximal end of the left margin.

Distal part of a blade. Direct retouch on the distal end of the right margin.

Small blade segment.

Distal part of a blade. Rolled.

Small blade segment. Direct retouch on the left margin.

Proximal part of a blade. Direct retouch on both margins and the proximal end.

Medial part of a blade. Scraper retouch.

Medial part of a blade or blade-flake. Worn/rolled.

Proximal part of a blade. In two pieces.

Proximal part of a blade or blade-flake. Scraper edge (direct retouch) at the distal end.

Tanged point on blade. Both ends of the blank have been removed. Inverse invasive retouch on the tip. Bifacial retouch on the tang.

Proximal part of blade. Scraper edge at the distal end (direct retouch). Burination initiating from the retouched edge on both margins.

Blade segment. Scraper edge (direct retouch) at the distal end.

Medial part of a blade. Direct irregular retouch on the left long margin and inverse retouch on the right margin. The proximal end has a scraper-like retouch.

Tanged point on blade. Both ends of the blank have been removed. Inverse invasive retouch on the tip, distal end and direct invasive retouch on the right margin of the tip. Bifacial retouch on the tang.

Intact blade.

Proximal part of a blade with retouched margins (direct retouch). The proximal end is rounded and polished.

Medial part of a blade. Direct retouch on both margins.

Proximal part of a blade.

Medial part of a blade. Direct retouch on both margins.

Proximal part of a secondary crested blade. Direct retouch on the distal end of the right margin.

Medial part of a blade.

Proximal part of a secondary crested blade. Direct retouch on both margins.

Proximal part of a blade.

Distal part of a blade. Inverse retouch on part of the right margin and direct retouch on the left margin.

Intact curved blade.

Narrow face bladelet core. The core face is 29 mm long.

Bladelet/ bladeflake.

Bladelet/ bladeflake.

Proximal part of a cortical blade.

| Site | Material | Context | Lab. No. |
|---|---|---|---|
| Eastern Finland | | | |
| Sarkanoja | 8800–8630 | burnt bone/silk | unpublished |
| Saarenoja 2 | 8750–8630 | burnt bone/silk | unpublished |
| Ristola | 8660 | burnt bone | layer |
| Asola | 8650–8370 | burnt bone | find layer |
| Asola | 8360–8980 | burnt bone | find layer |
| Jokivarsi 1 | 9180–8630 | burnt bone | find layer |
| Rahakangas | 9130–8580 | burnt bone | find layer |
| Rahakangas | 9120–8460 | burnt bone/silk | find layer |
| Southern Lapland | | | |
| Neitila 4 | 5990–5380 | charcoal | part above find layer |
| Northern Lapland | | | |
| Sujala | 8700–8300 | charcoal | area |
| Sujala | 8610–8310 | charcoal | refuse pit |
| Sujala | 8540–8260 | charcoal/birch | Dwelling area |
| Sujala | 8290–7830 | burnt bone | Dwelling area |
| Sujala | 8290–7790 | burnt bone | Dwelling area |
| Vuopaja N | 6680–6070 | charcoal | Refuse pit |

# Few and Far between – an Archive Survey of Finnish Blade Finds

Mikael A. Manninen & Esa Hertell

**ABSTRACT** **Blades and blade-related finds are scarce in Finland, where ground and polished stone tools and simple flake-based technologies prevailed during most of the Stone Age. The few finds of blades deriving from systematic blade production have been largely ignored in the past. Recently, three excavated early post-glacial sites (Lahti Ristola, Lappeenranta Saarenoja 2 and Utsjoki Sujala, *c.* 8800–8000 calBC), with assemblages indicating elaborate blade technology, have brought blades and blade technologies into archaeological research focus in the area. This paper presents results of an archive survey conducted to map the temporal and geographical distribution of the blade finds currently kept in Finnish museum collections. The survey revealed 34 locations with prehistoric blade artefacts (including stray finds). The finds point towards three areas of origin: north-western Russia, southern Scandinavia, and northern Norway. According to contextual and technological details, most of the finds belong to the Mesolithic but later artefacts are also present.**

**KEYWORDS**

**Blade technology, blades, lithics, radiocarbon dates, shore-displacement chronology, typology, Finland.**

## Introduction

Ground and polished stone tools and simple flake-based technologies prevail in Stone Age assemblages in Finland, whereas artefacts indicating blade technology are markedly scarce (Hertell & Manninen 2005; Jussila *et al.* 2007; Luho 1956; Nuñez 1998; Rankama 2002; Rankama *et al.* 2006; Schulz 1990). Due to this scarcity, blade artefacts were rarely discussed in the archaeological literature in Finland prior to the 1980s (but see, e.g., Luho 1956; Meinander 1964). However, since the recognition of an Early Mesolithic component in the assemblage from the Ristola site in Lahti in the early 1980s, the presence of blades in the local archaeological record has become increasingly acknowledged (e.g., Edgren 1984; Hertell & Manninen 2006; Kinnunen *et al.* 1985; Matiskainen 1989; Matiskainen 1996; Pesonen 2005; Schulz 1996). Recently, three excavated early post-glacial sites (Lahti Ristola, Lappeenranta Saarenoja 2, and Utsjoki Sujala, *c.* 8800–8000 calBC) with assemblages indicating elaborate blade technology, have brought blades and blade technologies into archaeological research focus in the area (e.g., Jussila & Matiskainen 2003; Jussila *et al.* 2010; Kankaanpää & Rankama 2006; Kankaanpää & Rankama *this volume*; Rankama & Kankaanpää 2007a; b; 2008; Takala 2004; 2006; 2009).

In line with the growing interest in blade technologies, this paper provides an overview of blade finds from Finland. We present the results of an archive and literature survey conducted to map the temporal and geographical distribution of blade finds in the country. Special attention is given to stray finds and sites that have received little attention in earlier studies or are not currently being studied by others. In addition, we will discuss the results in relation to blades from neighbouring regions and the small number of published blade assemblages in Finland.

## Definitions, survey methodology and the potential of the database

In this paper, we consider a blade to be a detached piece with a single point of fracture initiation that has a minimum length-to-width ratio of 2:1 in addition to straight parallel sides that run in the direction of the force of detachment and that consequently are more or less perpendicular to the platform remnant. According to our definition, a blade also has one or more dorsal ridges more or less parallel to the lateral edges. Consequently, some artefacts published as blades in earlier studies were excluded from the survey. Distinguishing between irregular blades and bladelike flakes using these criteria is uncertain in many cases, and therefore, we have used contextual evidence, and in some cases subjective opinion, when classifying ambiguous bladeflakes. Due to the problems in detecting many of these features reliably in quartz artefacts and the vast amount of unclassified quartz assemblages in museum collections against the handful of published analyses of quartz technology in Finland, we have excluded the possible rare quartz blades from this study (see Jussila *et al*. 2007; Luho 1956; Rankama & Kankaanpää *this volume;* Schulz 1990; Tallavaara 2007:49; but see Knutsson 1993; 1998; Siiriäinen 1981) and present blades made of raw materials other than vein quartz or quartz crystal.

The core platform and the core-face are usually prepared to facilitate the removal of a symmetrical blade. Archaeological collections and experimental studies indicate that there is a wide variety of ways to prepare blade removals. These include cresting of the core face prior to blade removals; grinding and faceting of the core platform during reduction; the regularisation of the core platform edge by trimming off overhangs; isolating platforms; maintaining the core face convexity; and controlling the shape of the distal end of the core (Bordes & Crabtree 1971; Flenniken & Hirth 2003; Giria & Bradley 1998; Inizan *et al*., 1999; Pelegrin 2006). Evidence for systematic platform preparation and the application of many of these core preparation and maintenance methods is also known in Finland, most notably from the Sujala site located in northern Finnish Lapland (Kankaanpää & Rankama 2006; *this volume*; Rankama & Kankaanpää 2007a; b; 2008). Our survey did not require evidence of such preparation, as its signs are not preserved in artefacts that lack the proximal end of the blade, such as blade sections and many types of tools made on blades.

The blade data were gathered from publications, the National Board of Antiquities archaeological find catalogue (KM), and unpublished reports. No systematic sampling (e.g., random sampling) was attempted. Instead, the current database was simply allowed to accumulate when blades, tools and cores were encountered in books, reports, or collections. Some artefacts were studied only on the basis of published reports, but blade artefacts available in the archives and collections in mainland Finland were examined and documented by the present authors when possible. Blade artefacts deemed to be modern, most notably gun flints, were excluded from the database. The resulting data (i.e., measurements and short descriptions of artefacts comprising a group accumulated during some 125 years from stray finds sent to the collections or from finds made in excavations and surveys) are presented here (see **Appendix I** for data). Additional finds that we have not had the chance to verify and/or document but that have been reported as blade artefacts are listed in **Appendix II**.[1]

Despite the data-collection strategy, it is unlikely that any large blade assemblage has gone unnoticed in this survey. Because of the way the data was collected, however, the database cannot be taken to prove the lack of blades in an area, or used to study the density of blade finds in statistical terms by comparing the density of finds between one area and the next.

[1] We wish to thank Petro Pesonen for providing information on many of these artefacts.


**Figure 1.** Blade finds from Southern Finland (see map for locations and Appendix III for catalogue numbers): a1–7) Ristola; b1–2) Asola; c1–5) Bötesberget; d1–3) Lammashaka; e) Siltapellonhaka; f) Sperrings; g) Pöllölä; h) Hietalahti 1; i) Teuronjoki; j) Saarenoja 2; k) Pöydänpäänniemi; l) Jönsas; m) Kirkonkylä. Scale in centimetres. National Museum of Finland.


**Figure 2.** Blade finds from eastern Finland: a) Jaakonsaari; b) Nilsiä; c) Kotiranta; d) Jokivarsi 1; e) Issakkalansärkkä; f) Joensuu; g) Niemenjärvi; h1–8) Syväys 1. Scale in centimetres. National Museum of Finland (a, c–h) and Kuopio Museum (b).

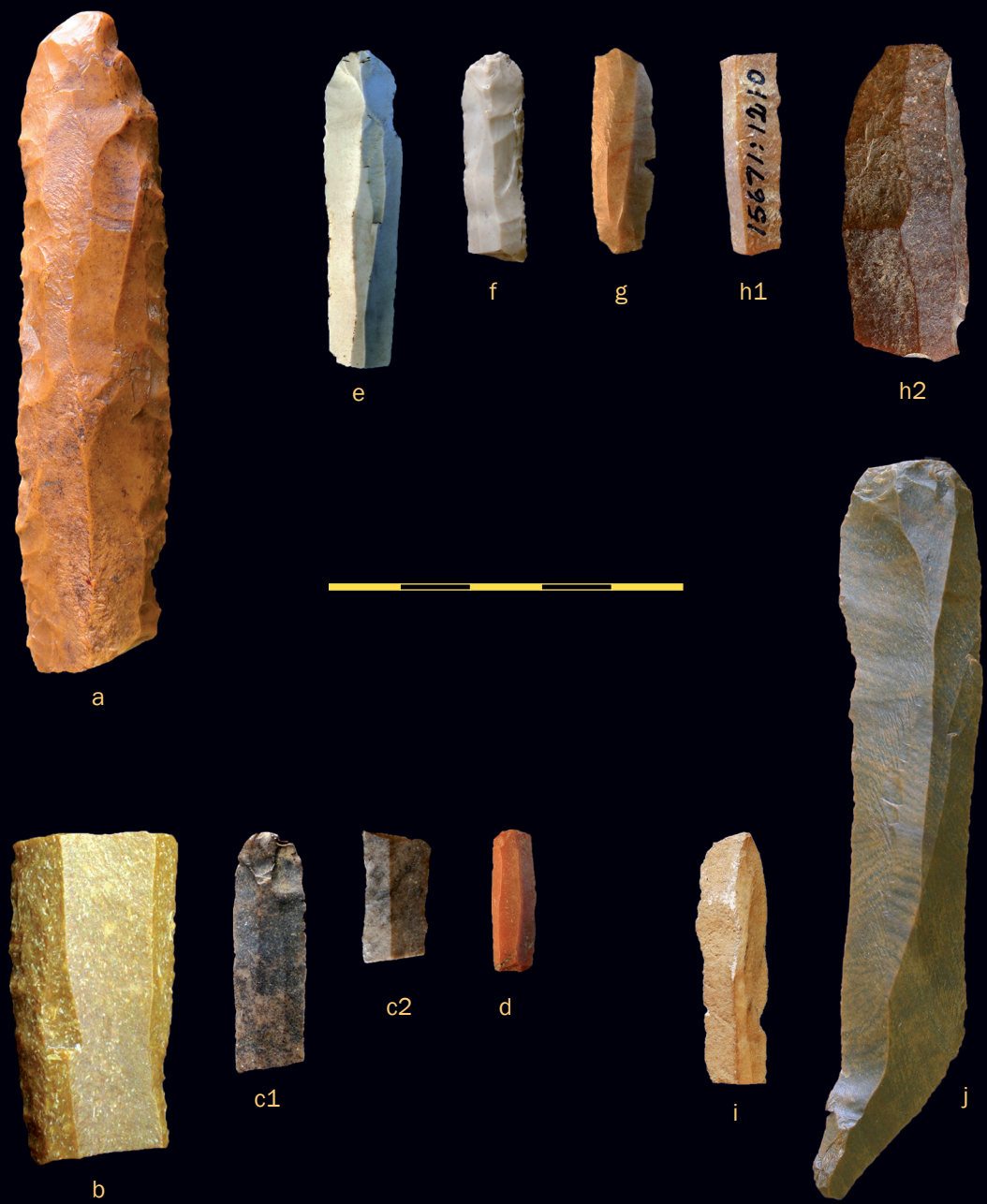



**Figure 3.** Blade finds from northern Ostrobothnia (a), Kainuu (b–d), southern Lapland (e–h), and northern Lapland (i–j): a) Myllykoski; b) Jussinlahti; c1–2) Kalmosärkkä; d) Vonkka 2; e) Pitkäniemi; f) Korkalon pelto; g) Keskioikarainen; h1–2) Neitilä 4; i) Vuopaja N; j) Rovaniemi. Scale in centimetres. National Museum of Finland.

