ROGER GRACE

chaîne opératoire

IKARUS BOOKS

Published 2012 by

IKARUS BOOKS

www.rogergrace.macmate.me/ikarusbooks

Visit website for information on other publications

Chaîne opératoire, translated as operational sequence, has been described as, "the different stages of tool production from the acquisition of raw material to the final abandonment of the desired and/or used objects.”

This book explains the links of the operational chain and how these can be used to interpret stone age sites using analysis of material from England and Norway.

chaîne opératoire

Chaîne opératoire, translated as operational sequence, has been described as, "the different stages of tool production from the acquisition of raw material to the final abandonment of the desired and/or used objects.”

Section 1

Introduction

Introduction

Chaîne opératoire, translated as operational sequence, has been described as, "the different stages of tool production from the acquisition of raw material to the final abandonment of the desired and/or used objects. By reconstructing the operational sequence we reveal the choices made by ... humans." (Bar-Yosef et. al. 1992, 511). Excepting that the individuals in a group have a number of raw materials and techniques available to them; "identification of the most frequently recurring of these choices enables the archaeologist to characterize the technical traditions of the social group" (ibid). Culture is expressed in these choices that are made throughout the operational sequence. This approach contrasts with the typological approach that concentrates on the end product alone as opposed to the whole process of lithic exploitation. Typology automatically produces a limited sample as only a very small percentage of pieces are retouched. This is particularly the case with small Norwegian sites. The two sites that will be used as examples are Kvernepollen 9, from the Kollsnes project, situated on the West coast (Nærøy 1994), and Farsund (Lundevågen 17 in Ballin & Jensen 1995) situated on the southern extremity of the west coast (see Map). Kvernepollen is dated to the early Bronze age by typological dating because of the presence of bifacial leaf shaped points (overflateretusjerte spisser, see Nærøy 1994, 198) and Farsund is a Mesolithic site carbon dated to c. 7800 BP (Ballin & Jensen 1995, 36). Both sites were totally excavated and the analysis presented here is based on all pieces greater than 10mm. in any dimension (i.e., omitting the splinter in Norwegian terminology).

INTERACTIVE 1.1 **Location of sites**

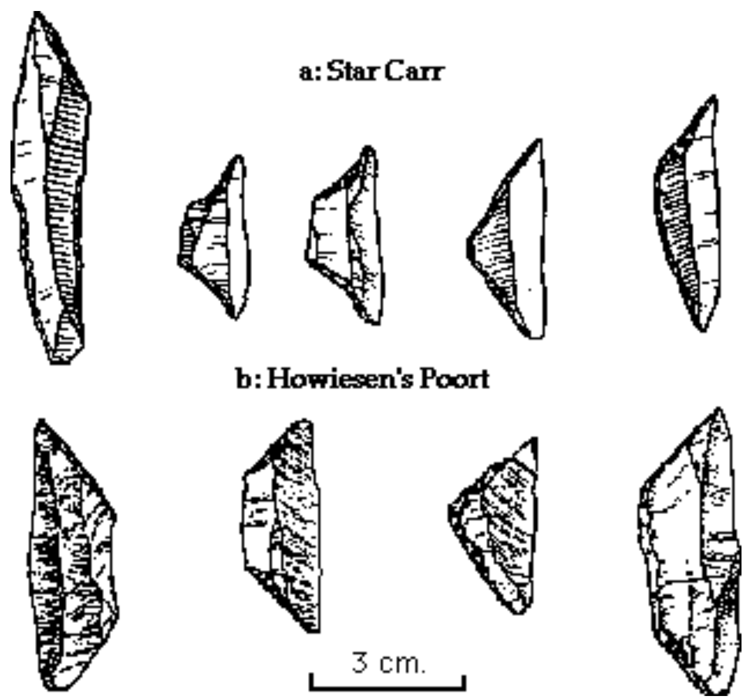
At Kvernepollen there are 12 retouched pieces (7 bifacial points, 3 sidescrapers, 1 endscraper, 1 backed flake) among the 838 pieces analysed. At Farsund there are 20 retouched pieces (12 scrapers, 4 retouched bladelets, 1 retouched blade, 1 retouched flake, 1 piercer, 1 broken tanged piece) among the 1235 pieces analysed. These 'tools' represent entire episodes of occupation.