## Results

The survey revealed 34 prehistoric blade find locations and 13 additional locations where blade finds have been reported, but were not verified and/or documented in this study for logistical reasons, representing a total of 47 locations. This is a small number when compared to the total number of known Stone Age sites in Finland (*c.* 10,000 sites excluding stray find locations). If the three aforementioned excavated early post-glacial sites are excluded, blade artefacts in Finland are primarily single stray finds or single finds within site assemblages.

The group of artefacts documented in the survey consists of cores, blades and blade fragments, arrowheads, scrapers, burins, and other retouched tools on blades (**Figs. 1–3**)[2]. The raw material variation among the blade artefacts is considerable. Many artefacts appear to be made on varieties of eastern Carboniferous flint, but blades made of jasper, North-Norwegian cherts, and Cretaceous and possibly Tertiary flint seem to be represented as well (**Fig. 4, Appendix I**)[3]. The raw material classification, however, is based primarily on visual appearance, context, and artefact type, and only in a few cases has the origin of the raw material used to produce blades been studied petrologically (Kinnunen *et al.* 1985; Takala 2004:Fig. 110; Rankama & Kankaanpää 2008:888). In particular, the origin of grey and black flints is often difficult to determine from the visual appearance of the raw material, as different kinds of Cretaceous and Tertiary flints are found in the area stretching from southern Scandinavia to the Moscow region in Russia (e.g., Herforth & Albers 1999:Abb. 1). The colourful raw materials are more readily defined as eastern flints from the Carboniferous formation that stretches from the Moscow area north to the White Sea (e.g., Kinnunen *et al.* 1985), although they can be confused with North-Norwegian cherts (Hood 2006), Paleozoic flints available, for instance, in Estonia (Kriiska *et al. this volume*), and local jaspers (e.g., Kinnunen *et al.* 1985).

| | No. of sites | No. of blade artefacts |
|---|---|---|
| Carboniferous flints | 13 | *c.* 300 |
| Cretaceous flints | 9 | *c.* 150 |
| Jasper | 1 | 2 |
| Silicified slate-like material | 1 | 2 |
| Northern chert | 3 | *c.* 3000 |
| Undefined flint/chert | 9 | 12 |

**Figure 4.** Raw materials of the Finnish blade artefacts (including published and a rough estimate of unpublished artefacts from Sujala, Ristola, Rahakangas 1, and Saarenoja 2). Provenance is suggested primarily according to the visual appearance of the raw material and should be considered tentative.

### Spatial distribution of the blade finds

Present-day Finland was completely covered with ice during the last glacial cycle and gradually emerged from under the north-west-retreating Scandinavian ice sheet between *c.* 10,500 calBC and *c.* 8000 calBC (Saarnisto & Saarinen 2001; Johansson & Kujansuu 2005). In concert with the retreating of the ice, isostatic uplift was initiated, and large parts of the country emerged from the waters of the marine and lacustrine phases of the Baltic Sea Basin, i.e., the Baltic Ice Lake *c.* 10,500–9600 calBC, the Yoldia Sea *c.* 9600–8750 calBC, the Ancylus Lake *c.* 8750–6200 calBC, and the Litorina Sea *c.* 6200–1600 calBC (dates according to Andrén *et al.* 2000).

The geographical distribution of blade finds in Finland (**Fig. 5**) shows that although the locations are relatively widely spaced, blades have been found in most parts of the country, from southern Finland to northern Lapland. The primary exception is the western coastal area that was largely submerged during the Mesolithic and emerged only during later periods. The large Ancylus Lake archipelago in central Finland also seems to be currently lacking blade finds, although this could be partly a consequence of data-gathering methods. A large part of the artefacts derives from supra-aquatic areas in eastern and northern Finland (i.e., from areas that were never on the shore of the Baltic Sea basin), but an equal number of the blade finds are from locations that were on the coast during the Holocene. For the purpose of this paper, the locations with documented and/or published blades can be divided into five groups according to geographical distribution:

[2] All photographs and drawings by the authors.

[3] The terms *flint* and *chert* are used interchangeably in the literature when discussing the Carboniferous flint/chert, whereas the North-Norwegian flint-like fine grained raw materials are usually called *chert*. In this paper we use *flint* when discussing the Carboniferous chert/flint and *chert* when discussing the northern fine grained raw materials.

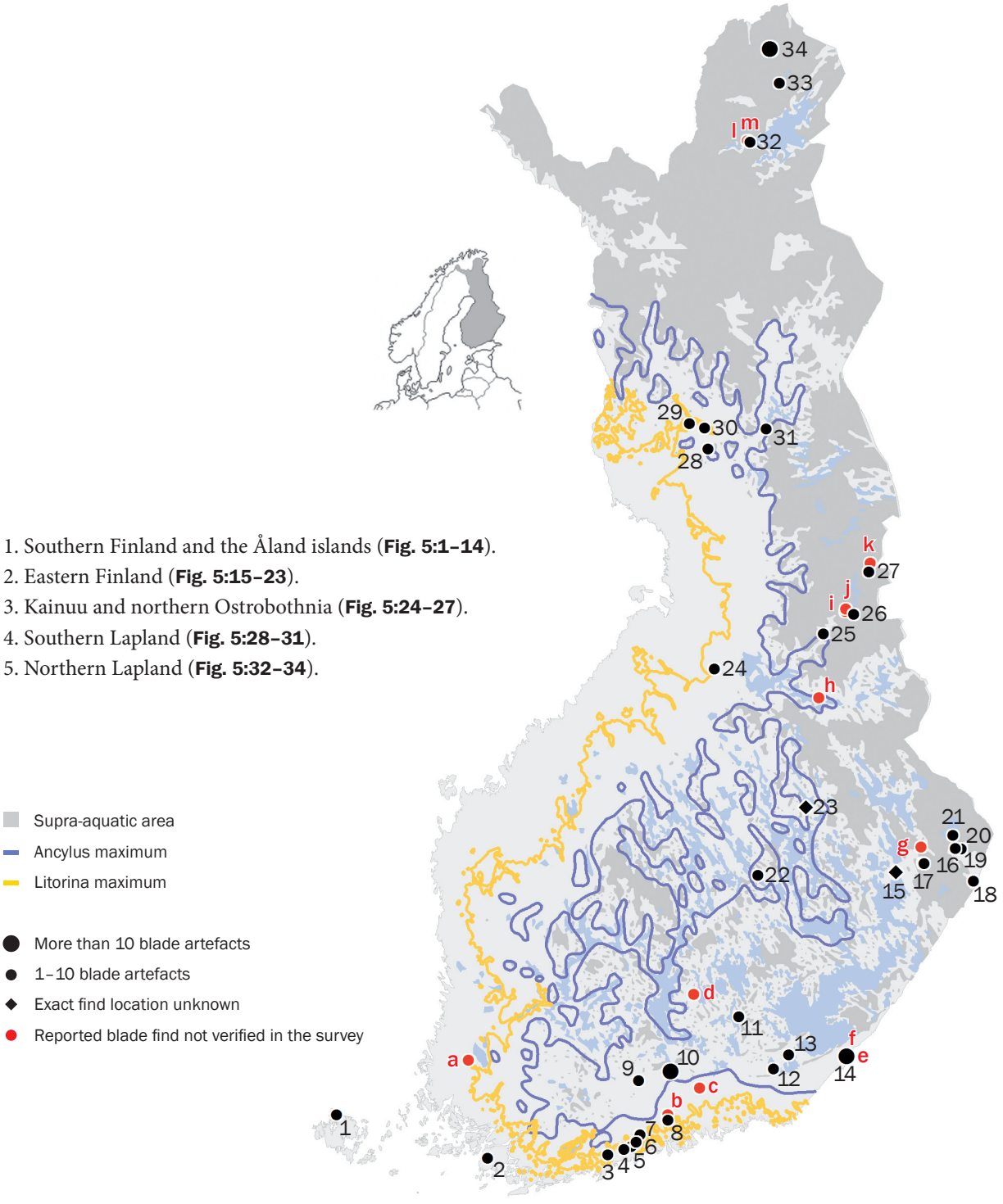



**Figure 5.** Blade find locations, supra-aquatic areas, the Ancylus transgression maximum (*c.* 8400 calBC), and the Litorina transgression maximum (*c.* 5600 calBC) in Finland (note that the highest shores are diachronic). Sites with published blades or blades documented in this survey (black dots and diamonds). **Southern Finland:** 1. Smikärr; 2. Bötesberget (Nordanå C); 3. Sperrings; 4. Jönsas; 5. Kirkonkylä; 6. Asola (Koivukylä 5); 7. Lammashaka; 8. Siltapellonhaka; 9. Teuronjoki; 10. Ristola; 11. Pöydänpäänniemi; 12. Hietalahti 1; 13. Pöllölä; 14. Saarenoja 2. **Eastern Finland:** 15. Joensuu; 16. Jokivarsi 1; 17. Rahakangas 1; 18. Niemenjärvi; 19. Issakkalansärkkä; 20. Jaakonsaari; 21. Syväys 1; 22. Kotiranta; 23. Nilsiä. **Kainuu & northern Ostrobothnia:** 24. Myllykoski; 25. Vonkka 2; 26. Jussinlahti; 27. Kalmosärkkä. **Southern Lapland:** 28. Pitkäniemi; 29. Korkalon pelto; 30. Keskioikarainen; 31. Neitilä 4. **Northern Lapland:** 32. Vuopaja N; 33. Rovaniemi; 34. Sujala. Sites with reported (unpublished) blades not verified in this survey (red dots): a) Kolmhaara; b) Taka-Piskulan Ruoksmaa; c) Tortola 2; d) Uusi Ruskeala C; e) Saarenoja-Muilamäki; f) Hiekkasilta-Hiekkakuoppa; g) Mäntyniemi; h) Kiikarusniemi; i) TB:n ranta; j) Kukkosaari; k) Tormuan särkkä; l) Saamenmuseo; m) Vuopaja.

| Area | Site | calBC, 2σ | Material | Context | Lab. No. | BP | Publication |
|---|---|---|---|---|---|---|---|
| Southern Finland | Saarenoja 2 | 8800–8350 | burnt bone/elk | unpublished | Hela-758 | 9350±75 | Jussila *et al.* 2010 |
| | Saarenoja 2 | 8750–8330 | burnt bone/elk | unpublished | Hela-728 | 9310±75 | Takala 2004 |
| | Ristola | 8250–7760 | burnt bone | Find layer | Hela-727 | 8880±75 | Takala 2004 |
| | Asola | 6650–6470 | burnt bone | Find layer | Ua-32206 | 7740±50 | Leskinen & Pesonen 2008 |
| | Asola | 6330–5980 | burnt bone/ seal | Find layer | Ua-32207 | 7540±55 | Leskinen & Pesonen 2008 |
| Eastern Finland | Jokivarsi 1 | 9180–8630 | burnt bone | Find layer | Ua-41027 | 9507±85 | Pesonen *et al. unpublished* |
| | Rahakangas 1 | 9130–8580 | burnt bone/elk | Find layer | Hela-2380 | 9461±61 | Pesonen *et al.* 2010 |
| | Rahakangas 1 | 9120–8460 | burnt bone/elk | Find layer | Hela-882 | 9405±80 | Pesonen 2005 |
| Southern Lapland | Neitilä 4 | 5990–5380 | charcoal | Hearth above find layer | Hel-191 | 6750±170 | Kehusmaa 1972 |
| Northern Lapland | Sujala | 8700–8300 | charcoal | Dwelling area | Hela-1102 | 9265±65 | Kankaanpää & Rankama *this volume* |
| | Sujala | 8610–8310 | charcoal | Refuse pit | Hela-1442 | 9240±60 | Kankaanpää & Rankama *this volume* |
| | Sujala | 8540–8260 | charcoal/birch | Dwelling area | Hela-1441 | 9140±60 | Kankaanpää & Rankama *this volume* |
| | Sujala | 8290–7830 | burnt bone | Dwelling area | Hela-1103 | 8940±80 | Kankaanpää & Rankama *this volume* |
| | Sujala | 8290–7790 | burnt bone | Dwelling area | Hela-1104 | 8930±85 | Kankaanpää & Rankama *this volume* |
| | Vuopaja N | 6680–6070 | charcoal | Refuse pit | Hel-3570 | 7530±150 | Arponen & Hintikainen 1995 |

**Figure 6.** Mesolithic radiocarbon dates from contexts dating blades in Finland. Calibrated in OxCal 4.1.7 (Bronk Ramsey 2010). Ua-32207 calibrated using Marine09 calibration curve (Reimer *et al.* 2009) with Delta_R LocalMarine -80 (Olsson 1980; Stuiver *et al.* 1986–2010). Atmospheric and marine data from Reimer *et al.* (2009).

## Temporal distribution of the blade finds – Radiocarbon dates

Radiocarbon dates from contexts most securely dating blades in Finland are presented in **Figure 6**. Published data on Early Mesolithic blade technology exist for the Ristola and Sujala sites and, to a lesser degree, also for the Saarenoja 2 site. These sites have all yielded radiocarbon dates from the time period 8800–7800 calBC, as well as symmetric blades, Post-Swiderian tanged points, and other related Early Mesolithic artefact types. (Jussila *et al.* 2010; Jussila & Matiskainen 2003; Kankaanpää & Rankama 2006; 2009; *this volume*; Rankama & Kankaanpää 2005; 2006; 2007a; 2007b; 2008; Takala 2003; 2004; 2009; Takala *et al.* 2006.) The Sujala and Saarenoja 2 sites can be considered closed Early Mesolithic contexts, whereas the Ristola site is a ploughed field that contains artefacts from several time periods. In addition to the Mesolithic occupation, radiocarbon and artefactual data indicate Stone Age occupation of the site at least during the pottery Mesolithic/Neolithic Typical Comb Ware and Corded Ware periods (Takala 2004). For these reasons, the dated bone sample from Ristola that derives from a mixed layer, although from the same area as some of the blade finds, cannot be connected to them without some reservations.

Two Early Mesolithic blade sites (Rahakangas 1 and Jokivarsi 1) in eastern Finland are dated to 9200–8500 calBC. The Rahakangas 1 site has yielded some blades and blade fragments in excavations, whereas surface collecting and test pits at the Jokivarsi 1 site have yielded a scraper on blade. (Pesonen *et al. unpublished*; Pesonen 2005; Pesonen *et al.* 2010). The assumed connection between the dates and the blades at these sites is based on the proximity of the dated samples and the blade finds as well as the general artefact distributions at the sites.

In addition to the Early Mesolithic dates, there are two sites, Asola in southern Finland and Vuopaja N in northern Lapland, where dated samples can be considered to date blade artefacts to later parts of the Mesolithic. The 6680–6070 calBC date from Vuopaja N derives from a refuse pit with associated blade finds (Halinen 2005:Figs. 38E–G), and the site has also yielded blade artefacts in a pre-excavation survey (Siiriäinen 1982). In total, seven or eight blade artefacts (a core, a

possible scraper on blade and five or six blades/ blade segments) have been reported from the site (Halinen 2005; Kankaanpää & Rankama 2005). The dates on burnt bone from Asola, 6650–6470 calBC (undetermined species) and 6330–5980 calBC (seal, corrected for reservoir effect), derive from the proximity of two conjoining pieces of a retouched flint blade (Leskinen & Pesonen 2008:68). There is also a fragment of another, more equivocal blade (KM 20164:94) from the site, but with the exception of these, other blade artefacts are not present in the excavation finds.

In addition to the more or less directly radiocarbon-dated blade contexts, there is one Late Mesolithic date (5990–5330 calBC) from the Neitilä 4 site in southern Lapland, indicating the age of a hearth located stratigraphically above the layer containing the two jasper blades found at the site and thus giving an *ante quem* dating for the blades (Kehusmaa 1972).

## Temporal distribution of the blade finds – Shore-displacement chronology

Many of the blade find locations can be roughly dated using shore-displacement chronology. The method assumes that Stone Age sites in Finland have been shore-bound - which is not always the case (Jussila & Kriiska 2006; Manninen & Valtonen 2002; Taavitsainen 1982). Two major transgressive phases, the Ancylus and Litorina transgressions, further complicate the dating of sites with shore-displacement chronology. Despite these difficulties, the method has been proven to date sites with sufficient accuracy, especially when used to study the relative chronology of sites in a restricted area (e.g., Jussila & Kriiska 2004; Jussila *et al.* 2007; Kylli 2001; Siiriäinen 1974; Matiskainen 1989).

Two clusters of blade find locations, located in southern Finland and southern Lapland, are such that shore-displacement chronology can be used to study the relative age of blades as well as to give approximate *terminus post quem* dates for blade artefacts. In both areas, several of the blade find locations have emerged from the waters of the Baltic Sea Basin during the Holocene (**Figs. 5, 7**). However, it should be kept in mind that especially in southern Lapland the find locations are located next to small lakes or rivers and may consequently be considerably younger than the maximum age indicated by the Baltic shoreline date. As shown in the

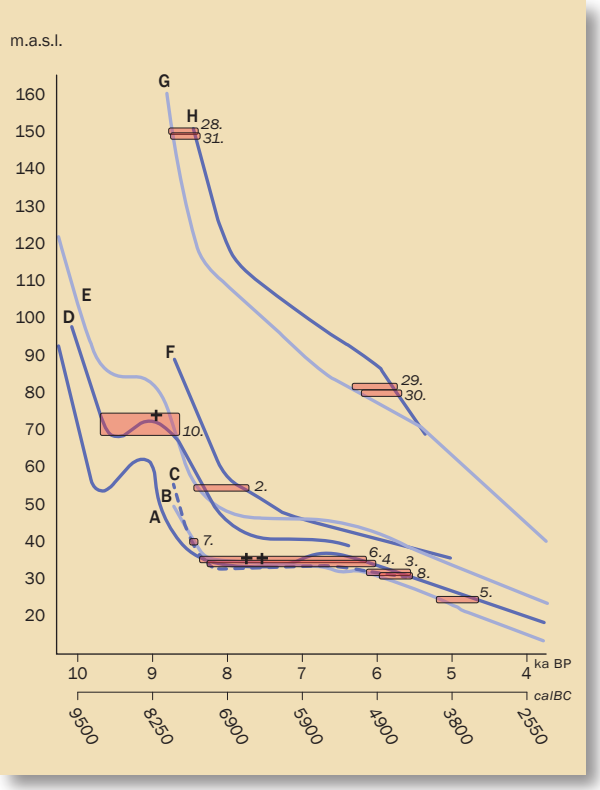



**Figure 7.** The maximum dates of blade finds in relation to shore displacement curves. The curves: A) Espoo area (Ristaniemi & Glückert 1987); B) Helsinki Region (Kylli 2001); C) Uplift zone 3,5 mm/yr (Matiskainen 1989); D) Ristola site (Takala 2004); E) Third Salpausselkä (Ristaniemi & Glückert 1987); F) Uplift zone 4,5 mm/yr (Matiskainen 1989); G & H) Area north of the Gulf of Bothnia (Saarnisto 1981 & Kylli 2001). Approximate shoreline dates for some of the blade sites in southern Finland and southern Lapland: 2. Bötesberget; 3. Sperrings; 4. Jönsas; 5. Kirkonkylä; 6. Asola; 7. Lammashaka; 8. Siltapellonhaka; 10. Ristola; 28. Pitkäniemi; 29. Korkalon pelto; 30. Keskioikarainen; 31. Neitilä 4. The three crosses mark the radiocarbon dates (uncalibrated BP) from the Ristola and Asola sites (see **Figure 6**.).

figure, shore-displacement curves in different studies have slight differences depending on the study material, exact study location, and other factors (see Kylli 2001), but they nevertheless agree quite well on a regional scale. Due to easier comparability, shore-displacement curves drawn using uncalibrated BP dates have been selected here. However, curves drawn using calibrated radiocarbon dates also give similar results for these areas (e.g., Hyvärinen 1999; Saarnisto 2005; Vuorela *et al.* 2009).

Shore-displacement chronology suggests that the blades from Pitkäniemi and Neitilä 4 in southern Lapland (curves G & H) have a maximum date somewhere

between *c*. 7800 and 7500 calBC (8750–8500 BP), whereas the blades from Korkalon pelto and Keskioikarainen in the same general area have a maximum date somewhere between *c*. 5300 and 4650 calBC (6300–5800 BP).

Of the southern blade sites in the area of curves D, E, and F, Ristola has the earliest *post quem* date according to shore-displacement chronology. Takala (2004:145–147) suggests that, due to the Ancylus transgression, it is possible to shoreline-date the Ristola blade assemblage between *c*. 9200 and 7600 calBC (9700–8600 BP). The latter half of this time span is in good agreement with the *c*. 8250–7760 calBC radiocarbon date from the site. When it comes to the maximum date of the blades from the Bötesberget site, the curves diverge somewhat and give maximum dates between *c*. 7500 and 6400 calBC (8400–7700 BP) (see also Asplund 2008:52, 166–168).

The dating of shorelines in the area represented by curves A, B, and C is hampered by the Litorina transgression, which kept the shoreline relatively stable for an extended time period between *c*. 7200–5300 calBC (8200–6300 BP). However, only two of the blade sites, Asola and Jönsas, are on elevations coinciding with this time period, and the former site has also yielded the above-mentioned radiocarbon dates. The other sites are not affected by the transgressions and have the following maximum shore-line dates: Lammashaka 7500 calBC (8400 BP), Sperrings between 5000 and 4500 calBC (6100–5700 BP), Siltapellonhaka between 4900 and 4400 calBC (6000–5600 BP), and Kirkonkylä between 4000 and 3400 calBC (5200–4700 BP).

Some of the blade-find locations in other areas can also be given maximum dates with the same principle. The Saarenoja 2 site in Lappeenranta (former Joutseno) is located near to the highest Ancylus transgression shore-line but has a maximum shoreline date of *c*. 9400 calBC (Jussila *et al*. 2010; Jussila & Matiskainen 2003), the find location of the Myllykoski blade found in Siikalatva (former Kestilä) has emerged approximately at the Ancylus Lake/Litorina Sea interface (Koivunen 1985), and the Smikärr (lower) site in the Åland islands has a maximum date of *c*. 3300 calBC (Meinander 1964; Stenbäck 2003:92).

## Temporal distribution of the blade finds – Typology

### Blade cores

Blade cores are known from four locations in Finland (**Figs. 9 & 10**), and they represent at least three approaches to configuring a blade core.

Cores from the Sujala site (**Fig. 8:c**) show evidence of blade removals around a large part of the perimeter of the core and initiating from a single platform (e.g., Rankama & Kankaanpää 2008). Parallels for the cores can be found in Mesolithic contexts in northwestern Russia (Koltsov & Zhilin 1999b; Oshibkina 1997). In addition to the Sujala site, core tablets associated with this blade production technology have also been published from Ristola (Takala 2004:115).

A core deriving from the Vuopaja N site (**Fig. 8:b**) represents a strategy in which the original block is thinned from the sides and one narrow face becomes the core face (Siiriäinen 1982). These types of cores are known by a variety of names: handle core, keeled core, wedge-shaped core, and narrow face core, among others. During the Mesolithic, this kind of strategy of configuring a core and producing small bladelets was practised both east and west of Finland. In Sweden, it is dated to *c*. 6400–4300 calBC (Guinard & Groop 2007; Manninen & Knutsson *this volume*; Olofsson 2003). In Russia, a similar approach is documented, for example, at the Veretye I site in the Lake Onega region that has yielded dates falling between *c*. 9000 and 6500 calBC (9600–7700 BP) (Oshkibkina 1997).

A stray find from Eastern Finland, the Pöydänpäänniemi core, shows blade removals initiating from two opposite ends around most of the perimeter of the core (**Fig. 8:d**) and can be labelled an opposite platform blade core or cylindrical blade core. Parallels for the artefact are not easily found in the literature, but it has some common features with, for example, some Late Mesolithic cores in the Volga-Kama region (Vybornov 2009:Ris.193:1) and the cylindrical Scandinavian Middle Neolithic cores sometimes identified as Pitted Ware culture cores (Vang Petersen 1999:56–57; Bergsvik 2003:91–94). However, the rounded and polished ends of the core indicate secondary use as a strike-a-light (Koch 1990; Stapert & Johansen 1999). Strike-a-lights with polished ends are typical for the South-Scandinavian Neolithic/Bronze Age, but they have been used also

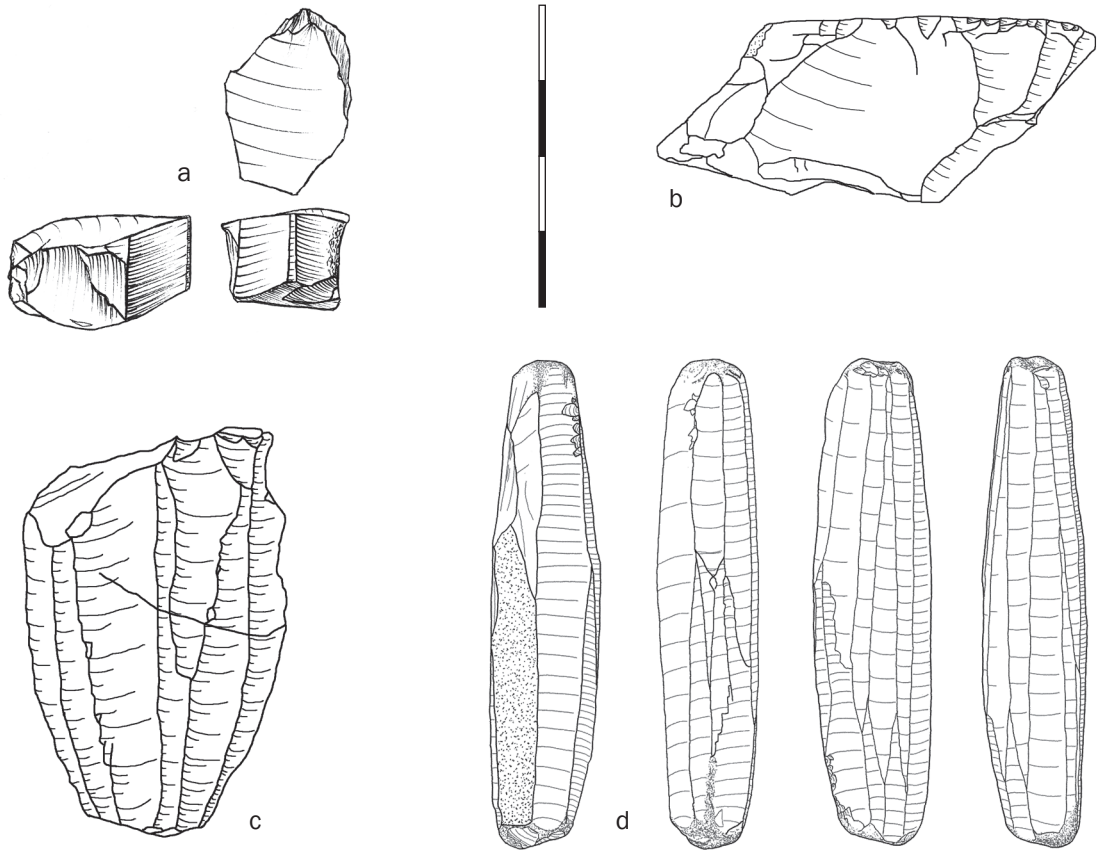



**Figure 8.** a) Saarenoja 2; b) Vuopaja N; c) Sujala; d) Pöydänpääniemi. B) drawn after Siiriäinen (1982); c) drawn after Rankama & Kankaanpää (2008). Scale in centimeters.

earlier in the area (e.g., Koch 1990; Lidén 1948:44; Vang Petersen 1999:140–141).