Types of tools have been interpreted as being made according to some mental template so that they were made to a preset form expressing ethnicity. Therefore when the same types of tools are found at different sites this represents occupations by the same culture group. This is the basis of space-time systematics, that is the placing of sites in chronological sequence and geographical location, and inferring the relationships between them.

With the development of New Archaeology and the attempt to express human behavior in terms of scientific laws, it became the fashion to relate stone tools to environment. Stone tools became the mechanism by which humans adapted to changing environmental conditions, following the model of Darwinian evolutionism, and hopefully following laws similar to genetics in animal species. Though the search for laws of human behavior, following this model, appears to have been abandoned, the assumed correlation between the environment and stone tools continues within the evolutionary paradigm. However this correlation has become increasingly difficult to sustain.

For example, there was the idea of a very rapid change from Upper Palaeolithic industries to Mesolithic industries due to the climatic and environmental changes during the transition to the post glacial period. In order to adapt to these changing environmental conditions, Mesolithic technology was adopted to facilitate hunting in more forested environments. Though environmental adaptation plays a part in the transition from Palaeolithic to Mesolithic it is only one factor. The transition began before the end of the last glaciation as microliths are found in the Magdelanian and the Azilian during the Upper Palaeolithic, and in some areas did not occur until after these environmental changes took place, (epi-Gravettian in Italy). Microliths typologically and technologically indistinguishable from North European types (as found at Star Carr, Clark 1954), are found in Howieson's Poort assemblages (Mellars 1989) at the tip of Southern Africa and dated to at least 40,000 years ago.

Figure 1: microliths



Also the early sites in Norway have a Mesolithic technology and typology and yet the environment was similar to the late Upper Palaeolithic in southern Europe, which had an Upper Palaeolithic typology. Therefore Mesolithic tools cannot be seen simply as an environmental adaptation.

The ecological approach has been taken a stage further in saying that though stone tools may not be correlated with changing environmental conditions, social structure is. This theory, propounded by people such as Gamble (1986), is that prior to the Upper Palaeolithic, human groups did not have the social structure that would enable them to adapt to 'marginal' environments. Either the dense forest of full interglacial periods or steppe/tundra conditions of colder periods. This would mean that no occupation of Norway took place prior to the post glacial period. However a recent paper (Roebroeks et al. 1992) has demonstrated that there are a number of sites occupied in similar marginal conditions during the Middle Palaeolithic, demonstrating that Neanderthals did indeed occupy such areas. Of course subsequent ice action would have eradicated evidence of such occupation in Norway. One only has to imagine the effect of ice sheets moving over the kinds of sites that are excavated in Norway to realize that nothing would survive such conditions, unless there were exceptional circumstances.

Considering the lack of correlation of the environment with stone tools and/or social structure, the role of 'human choice' has become more important in understanding stone age sites. One way of studying 'human choice' is through the chaîne opératoire approach. The operational sequence is from raw material procurement to primary reduction techniques (the reduction of nodules to cores), secondary reduction (the removal of blanks from cores and the manufacture of tools with retouch), the use of tools and the discard of the artifacts.

The essential difference between this approach and a typological approach is that it encompasses the whole process of the life history of the lithic material, from basic nodules to the remains that archaeologists excavate. As Stringer and Gamble comment, "The typology of stone tools has been largely superseded by models of behaviour that concentrate more on the 'biography' of the implement - how it was made, used, resharpened, recycled, changed shape and finally thrown away." (Stringer & Gamble 1993, 143). An extension to this operational chain is the post-depositional disturbance of the site and even excavation strategy, as these will have an effect on our understanding of the human choices that were made through out the operational sequence. Cultures, in terms of groups that were ethnically or traditionally similar, are expressed by these choices.