The finds from the 2008–2010 excavations at the Saarenoja 2 site also include cores (Jussila *et al.* 2010), but detailed information on this material is still unpublished. However, a blade core fragment from the year 2000 test excavation can be introduced here (**Fig. 8:a**). This is a blade core turned into a bipolar core in which the original blade core configuration is no longer discernible.

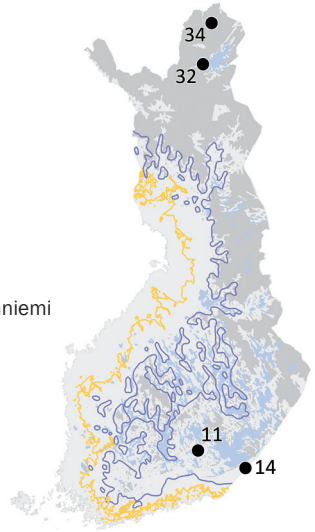



**Figure 9.**
Locations with blade cores:
11. Pöydänpäänniemi
14. Saarenoja 2
32. Vuopaja N
34. Sujala

| Areal group | Site | Quantity | Type | Data |
|---|---|---|---|---|
| Northern Lapland | Sujala | 14* | Conical/sub-conical | Kankaanpää & Rankama *this volume* |
| Northern Lapland | Vuopaja N | 1 | Handle core like | Siiriäinen 1982 |
| Southern Finland | Saarenoja 2 | 1+ | Unpub. | Jussila *et al.* 2010 |
| Southern Finland | Pöydänpäänniemi | 1 | Opposite platform | Appendix I |

**Figure 10.** Blade cores. *including fragments; +more than one

## Projectiles on blade

Arrowheads on blade are relatively common among the Finnish blade finds and are known from eleven sites/locations (**Figs. 11 & 12**). Based on their orientation, blade points can be divided into two groups: points oriented parallel to the longitudinal axis of the blade and points oriented at an angle to it. An orientation parallel to the longitudinal axis is more common in the Finnish material.

Most of the projectile points found in secure contexts, or within larger blade assemblages are Early Mesolithic points oriented parallel to the blank, namely, the points from Saarenoja 2 (Jussila *et al.* 2010), Sujala (Kankaanpää & Rankama *this volume*), and Ristola (Takala 2004) (**Fig. 13:b&c**). These points represent post-Swiderian points that are dated to *c.* 10,100–7500 calBC (Rankama & Kankaanpää 2008:895 and references). Points with parallel invasive retouch scars covering a large part of the ventral surface of the point can be considered to represent the Pulli sub-types, which are dated to *c.* 8950–7550 calBC (Butrimas & Ostrauskas 1999; Ostrauskas 2000:170; Takala 2006).

The other points with typical characteristics of Post-Swiderian points are a stray find from the Niemenjärvi Lake in Ilomantsi (Hertell & Manninen 2006; Meinander 1964:55) and another from an unknown location near Kuopio, most likely from Nilsiä (but see Matiskainen 1986:89)[4]. Both points have the characteristic bifacially retouched tang and invasive retouch on the ventral side of the tip (**Fig. 13:a&d**). A good parallel for the overall configuration of the Nilsiä point comes from the residential site of Popovo in Russia (Oshibkina 2004:Fig. 5), and it can be regarded as representing a large Pulli point. The point is exceptionally long, over 10 cm, although an even longer broken Pulli point has been published from the Ringuvenai site in Latvia (Ostrauskas 2000:Fig. 2).

Parallel orientation is also present in the Smikärr points (Meinander 1964) and the Kirkonkylä, Jönsas, and Lammashaka points, of which the last is a tip fragment (**Fig. 13:g–j**). The age and cultural affiliation of the Jönsas point, and especially the Kirkonkylä point, have been discussed in the literature by several authors (e.g., Leskinen & Pesonen 2008:68–69; Meinander 1964:56; Pesonen 2005; Takala 2004:142; 2006; Takala *et al.* 2006)

[4] Notes in the National Board of Antiquities' archive suggest that the point derives from Nilsiä and was donated to the Kuopio Historical society/Kuopio Museum either by Mr. Granit in 1884 or by Mr. Kronqwist in 1892. However, the find location is not known and it is possible that the point was originally found somewhere else.

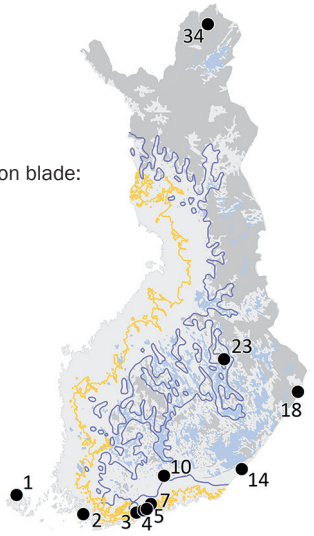



**Figure 11.**
Locations with projectile pointson blade:
1. Smikärr
2. Bötesberget
3. Sperrings
4. Jönsas
5. Kirkonkylä
7. Lammashaka
10. Ristola
14. Saarenoja 2
18. Niemenjärvi
23. Nilsiä
34. Sujala

| Areal group | Site | Quantity | Type | Typol. date** | Data |
|---|---|---|---|---|---|
| Northern Lapland | Sujala | 49* | Post-Swiderian | c. 10100–7500 calBC | Kankaanpää & Rankama *this volume* |
| Eastern Finland | unknown/Nilsiä? | 1 | Post-Swiderian | c. 10100–7500 calBC | Appendix I |
| Eastern Finland | Niemenjärvi | 1 | Post-Swiderian | c. 10100–7500 calBC | Hertell & Manninen 2006; Appendix I |
| Southern Finland | Saarenoja 2 | 3+ | Post-Swiderian | c. 10100–7500 calBC | Jussila *et al.* 2010; Rostedt *pers. comm.* |
| Southern Finland | Ristola | 7 | Post-Swiderian | c. 10100–7500 calBC | Takala 2004 |
| Southern Finland | Lammashaka | 1 | Scandinavian A-type? | c. 2800–2600 calBC ? | Appendix I |
| Southern Finland | Jönsas | 1 | Scandinavian A-type | c. 2800–2600 calBC | Leskinen & Pesonen 2008; Appendix I |
| Southern Finland | Kirkonkylä | 1 | Scandinavian A-type | c. 2800–2600 calBC | Meinander 1964; Appendix I |
| Southern Finland | Sperrings | 1 | Transverse point | c. 6400–3900 calBC | Europaeus 1925; Appendix I |
| Southern Finland | Bötesberget | 2 | Microliths | c. 6400–3900 calBC | Appendix I |
| Åland | Smikärr | 2 | Scandinavian A-type | c. 2800–2600 calBC | Meinander 1964 |

**Figure 12.** Projectile points on blade.

* including fragments and preforms, ** see text for references

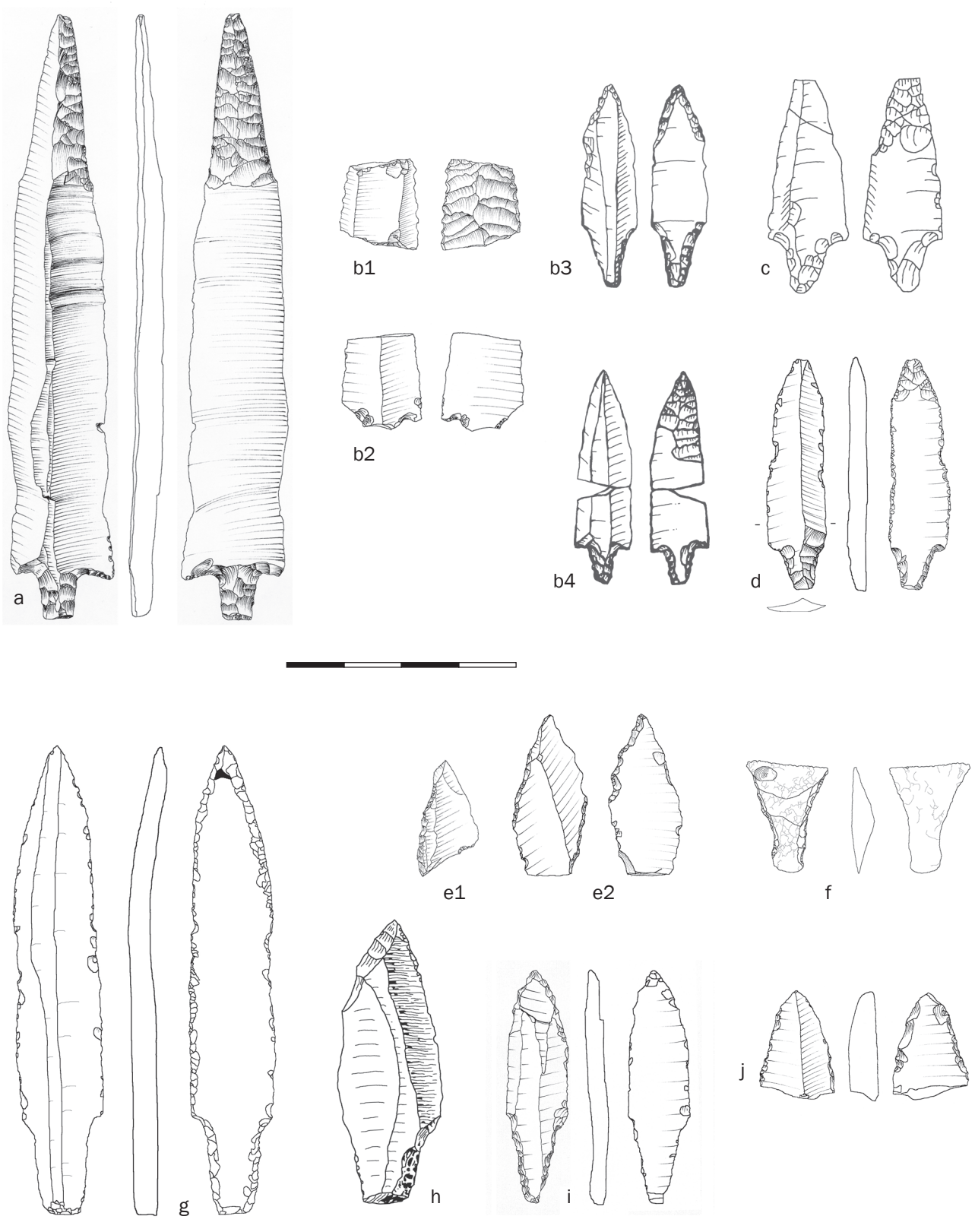



**Figure 13.** Projectile points on blade: a) Nilsiä; b1–4) Ristola; c) Sujala; d) Niemenjärvi; e1–2) Bötesberget; f) Sperrings; g) Kirkonkylä; h) Smikärr; i) Jönsas; j) Lammashaka. B3 & b4) drawn after Takala (2004); c) drawn after Kankaanpää & Rankama (*this volume*), h) drawn after Meinander (1964). Scale in centimetres.

and both a South-Scandinavian and a eastern Post-Swiderian origin have been suggested. However, as has been noted by some of these authors, the points lack the ventral invasive retouch typical for Post-Swiderian points.

The Smikärr points have been found in association with typical Eastern Swedish Pitted Ware pottery (Meinander 1964), whereas the Jönsas point derives from a multiperiod site and the find location of the Kirkonkylä point has yielded no other finds (Leskinen & Pesonen 2008:68–69; Meinander 1964). However, counterparts to the Jönsas and Kirkonkylä points can be found in southern Scandinavia in variants of type-A blade points (e.g., Glob 1952:Fig. 310, 311; Strinnholm 2001:Fig. 28). Type-A points are usually associated with the Pitted Ware culture and dated, allowing for regional variation, between *c.* 4000 and 2500 calBC (Bergsvik 2003:85–95; Meinander 1964; Strinnholm 2001:108; Vang Petersen 1999:17, 79–81).[5] A small ground and polished area on the ventral surface of the tip of the Kirkonkylä point could suggest a similar production strategy as for the Siretorp points in Blekinge, Sweden, which, according to Meinander (1964:41) are often made on blades struck from polished flint axes turned into blade cores.[6]

Points oriented against the long axis of the blade are known from the Bötesberget and Sperrings sites (**Fig. 13:e&f**). These points are microlithic transverse and oblique points. The Sperrings artefact is a burnt transverse point and is the only blade artefact from a site that otherwise has yielded mainly artefacts appended to the early phase of the pottery-Mesolithic Comb Ware culture (Europaeus 1927). The Bötesberget points belong to an assemblage that includes also other blade artefacts (see below) as well as flakes and debris of the same raw material. Asplund (2008:52–53) has suggested that the assemblage could have originated in the Estonian Mesolithic, but the microliths, and especially the microburin fracture used to produce the tip of at least one of the points, instead suggest an origin in southern Scandinavia. To our knowledge geometric microliths and the microburin technique are rare in the Estonian Mesolithic, whereas oblique and transverse points and geometric microliths of flint are common in the southern Baltic area, where they are dated to the time period 6400–3900 calBC (e.g., Edinborough 2009; Vang Petersen 1999).

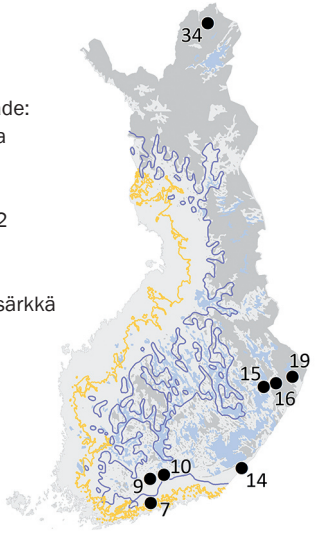



**Figure 14.**
Locations with scrapers on blade:
7. Lammashaka
9. Teuronjoki
10. Ristola
14. Saarenoja 2
15. Joensuu
16. Jokivarsi 1
19. Issakkalansärkkä
34. Sujala

[5] In Pitted Ware contexts in parts of Sweden north of Scania, tanged blade points and cylindrical blade cores are usually single finds and therefore some researchers have questioned whether the assemblages ascribed to the Pitted Ware culture in southern Scandinavia represent the same archaeological culture as the roughly contemporaneous Pitted Ware culture in eastern Sweden and the Åland islands (see Larsson 2008:56).

[6] We wish to thank Berit Valentin Eriksen for pointing out this detail that has gone unnoticed in previous research.

| Areal group | Site | Quantity | Data |
|---|---|---|---|
| Northern Lapland | Sujala | 19* | Kankaanpää & Rankama *this volume* |
| Eastern Finland | Issakkalansärkkä | 1 | Hertell & Manninen 2006; Appendix I |
| Eastern Finland | Jokivarsi 1 | 1 | Pesonen 2005; Appendix I |
| Eastern Finland | unknown/Joensuu | 1 | Appendix I |
| Southern Finland | Saarenoja 2 | unpub. | Jussila *et al.* 2010; Rostedt *pers. comm.* |
| Southern Finland | Ristola | 15** | Takala 2004 |
| Southern Finland | Teuronjoki | 1 | Matiskainen & Ruohonen 2004; Appendix I |
| Southern Finland | Lammashaka | 1 | Appendix I |

**Figure 15.** Scrapers on blade. * including fragmentary & combined tools, ** including combined tools

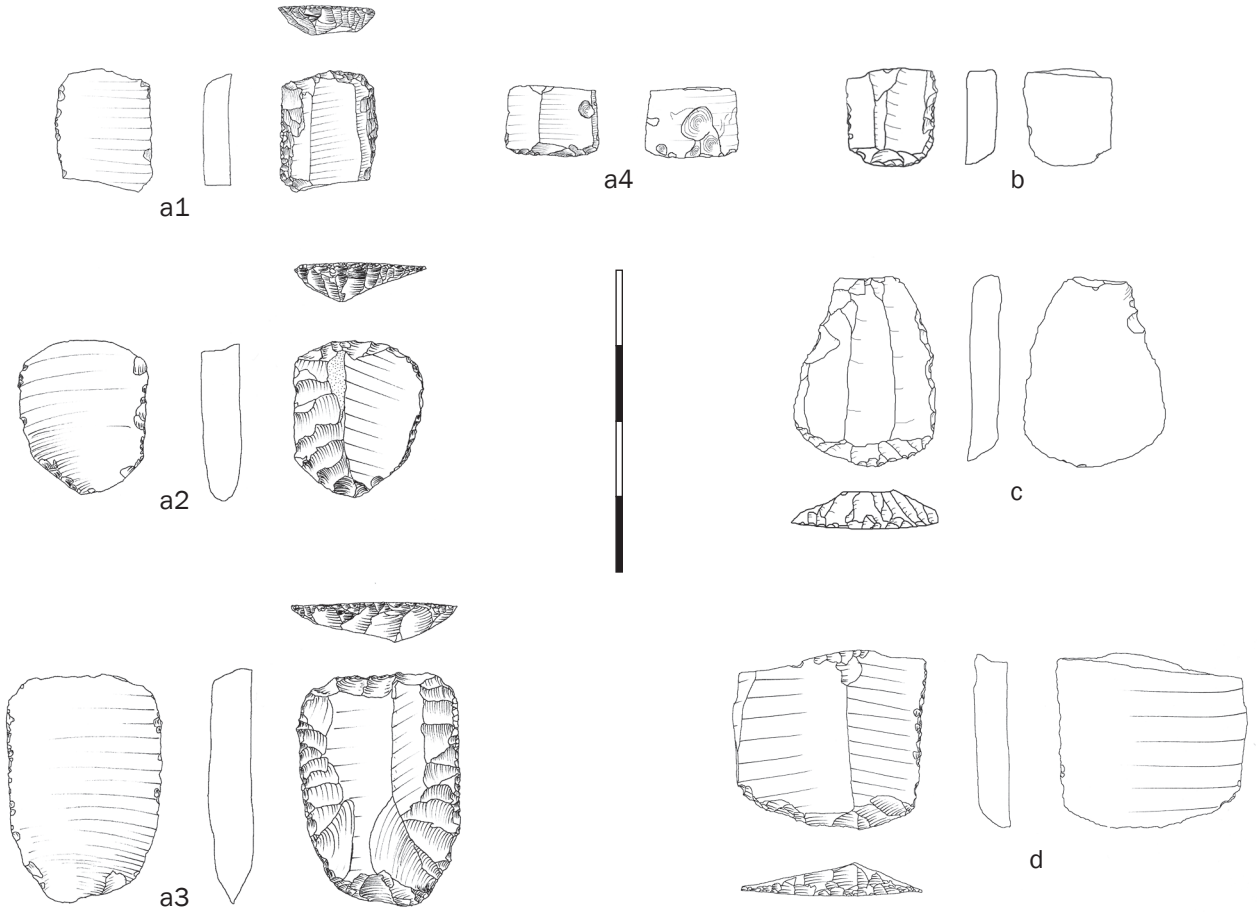



**Figure 16.** Scrapers on blade: a1–4) Ristola; b) Jokivarsi 1; c) Issakkalansärkkä; d) Teuronjoki. Scale in centimetres.

## Scrapers and burins on blade

The division between typological scraping and cutting tools is generally acknowledged to be neither clear nor self-evident. Here we discuss only what we consider to be good classic examples of retouched scrapers with an edge angle close to 90 degrees. Most of them are end-scrapers, of which some have the retouched edge continuing on the sides of the blank and could therefore also be classified as double-scrapers, etc. (e.g., Takala 2004:122–123).

Scrapers on blade from eight locations are present in the survey data (**Figs. 14, 15 & 16**). In one case (Issakkalansärkkä), it is questionable as to whether the blank had in fact been a blade or a flake with parallel dorsal ridges, but we have nevertheless included it in the blade scraper category. Many blade artefacts in the collections classified as scrapers or tools (e.g., KM 18200:83 from Syväys 1 and KM 15563:2 from Espoo Kuusela) turned out to be modern strike-a-lights or single edged gun flints with signs of striking with steel on the worked margins (strike-a-lights) or characteristic use-wear on the unretouched edge (gun flints) (Kenmotsu 1990; Skertchly 1879).

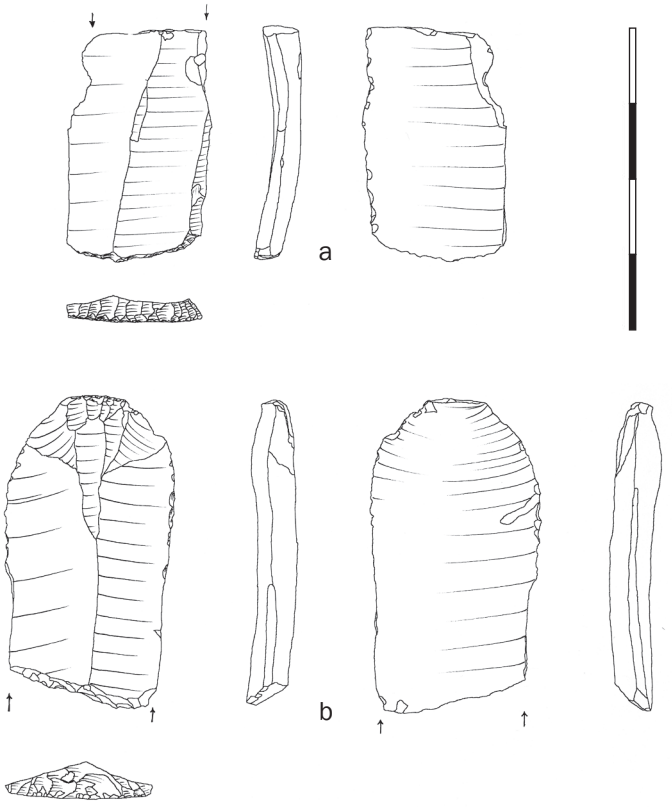



**Figure 17.** Burin/scrapers on blade: a) Lammashaka; b) Joensuu. Scale in centimetres.

Two previously unpublished artefacts have been classified as scraper/burins in the survey. Of these, the artefact from Joensuu (**Fig. 17:b**) has had burin spalls detached from the retouched end of the blade, whereas in the otherwise similar scraper/burin from Lammashaka (**Fig. 17:a**), the burin blows have been struck from the end opposite to the retouched edge. Including these artefacts, burins on blades are known from five locations (**Figs. 18 & 19**). The dating of the scrapers and burins on blade found in Finland cannot be determined solely on a typological basis, but it can be noted that, at least at the moment, most of them appear to derive from clear Early Mesolithic contexts (Sujala, Saarenoja 2, Ristola, and Jokivarsi 1).

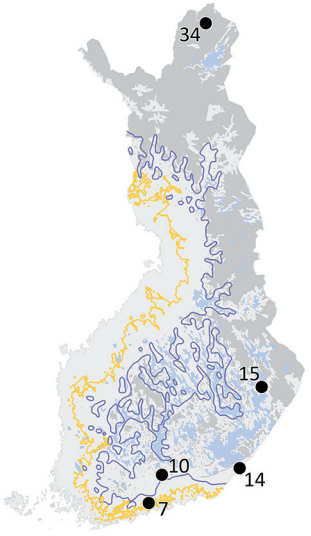



**Figure 18.**
Locations with burins on blade:
7. Lammashaka
10. Ristola
14. Saarenoja 2
15. Joensuu
34. Sujala

| Areal group | Site | Quantity | Data |
|---|---|---|---|
| Northern Lapland | Sujala | 45* | Kankaanpää & Rankama *this volume* |
| Eastern Finland | unknown/Joensuu | 1 | Appendix I |
| Southern Finland | Saarenoja 2 | unpub. | Jussila *et al.* 2010; Rostedt *pers. comm.* |
| Southern Finland | Ristola | 12 | Takala 2004 |
| Southern Finland | Lammashaka | 1 | Appendix I |

**Figure 19.** Burins on blade. * including fragmentary

## Retouched and unmodified blades and blade segments

The remaining blade artefacts comprise a fairly heterogeneous group that includes unmodified blades, retouched blades (including inserts), and blade segments. Technological details and dimensions of these artefacts vary. The majority is found in the few excavated assemblages: mostly from Sujala, Ristola, and Saarenoja 2 but also from Syväys 1 (Hertell & Manninen 2006); Rahakangas 1 (Pesonen *et al*. 2010), Vuopaja N (Kankaanpää & Rankama 2005), Neitilä 4, and Bötesberget.

The only typo-chronologically datable artefacts in this group are the inserts. Clear examples of inserts made on blade are found in Finland only in the Early Mesolithic Ristola and Saarenoja 2 assemblages, and two possible inserts have also been published from the Sujala site (Jussila & Matiskainen 2003; Jussila *et al.* 2010; Rankama & Kankaanpää 2008:Fig. 7; Takala 2004:Fig. 141).

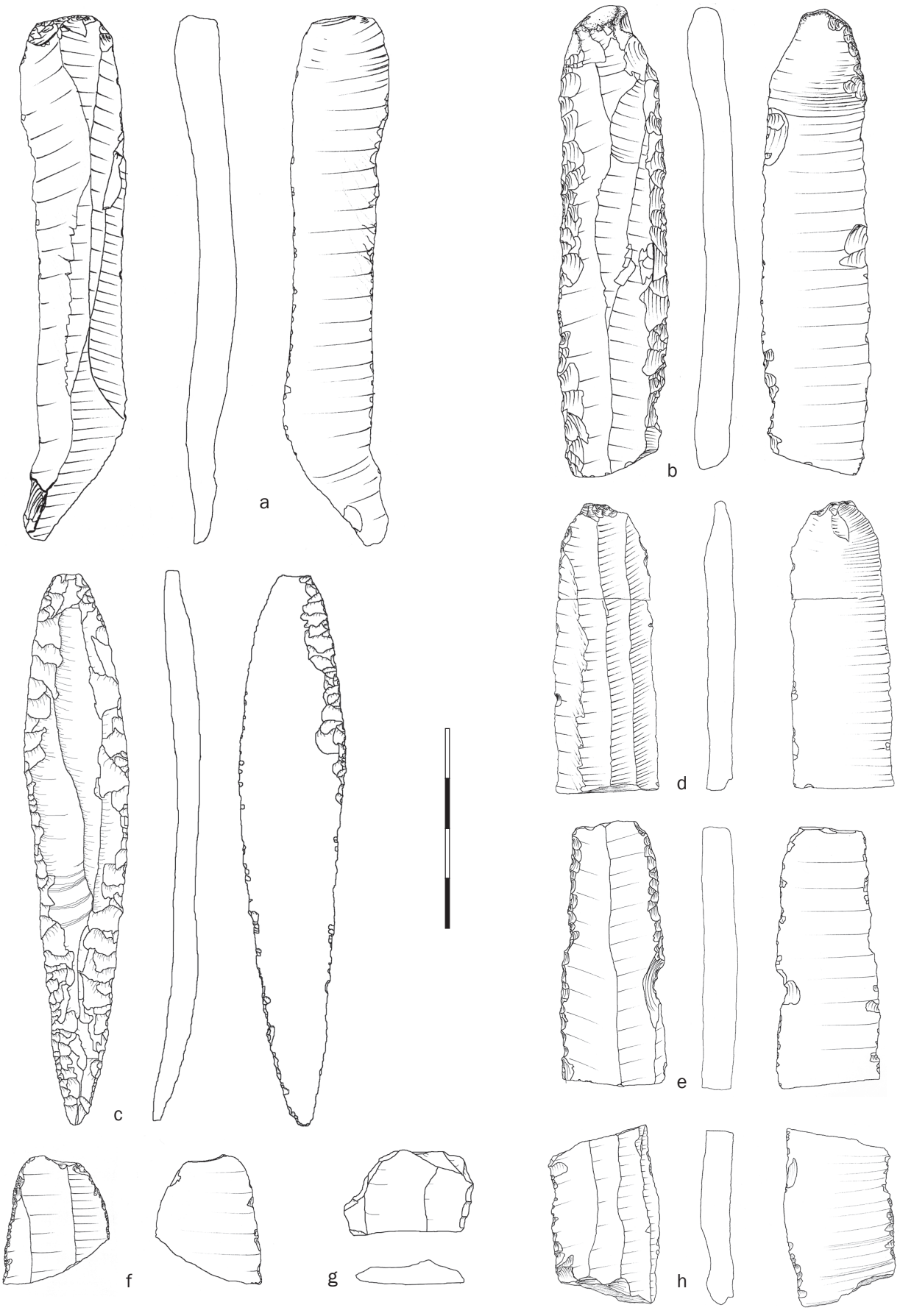
Most of the artefacts are unmodified and retouched blades and blade segments that show variation in production technology and size (**Fig. 20**). Clear differences are visible, for example, between the large platform remnant and long bulb of the (Inari) Rovaniemi blade (**Fig. 20:a**) and the small platform remnants and relatively thick and short bulbs of the Pitkäniemi and Kalmosärkkä blades (**Fig. 20:l&r**) – probably indicative of the use of direct percussion (Rovaniemi) *versus* pressure (Pitkäniemi and Kalmosärkkä) in their production. Blade production using pressure is considered an eastern trait in North-European Mesolithic contexts (Hartz *et al*. 2010; Koltsov & Zhilin 1999a; Ostrauskas 2000:175–176), whereas the direct percussion technique, alongside the raw material, suggests a North-Norwegian Early Mesolithic origin for the Rovaniemi blade (Kankaanpää & Rankama 2005:130).