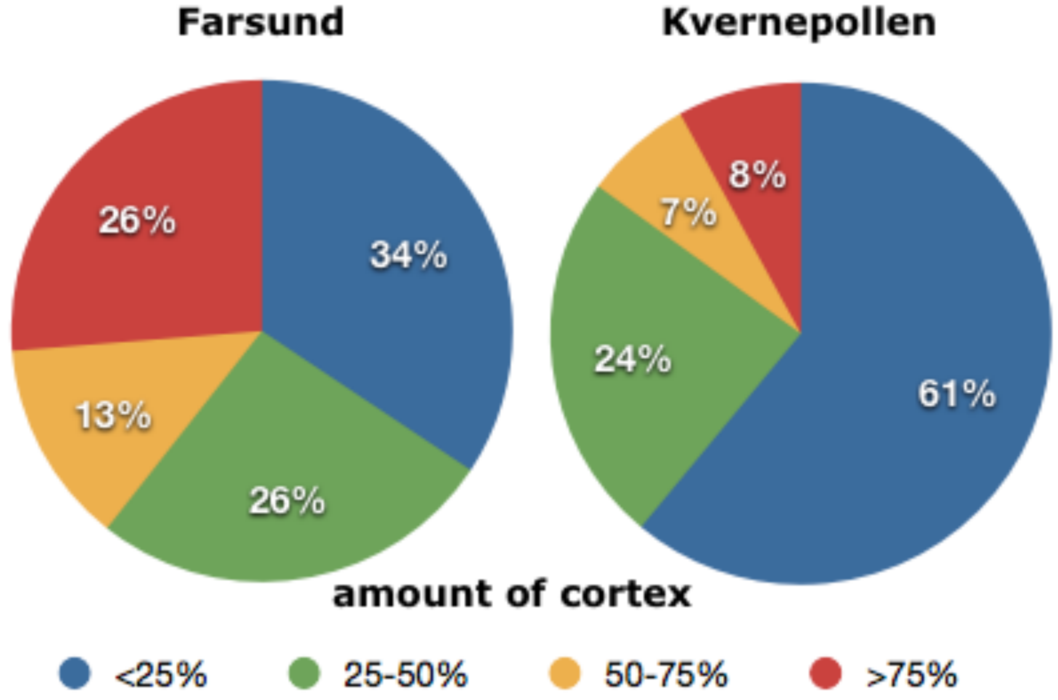
Raw material procurement

Turning to Norwegian sites, raw material procurement is obviously an important factor as a variety of raw materials were used and often found on the same site. Not just flint but quartz, quartzite, rhyolite, rock crystal, slate, etc. Some of these non flint materials have specific sources, as in the case of rhyolite coming from the island of Bølmo in Western Norway. In terms of human choice, why do they choose to exploit rhyolite? This involves traveling to the source by boat, and transporting it as nodules or finished products throughout its distribution in Western Norway. Is the choice of rhyolite an ethnic marker in that a specific material was associated with a particular tribe? Does possession of rhyolite proclaim their origin in Western Norway as opposed to groups originating in Eastern Norway?

It could be argued that there is no choice involved, in that a scarcity of flint determined that rhyolite would be exploited, but why not use, for example, quartzite that was much easier to obtain. Looking at the next link in the chaîne opératoire, does rhyolite have any particular knapping properties that recommend it so that the choice is technological? Does rhyolite have advantages over other materials functionally, in that it is more efficient than, say, quartzite for specific tasks? This would be revealed by the uses of the tools at that phase of the operational sequence.

There are also choices in the means of raw material exploitation. The material can be processed at source, transported as nodules, pre-formed cores or as finished products. The two sites from Kvernepollen and Farsund can be contrasted in this aspect. Though both are coastal sites, exploiting similar environmental resources, there is a difference in that pre-formed cores were transported into Kvernepollen, whereas nodules were taken onto the site at Farsund.