With the exception of the Kotiranta blade discussed below, the widths of the blades listed in **Appendix I** vary between 5.5 mm and 25 mm. The published Early Mesolithic assemblages are in line with these numbers: blade width in the Sujala assemblage varies between 3–30 mm and un-retouched blades in the Ristola assemblage are 5–20 mm wide (Kankaanpää & Rankama 2006:Fig. 4; Takala 2004:Fig. 123). Hence, the often used division between microblades/bladelets (<10mm) and macroblades (>10mm), is not fruitful in a heterogeneous artefact group such as this that derives from a variety of sources and includes also blades from production technologies where the width of the end product diminishes as the production continues. However, some of the blades, such as the blade from Vonkka 2 (**Fig. 20:z**), may nevertheless derive from specialised microblade/bladelet production.

Only on one blade (**Fig. 20:x**, Bötseberget) is there a microburin scar. The majority of blades are intentionally or accidentally snapped perpendicular to the long axis of the blade. In some artefacts, the point of impact left from a blow directed on the dorsal side of the blade in order to generate the break is shown. This technique is present in the Sujala assemblage (e.g., Rankama & Kankaanpää 2008: 889), and impact marks that more or less certainly follow from this procedure are also present in blades documented in this survey (e.g., KM 14504:453, :475; KM 17875:66; KM 18501:1550; KM 31136; KM 35157:2).

There are also two probable strike-a-lights among the blades. A retouched blade used as a strike-a-light (**Fig. 20:b**) has been found in the Myllykoski rapids in Siikalatva. Koivunen (1985) has suggested that the artefact could be a Neolithic sickle originating in southern Scandinavia, but the artefact lacks the characteristic sickle gloss often found in such artefacts (e.g., Jensen 2000:Fig. 1). However, the proximal end of the blade shows similar rounding and polishing as the ends of the Pöydänpäänniemi core (see above), an indication of use as a strike-a-light. While the rounding of the Myllykoski blade suggests use with pyrite, the unevenly battered margins of the Pöllölä blade (**Fig. 20:i**) suggest that it may have been used for the same purpose, but in more recent times and with steel.

**Figure 20.** Retouched and un-retouched blades and blade segments: a) Rovaniemi; b) Myllykoski; c) Jaakonsaari; d) Ristola; e) Hietalahti 1; f) Lammashaka; g) Syväys 1; h) Ristola; i) Pöllölä; j) Jussinlahti; k) Syväys 1; l) Pitkäniemi; m) Asola; n, o & p) Syväys 1; q) Bötesberget; r) Kalmosärkkä; s) Asola; t) Bötesberget; u) Syväys 1; v) Neitilä 4; w) Ristola, å) Keskioikarainen; ä) Kalmosärkkä; â, ö) Syväys 1; x) Bötesberget; y) Siltapellonhaka; z) Vonkka 2. W) drawn after Takala (2004). Scale in centimetres. ▶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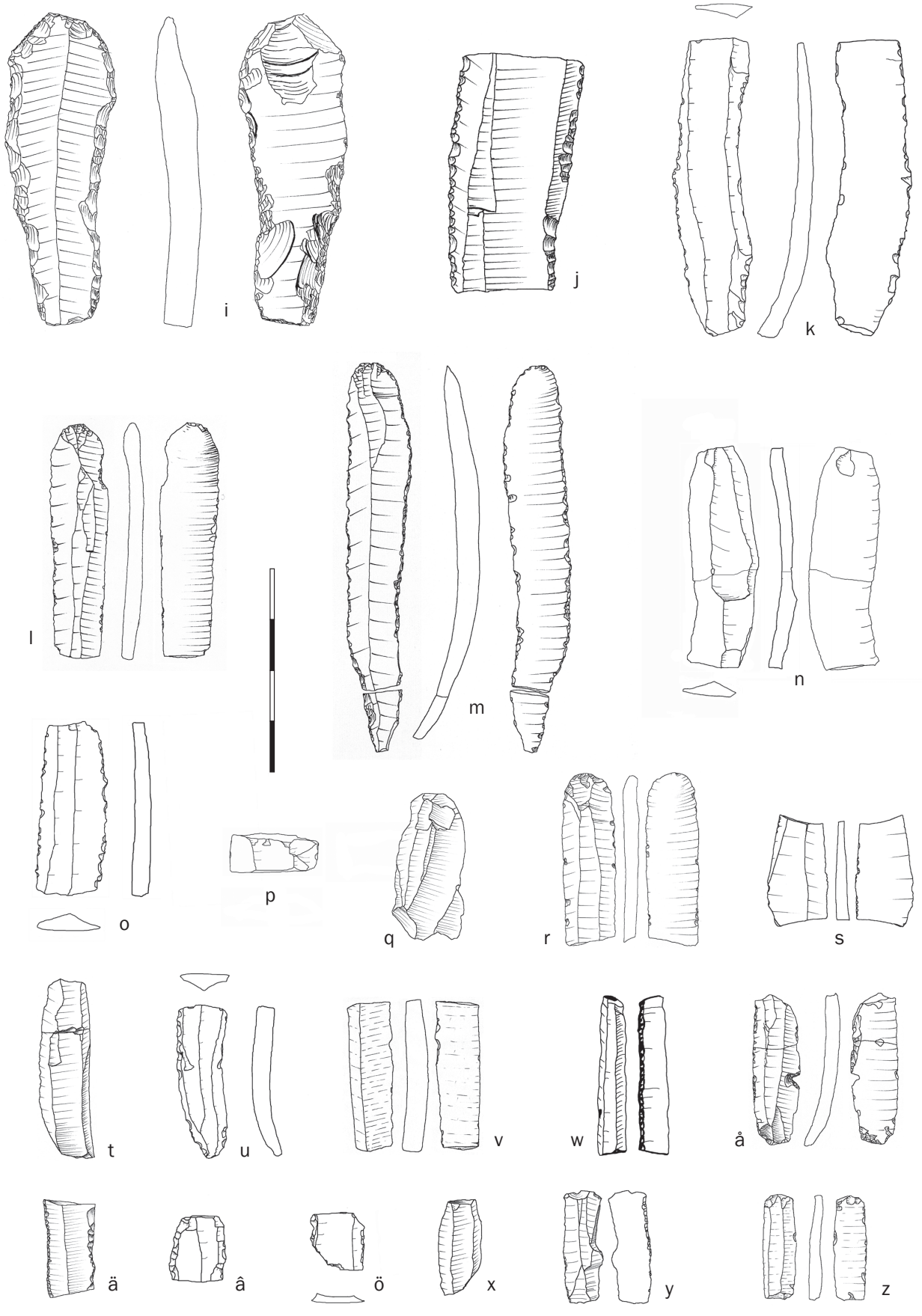
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A small group of core trimming/preparation blades can be also distinguished in the material. These include one cortical blade from the Vuopaja N site (**Fig. 21:c**) and three blades, from Vuopaja N (Siiriäinen 1982:Fig.4), Korkalon pelto, and Neitilä 4 (**Fig. 21:a&b**), that bear possible evidence of cresting of the original cores.

A somewhat enigmatic find among the retouched blades is the nearly 19 cm long, and originally even longer, regular blade from Kotiranta in Suonenjoki, eastern Finland (**Fig. 22**). Because both the proximal and distal ends of the blade have been removed, the length of the blade must initially have been over 20 centimetres. Almost all of the margins bear an irregular retouch, direct on one long margin and inverse on the other. The proximal end has a scraper-like retouch. The blade was found in 1986 on a ploughed forest floor without any associated artefacts (Aroalho 1986).

Blades of this size and regularity are not common in the archaeological record anywhere in the world. The length of the blade, as well as the regular scars left by the previous detachments, makes it likely that the blade was made using lever pressure. Jaques Pelegrin (2006) has studied the production of such regular over-20-cm-long blades in Near East and Europe, where they date mainly to *c*. 4000–2000 calBC. Of the seven production areas discussed by Pelegrin, the thickness of the Kotiranta blade in relation to its length and width has its closest parallels in Chalcolithic blades from Portugal. The origin of the raw material, a relatively coarse grey and white banded flint sprinkled with white dots, remains unknown. Due to a lack of context and parallels for the blade in northern Europe, it seems probable, albeit not certain, that the blade has been imported to the country far after the time of production.[7]

[7] We wish to thank Berit Valentin Eriksen, Jan Ingolf Kleppe, Helena Knutsson, Antonio Melgado, Jaques Pelegrin, Mikkel Sørensen, and Mikhail Zhilin for sharing an interest in finding the area of origin and source of raw material for the Kotiranta blade.

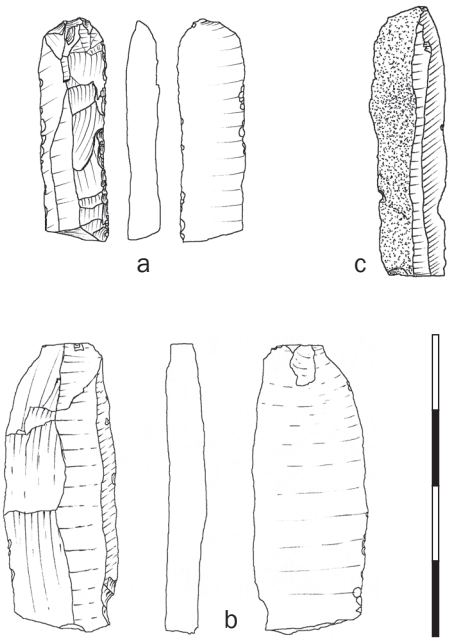


**Figure 21.** Core preparation blades: a) Korkalon pelto; b) Neitilä 4; c) Vuopaja N. Scale in centimetres.

## Discussion and summary

The blade artefacts discussed in this study constitute a somewhat heterogeneous group of artefacts in terms of size, types, raw material, and date. The survey collection shows the presence of different technofunctional artefact groups, arrowheads and scrapers being the most common. Most blades are on the wider side of the 10 mm borderline between macroblades and microblades/bladelets, indicating at the most part a production and movement of relatively large blades, but the core from Vuopaja N, as well as possibly some of the smaller blades, suggests that bladelet production is also represented in the material.

The dating evidence for blade finds is summarised in **Figure 23**. The radiocarbon-dated contexts are all Mesolithic, but the shoreline and typological dates give a longer time span for blade use. Especially in southern Finland and southern Lapland, shore-displacement

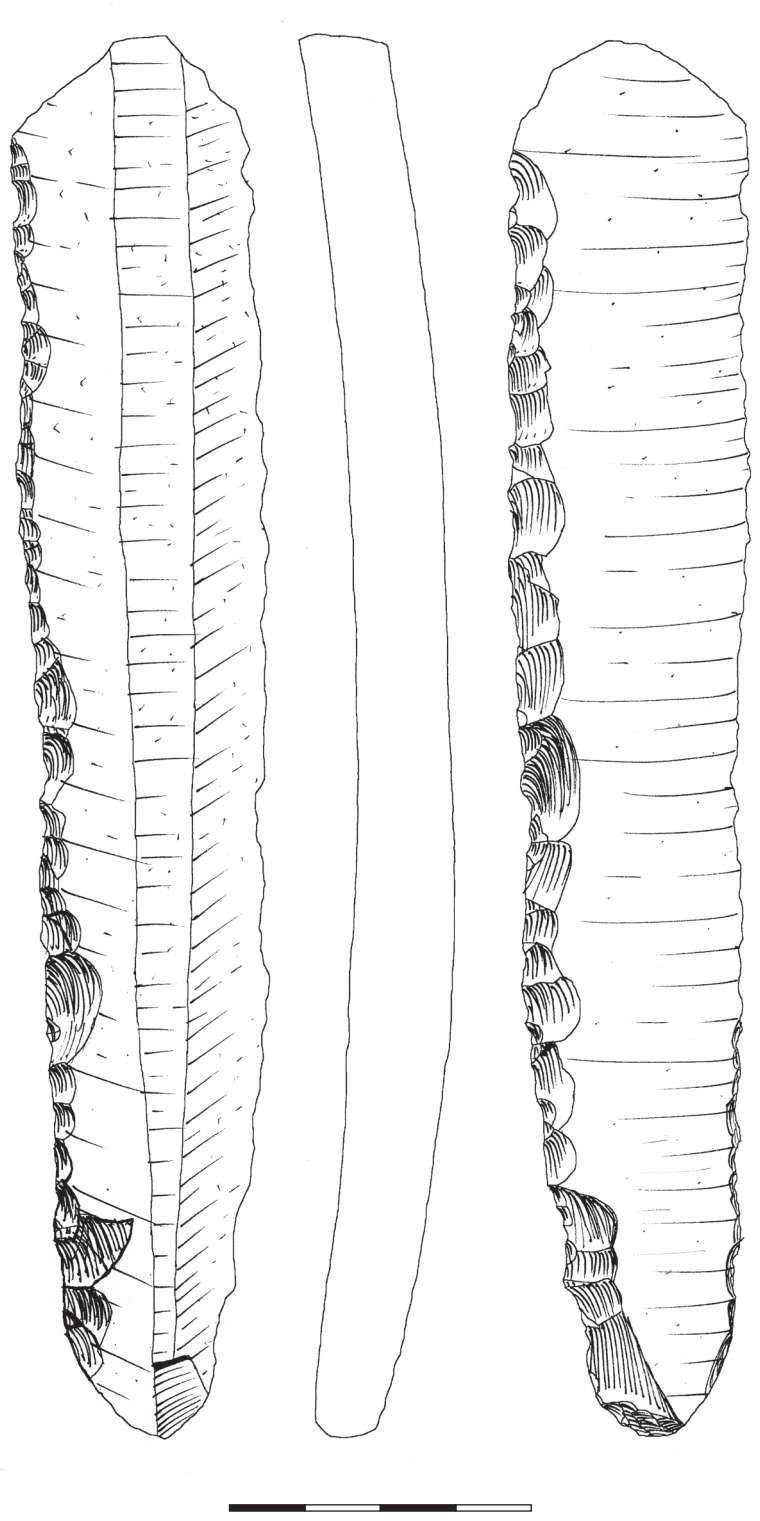

**Figure 22.** The Kotiranta blade (KM 23230). Scale in centimetres.

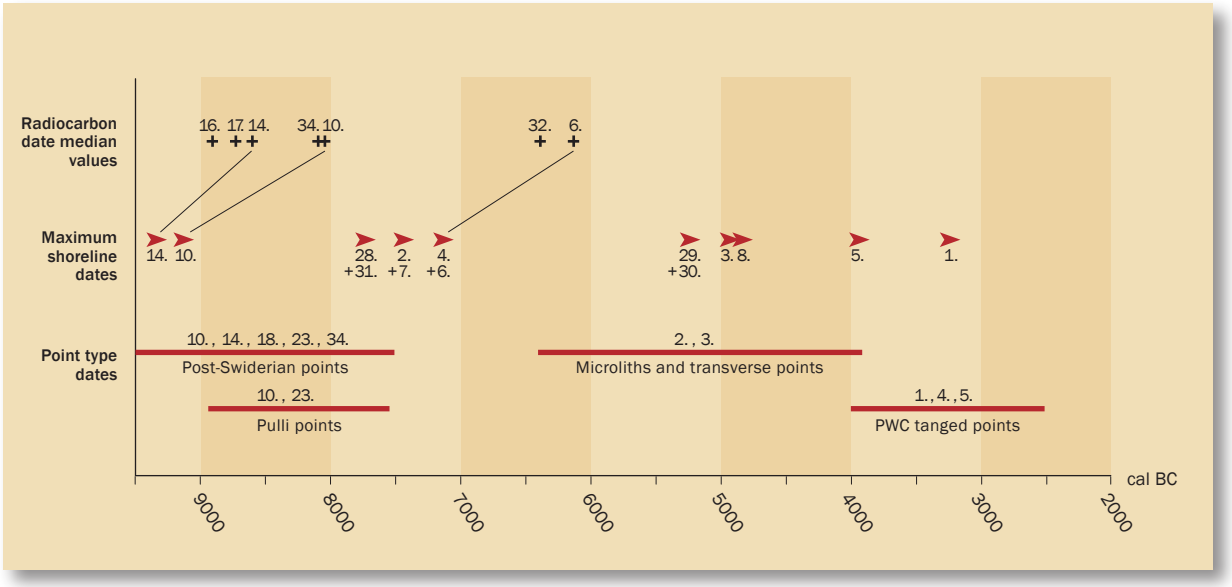


**Figure 23.** Assembled dates for the Finnish blade artefacts and find locations. PWC=Pitted Ware Culture.

chronology provides good evidence for blades below the Early Ancylus lake levels. In southern Finland, blades are found not only on Mesolithic shorelines, but also on elevations that clearly indicate Neolithic shorelines.

Technological details, raw material, and the division of artefact types indicate that most of the blades represent influences from Central Russia and, possibly, the East Baltic region. The microburin technique, combined with geometric microliths, common in southern Scandinavia but non-existent, for instance, in the standard sites of the East Baltic Kunda Culture (Ostrauskas 2000:172–175), has been detected only at the Bötesberget site at the south coast. In effect, alongside the single transverse point from Sperrings, the flint assemblage of the Bötesberget site can be considered the only Mesolithic site assemblage in Finland representing South-Scandinavian technological traits, thus indicating the existence of Mesolithic contacts between the South Baltic area and Finland.

Many non-diagnostic blade finds from supra-aquatic areas are beyond the radiocarbon, shoreline and typological dating methods. However, some clues for their temporal position can be found in neighbouring countries. In north-western Russia, the available data indicate a trend in which the role of blades in blank production decreases and the relative amount of flake blanks and bifaces increases from the Mesolithic to the Neolithic (e.g., Koltsov & Zhilin 1999b; Oshibkina 1997). This suggests that most of the non-diagnostic and undated blade artefacts of Carboniferous flint also date to the Mesolithic in Finland.

In southern Scandinavia, blades are more evenly distributed in time, but it nevertheless seems that excluding the probably Mesolithic Bötesberget site, in Finland, the relatively rare South-Scandinavian blade artefacts appear primarily in Neolithic (and possibly Bronze Age) coastal contexts, i.e., roughly at the same time as examples of other Scandinavian artefact types, such as Scandinavian axe types, flint daggers, and eastern-Swedish Pitted Ware pottery (e.g., Europaeus 1921; Laulumaa 2005). The Scandinavian type-A tanged points from the south coast and the Åland islands suggest that the same mechanism that produced isolated tanged points on Eastern Swedish Pitted Ware sites possibly extended as far east as mainland Finland. The blade artefacts surface collected from the Lammashaka site (a possible Pitted Ware Culture point fragment, a blade segment made of what looks like tertiary flint from South-Scandinavia, and a burin/scraper on blade), can be seen as suggesting a larger than average pottery Mesolithic/Neolithic blade assemblage in Finnish context.

A large number of blade artefacts in the current survey derive from southern Finland. This is not surprising, as it is in this area where most of the modern habitation is concentrated and, consequently, where most of the archaeological fieldwork has taken place. In this area, the

Holocene shorelines of the Baltic Sea basin are found relatively close to each other, and many sites of different ages are found starting from the Early Mesolithic. Southern Finland also has the largest variability of defined types and blade artefacts of different age. We suggest that the large variability of types is a statistical illusion related to the higher amount of finds in this area rather than evidence of any direct adaptive or cultural mechanisms.

In easternmost Finland an emerging high-density blade area can be recognised. Because of the relatively small amount of field work conducted in this area, and despite the unsystematic nature of the current survey, this density seems exceptionally high and suggests a mechanism resulting in a larger than average amount of blades in this area. This may be due to the early deglaciation and colonisation of the area (Pesonen *et al. in press*; Hertell & Manninen 2006).

Although most of the Stone Age coast is located in the southern half of the country, some finds from southern Lapland and Kainuu indicate an emerging possibility to chase and seriate blade sites from different prehistoric phases in the area using shore displacement chronology. The blade artefacts in southern Lapland and Kainuu also seem to be the northernmost blade finds of flint originating in Russia with the possible exception of the Vuopaja N site in Inari, northern Lapland. The emerging concentrations of blade finds in Kainuu and southern Lapland may be related to waterways that lead to White Sea (Huurre 1984), where flint is naturally available in the south-eastern coastal region.

The small number of sites in the northernmost part of Finland is likely to be the result of relatively limited field work activity in this area rather than a true reflection of the past. The presence of the three-thousand-blade short-term Sujala camp site in Utsjoki with signs of blade production using multiple cores alone implies that many unknown blade sites are hidden in the landscape in northern Finland. Because terrestrial hunters move often, the Sujala group must have occupied several camp sites in the course of their lives. Many of these sites can be expected to contain blades. If blades were made and blade manufacturing technology was passed from one generation to another over the decades, it is clear that dozens of Sujala-like blade sites are waiting for field archaeologists in the north, as evidenced by the recent discoveries across the border in northern Norway (Rankama & Kankaanpää 2010).

The raw materials used to produce the studied blades are highly variable. The raw materials of some of the artefacts show characteristic features of Cretaceous and Carboniferous flints, whereas the raw material sources of others are less clear and may include, in addition to North Norwegian cherts, local sources, Paleozoic flints (Jussila *et al.* 2007), and possibly even fine-grained volcanic rocks used in blade production in Dalarna, Central Sweden (Lannerbro 1992), to name a few. Blades made of jasper, such as the possible secondary crested blade from Neitilä 4, suggest that blade production employing local jasper may also have existed. Publications on blades from Dalarna show that elaborate blade technology was also applied to jasper in the area (e.g., Lannerbro 1992). In Finland jasper blade production sites, if present, are likely to be found in Lapland and in other areas where jasper is locally available.

The survey of blade finds presented here, although not comprehensive, illustrates the temporal and geographical distribution and scarcity of blades in archaeological assemblages in Finland. The blade find locations form five clusters, one in the south, one in the south-east, two in the north-east and finally, one in northernmost Finland. The finds show a trajectory of cultural developments where contacts of local groups grew into different directions in the course of time. In the Early Mesolithic, connections oriented towards the east and south-east were maintained in the whole area of present-day Finland. Later during the Mesolithic, regional differences seem to have emerged, and other, most notably South-Scandinavian, blade artefacts started to appear. As a rule of thumb, it can be stated that in Finland, most blades date to the Early Mesolithic, most blade find locations date to the Mesolithic, but flint and chert blades have been used throughout prehistory and up to modern times.

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## Appendix I. The survey data. 1/2

| Areal group | Municipality | Site | Description | Archive no. | L | W | T | Raw material* | Color | Publication |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Askola | Siltapellon-haka | Medial part of a blade. Inverse retouch on part of the left margin. | KM 12933:1139 | 22 | 7.7 | 2.3 | Cretaceous (Senonian) | light grey (grey dots) | Luho 1957 |
| 1 | Espoo | Sperrings | Transverse point. Direct retouch on the margins. | KM 8313:118 | 20.3 | 15.3 | 4.2 | Cretaceous? | burnt white | Europaeus 1927 |
| 1 | Geta | Smikärr (nedre) | Tanged point (?) on blade. Tang at the proximal end of the blade. The tip of the point is the unmodified distal end of the blank. The tang is formed with direct retouch on the right and inverse retouch on the left margin. | KM 14103:218 | 40 | 15 | 6 | Cretaceous? | yellowish grey | Meinander 1964 |
| 1 | Geta | Smikärr (nedre) | Tanged point on blade. Tang at the proximal end of blade. The tang is formed with direct retouch on the right and inverse retouch on left margin. Direct retouch on the left side of the tip. | KM 14103:220 | 50 | 19 | 6 | Cretaceous? | yellowish grey | Meinander 1964 |
| 1 | Hausjärvi | Teuronjoki | Distal part of a blade. Scraper edge at the distal end (direct retouch). | KM 32983:213 | 23.5 | 25.1 | 5.7 | Jasper (unknown age) or carboniferous chert | red | Matiskainen & Ruohonen 2004 |
| 1 | Kemiönsaari | Bötesberget | Proximal part of a blade. Microburin fracture at the distal end. | KM 26616:252 | 18 | 8 | 3 | Cretaceous (Senonian?) | light yellowish grey | — |
| 1 | Kemiönsaari | Bötesberget | Proximal part of an irregular blade. | KM 26616:324 | 28 | 20 | 5 | Cretaceous (Senonian?) | light grey (white dots) | — |
| 1 | Kemiönsaari | Bötesberget | Medial part of a blade (rhomboid microlith). Inverse retouch on the right margin. Direct retouch on both ends. | KM 26616:436 | 28 | 13 | 3 | Cretaceous (Senonian?) | light grey (white dots) | — |
| 1 | Kemiönsaari | Bötesberget | Microlith (triangular?). Microburin scar at the proximal end. Direct retouch on the left margin. | KM 26616:437 | 21 | 17 | 3 | Cretaceous (Senonian?) | light yellowish grey | — |
| 1 | Kemiönsaari | Bötesberget | Distal part of a blade. In two pieces due to a modern break. | KM 26616:439 | 35 | 10 | 2 | Cretaceous (Senonian?) | light yellowish grey | — |
| 1 | Kerava | Lammashaka | Tip of a projectile on blade. Inverse margin retouch. | KM 31690:1 | 18 | 13 | 5 | Cretaceous (Senonian) | light grey (lighter dots) | — |
| 1 | Kerava | Lammashaka | Proximal part of a blade. | KM 31690:2 | 23 | 19 | 4 | Tertiary? (Bryozoans?) | burnt (grey and orange inclusios) | — |
| 1 | Kerava | Lammashaka | Medial part of a blade. Scraper edge at the distal end (inverse retouch). Burinations on break intiating from the proximal end on both margins. | KM 34360:2 | 30 | 19 | 5 | Cretaceous (Senonian) | light grey (lighter dots) | — |
| 1 | Lemi | Pöllölä | Proximal part of a blade. Irregular direct and inverse retouch on both margins. Large eraillure scar or secondary detachment on the ventral side of the proximal end. | KM 3359:5 | 61.2 | 21.8 | 8.1 | Cretaceous (Senonian) | dark grey with lighter spots | — |
| 1 | Luumäki | Hietalahti 1 | Medial part of a blade. Direct retouch on both margins. | KM 31136 | 53 | 21 | 7 | Cretaceous (Senonian?) | banded light grey with yellow patina | — |
| 1 | Mäntyharju | Pöydänpään-niemi | Cylindrical opposite platform blade core with a large number of narrow blade scars. Both platforms are rounded and polished. | KM 34023 | 63.9 | 15.4 | 12.8 | Cretaceous (Senonian?) | black with orange brown patina | — |
| 1 | Vantaa | Kirkonkylä | Tanged point on blade. Proximal end of the blank removed, distal end retouched with semi-abrupt inverse retouch. Small polished patch on the ventral surface of the tip. Tang formed with semi-abrupt inverse retouch. | KM 11606 | 81.4 | 14.6 | 4.1 | Cretaceous (Senonian) | light grey | Meinander 1964 |
| 1 | Vantaa | Asola | Blade (in two pieces) with direct retouch on both margins. | KM 20164:127+128 | 73 | 14 | 5 | Cretaceous? | mottled/banded dark/ light grey with yellow patina | Leskinen & Peso-nen 2008 |
| 1 | Vantaa | Asola | Medial part of a blade or blade-flake. | KM 20164:94 | 22 | 12 | 2 | Carboniferous? | yellow | |
| 1 | Vantaa | Jönsas | Tanged point on blade. Proximal and distal ends removed. Direct retouch on the tip and the tang. | KM 19913:272 | 40.7 | 10.8 | 3.5 | Cretaceous (Senonian, Falster?) | matte bluish grey patina | Takala 2004 |
| 2 | Ilomantsi | Jaakonsaari | Dagger-like blade with continuous direct retouch around the artefact. Invasive inverse retouch on the proximal end of the left margin. | KM 13022 | 111,6 | 21 | 6 | Carboniferous | chocolate brown | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Distal part of a blade. Direct retouch on the distal end of the right margin. | KM 17875:21 | 58.1 | 14.3 | 4.6 | Carboniferous? | light grey (light dots) | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Small blade segment. | KM 17875:66 | 7.3 | 16.6 | 4.2 | Carboniferous | light brown | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Distal part of a blade. Water rolled. | KM 18200: 220 | 30.6 | 10 | 3.8 | Carboniferous | white | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Small blade segment. Direct retouch on the left margin. | KM 18200:190 | 11.1 | 10.1 | 2.1 | Carboniferous? | light grey | Hertell & Manninen 2006 |