Figure 2

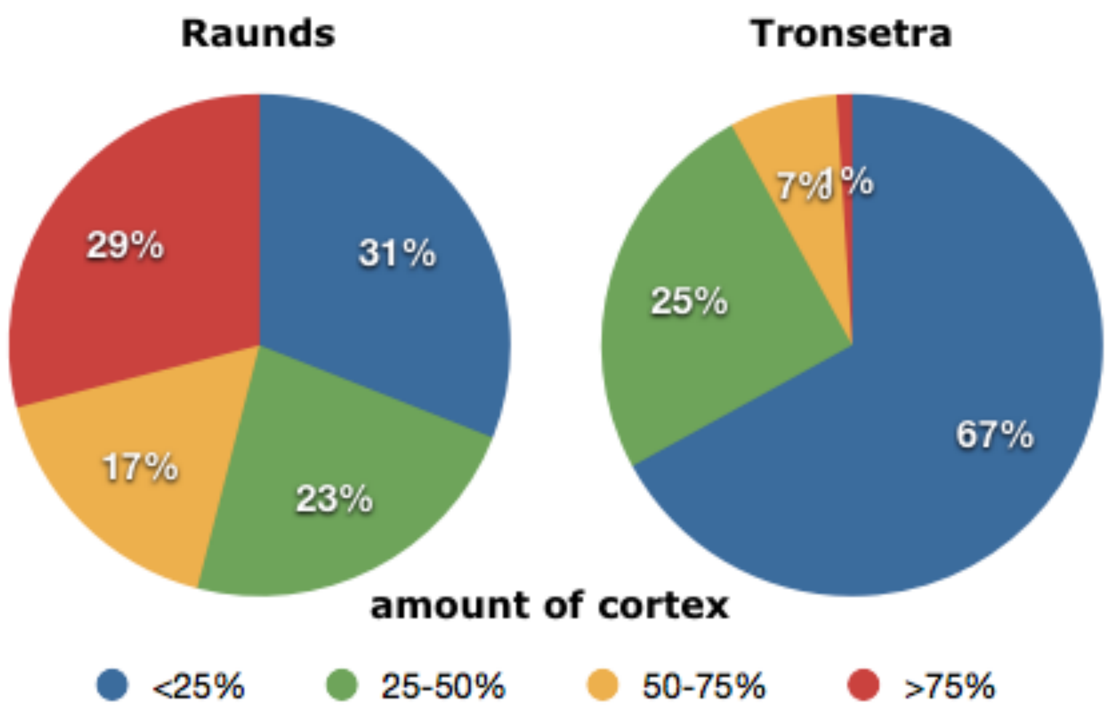


This can easily be illustrated by looking at the cortical element of the debitage (Fig. 2). The pattern from Farsund is typical of knapping from cortical nodules. The pattern from Kvernepollen illustrates a lack of cortex that indicates primary reduction took place elsewhere.

Also there were 10 primary flakes (flakes with 100% cortex) at Farsund and some of the cores are merely nodules with a few flakes removed. The knapper appears to have been testing the nodules for suitability and in some cases rejected them at that stage. This would suggest that there was a local source of flint. The pattern from Farsund is similar to the English Mesolithic site of Raunds where cortical nodules were also being knapped (Fig. 3). It could be suggested that these different patterns are a result of scarcity of flint in the later period when Kvernepollen was occupied.

However, the site of Tronsetra which is dated c.7250 BP has a similar pattern to Kvernepollen. Transporting pre-formed cores would seem a preferable strategy at Tronsetra, which is located in the mountains at c.800m above sea level and 100 kilometres from the coast.

Figure 3



The significance is that the differences are not necessarily related to time, but also to choice. Other sites (for example from Songa, Telemark, in Coulson 1986) in the mountains have cortical nodules, so not taking them to Tronsetra was from choice, not necessity.