* Determinations based on the visual appearance of artefacts. The sub-division of Scandinavian flints is based on Högberg & Olausson 2007. ** Kinnunen *et al.* 1985.

**Appendix I.** The survey data. 2/2

| Areal group | Municipality | Site | Description | Archive no. | L | W | T | Raw material* | Color | Publication |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Ilomantsi | Syväys 1 | Proximal part of a blade. Direct retouch on both margins and the proximal end. | KM 18200:253 | 12.6 | 10.9 | 3.8 | Carboniferous | banded reddish grey and white | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Medial part of a blade. Water rolled. | KM 18200:289 | 34.7 | 13.5 | 3.8 | Carboniferous | orange brown | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Medial part of a blade or blade-flake. Water rolled. | KM 18200:347 | 15.1 | 23.6 | 6.2 | Carboniferous? | opaque black | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Syväys 1 | Proximal part of a blade (in two pieces). | KM 18200:84 | 43.1 | 13.4 | 3.7 | Carboniferous | orange brown | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Issakkalan-särkkä | Proximal part of a blade or blade-flake. Scraper edge (direct retouch) at the distal end. | KM 25214:4 | 25.3 | 18.8 | 4.1 | Carboniferous | yellowish orange | Hertell & Manninen 2006 |
| 2 | Ilomantsi | Niemenjärvi | Tanged point on blade. Both ends of the blank have been removed. Inverse invasive retouch on the tip. Bifacial retouch on the tang. | KM 7172:1 | 40.3 | 10.4 | 3.1 | Carboniferous? | yellowish brown translucent | Meinander 1964 |
| 2 | Joensuu | unknown | Proximal part of blade. Scraper edge at the distal end (direct retouch). Burinations initiating on the retouched end on both margins. | KM 2573:6 | 41 | 22 | 6 | Carboniferous | purple translucent | — |
| 2 | Joensuu | Jokivarsi 1 | Blade segment. Scraper edge (direct retouch) at the distal end. | KM 34160:1 | 13 | 13 | 4 | Carboniferous | dotted yellow/brown | Pesonen 2005 |
| 2 | Suonenjoki | Kotiranta | Medial part of a blade. Direct irregular retouch on the left long margin and inverse on the right margin. The proximal end has a scraper-like retouch | KM 23230 | 186 | 32.2 | 12.2 | Tertiary? Jurassic? | layered grey with white bands and dots | — |
| 2 | Nilsiä(?) | unknown | Tanged point on blade. Both ends of the blank have been removed. Inverse invasive retouch on a large part of the distal end and direct invasive retouch on the right margin of the tip. Bifacial retouch on the tang. | Kuopio Museum 2371 | 104 | 18 | 6 | Cretaceous? | dark brown | Matiskainen 1986 |
| 3 | Hyrynsalmi | Vonkka 2 | Intact blade. | KM 31384:230 | 20 | 6 | 3 | Jasper (unknown age) or carboniferous chert | red | — |
| 3 | Siikalatva | Myllykoski | Proximal part of a blade with retouched margins (direct retouch). The proximal end is rounded and polished. | KM 23098 | 93.6 | 22.3 | 7.5 | Cretaceous (Senonian?) | orange brown patina | Koivunen 1985 |
| 3 | Suomussalmi | Kalmosärkkä | Medial part of a blade. Direct retouch on both margins. | KM 14504:453 | 19 | 10 | 3 | Carboniferous | dotted light/dark brown (burnt?) | Huurre 1959 |
| 3 | Suomussalmi | Kalmosärkkä | Proximal part of a blade. | KM 14504:475 | 34 | 10 | 3 | Carboniferous | dotted light/dark brown (burnt?) | — |
| 3 | Suomussalmi | Jussinlahti | Medial part of a blade. Direct retouch on both margins. | KM 35157:2 | 46.4 | 24.1 | 6.5 | Carboniferous | orange brown (small light dots) | — |
| 4 | Kemijärvi | Neitilä 4 | Proximal part of a secondary crested blade. Direct retouch on the distal end of the right margin. | KM 15671:1181 | 45 | 18 | 6 | Jasper (local**, unknown age) | red | — |
| 4 | Kemijärvi | Neitilä 4 | Medial part of a blade. | KM 15671:1210 | 29 | 9 | 5 | Jasper (local**, unknown age) | red | — |
| 4 | Rovaniemi | Korkalon pelto | Proximal part of a secondary crested blade. Direct retouch on both margins. | KM 15750:249 | 30 | 9 | 4 | Carboniferous | light grey striped | Kotivuori 1996 |
| 4 | Rovaniemi | Pitkäniemi | Proximal part of a blade. | KM 25587:1 | 46 | 11 | 3 | Carboniferous | white | Kotivuori 1996 |
| 4 | Rovaniemi | Keski-oikarainen | Distal part of a blade. Inverse retouch on part of the right margin and direct retouch on the left margin. | KM 30234:16 | 29 | 9 | 3 | Carboniferous | mottled light/dark brown | Kotivuori 1996 |
| 5 | Inari | Rovaniemi | Intact curved blade. | KM 23377:1 | 105 | 20.5 | 8.5 | Northern (Norwegian?) chert (unknown age) | striped brown/grey | Kankaanpää & Rankama 2005 |
| 5 | Inari | Vuopaja N | Narrow face bladelet core. The core face is 29 mm long. | KM 21437:1 | 58 | 19 | 25 | Northern (Norwegian?) chert (unknown age) | weathered white | Siiriäinen 1982 |
| 5 | Inari | Vuopaja N | Bladelet/ bladeflake. | KM 21437:2 | 25 | 7 | — | Northern (Norwegian?) chert (unknown age) | white | Siiriäinen 1982 |
| 5 | Inari | Vuopaja N | Bladelet/ bladeflake. | KM 21437:2 | 36 | 11 | — | Northern (Norwegian?) chert (unknown age) | white | Siiriäinen 1982 |
| 5 | Inari | Vuopaja N | Proximal part of a cortical blade. | KM 27810:22 | 35.6 | 10.3 | 3.9 | Carboniferous? | yellowish brown (cortical) | — |

* Determinations based on the visual appearance of artefacts. The sub-division of Scandinavian flints is based on Högberg & Olausson 2007. ** Kinnunen *et al.* 1985.

## Appendix II. Additional possible blade finds.

| Areal group | Municipality | Site | Archive no. |
|---|---|---|---|
| 1 | Askola | Taka-Piskulan Ruoksmaa | KM 13067:223 |
| 1 | Eura (Honkilahti) | Kolmhaara | ? |
| 1 | Hartola | Uusi Ruskeala c | KM 33916:1–33 |
| 1 | Lappeenranta (Joutseno) | Hiekkasilta-Hiekkakuoppa | KM 32560 |
| 1 | Lappeenranta (Joutseno) | Saarenoja-Muilamäki | KM 32559 |
| 1 | Orimattila | Tortola 2 | KM 31858:1–2 |
| 2 | Joensuu (Eno) | Mäntyniemi | KM 34109:8 |
| 3 | Hyrynsalmi | Vonkka 2 | KM15393:612 |
| 3 | Sotkamo | Kiikarusniemi | KM 28671:300 |
| 3 | Suomussalmi | Kalmosärkkä | KM 14829:339, KM 14830:752 |
| 3 | Suomussalmi | TB:n ranta | KM 29104:7 |
| 3 | Suomussalmi | Tormuan särkkä | KM 18322:550 |
| 3 | Suomussalmi | Kukkosaari | KM 25429:1 |
| 5 | Inari* | Saamenmuseo | KM 22443:80, :109, :204, :255, :443, :599, :637, :1142 |
| 5 | Inari* | Vuopaja | KM 23761:255, KM 28365:443 |
| 5 | Inari* | Vuopaja N | KM 27810:22, :79, :94, :361 |

* Bladeflakes included

## Appendix III. List of catalogue numbers of artefacts shown in the illustrations.

Figure 1.
a1) KM 18501:1524
a2) KM 18501:1550
a3) KM 18501:1004
a4) KM 18501:1221
a5) KM 18501:1182
a6) KM 18501:1227
a7) KM 18501:403
b1) KM 20164:94
b2) KM 20164:127+128
c1) KM 26616:439
c2) KM 26616:324
c3) KM 26616:436
c4) KM 26616:252
c5) KM 26616:437
d1) KM 34360:2
d2) KM 31690:2
d3) KM 31690:1
e) KM 12933:1139
f) KM 8313:118
g) KM 3359:5
h) KM 31136
i) KM 32983:213
j) KM 32558:17
k) KM 34023
l) KM 19913:272
m) KM 11606

Figure 2.
a) KM 13022
b) KHM 2371
c) KM 23230
d) KM 34160:1
e) KM 25214:4
f) KM 2573:6
g) KM 7172:1
h1) KM 17875:21
h2) KM 18200:84
h3) KM 18200:289
h4) KM 18200:220
h5) KM 17875:66
h6) KM 18200:253
h7) KM 18200:347
h8) KM 18200:190

Figure 3.
a) KM 23098
b) KM 35157:2
c1) KM 14504:475
c2) KM 14504:453
d) KM 31384:230
e) KM 25587:1
f) KM 15750:249
g) KM 30234:16
h1) KM 15671:1210
h2) KM 15671:1181
i) KM 21437:1
j) KM 23377:1

Figure 10.
a) KM 32558:17
b) KM 21437:1
c) KM 34574:204
d) KM 34023

Figure 13.
a) KHM 2371
b1) KM 18501:1221
b2) KM 18501:403
b3) KM 30873:328
b4) KM 30873:1265a+b
c) KM 35917:8279
d) KM 7172:1
e1) KM 26616:437
e2) KM 26616:436
f) KM 8313:118
g) KM 11606
h) KM 14103:220
i) KM 19913:272
j) KM 31690:1

Figure 18.
a1) KM 18501:1212
a2) KM 18501:1217
a3) KM 18501:1004
a4) KM 18501:10
b) KM 34160:1
c) KM 25214:4
d) KM 32983:213

Figure 19.
a) KM 34360:2
b) KM 2573:6

Figure 20.
a) KM 23377:1
b) KM 23098
c) KM 13022
d) KM 18501:1524
e) KM 31136
f) KM 31690:2
g) KM 18200:347
h) KM 18501:1550
i) KM 3359:5
j) KM 35157:2
k) KM 17875:21
l) KM 25587:1
m) KM 20164:127+128
n) KM 18200:84
o) KM 18200:289
p) KM 17875:66
q) KM 26616:324
r) KM 14504:475
s) KM 20164:94
t) KM 26616:439
u) KM 18200: 220
v) KM 15671:1210
w) KM 31452:793
å) KM 30234:16
ä) KM 14504:453
â) KM 18200:253
ö) KM 18200:190
x) KM 26616:252
y) KM 12933:1139
z) KM 31384:230

Figure 21.
a) KM 15750:249
b) KM 15671:1181
c) KM 27810:22