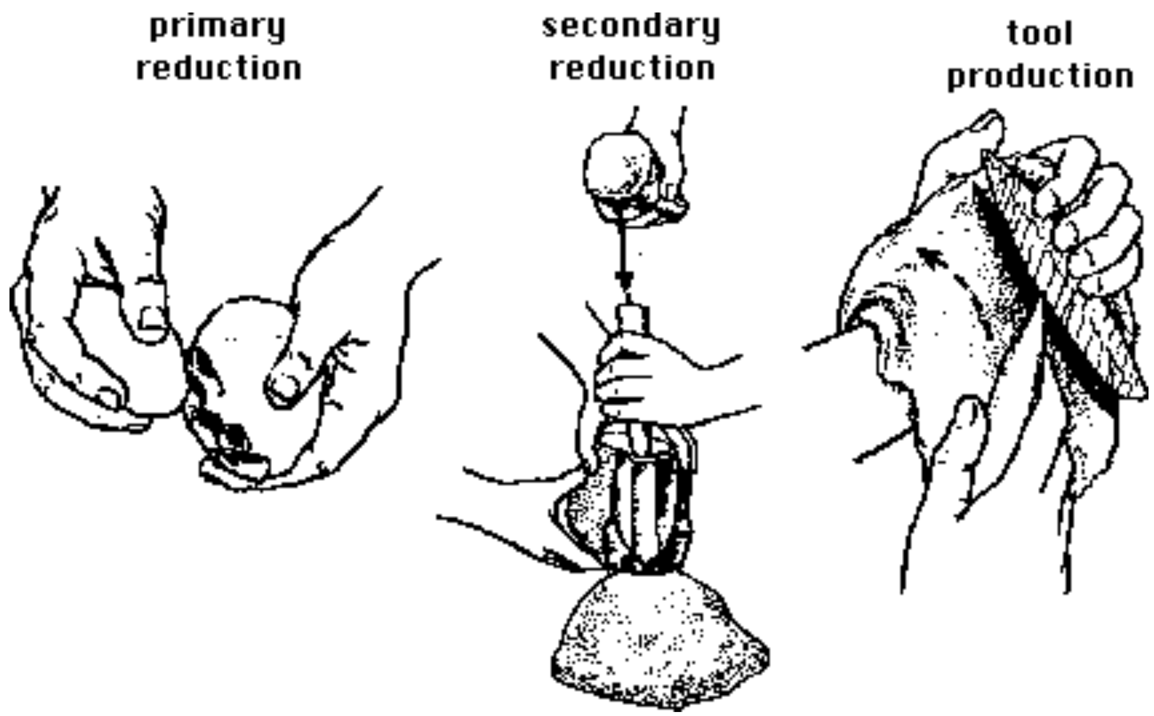
Quartzite was extensively used at Kvernepollen (see Fig. 5), whereas it is virtually absent at Farsund, even though quartzite is available locally in both areas and throughout the chronological period. Is this from scarcity of flint or a choice? The choice being not to use quartzite if sufficient flint is available. Alternatively, if the social dynamics and subsistence strategy involved small highly mobile groups (such as on hunting expeditions), the choice was to take flint as pre-formed cores and use quartzite as required, as opposed to occupying sites where flint was available. This choice of raw material procurement strategy may be a cultural marker rather than a necessity forced on the people by the availability of flint. Sites are found were flint is brought in as nodules and where quartzite is used (Songa, Telemark), suggesting that different strategies of raw material procurement are chosen, rather than simply determined by available resources.

Technology

Technology is divided into primary reduction, secondary reduction and typology. Primary reduction techniques are concerned with the reduction of nodules to cores, the kind of cores produced and the technology involved, for example the use of anvil technique to produce bi-polar cores. Secondary reduction techniques are those involved in producing blanks from cores and include such aspects as blade and flake technology, use of hard or soft hammer and micro-burin technique for the production of microlith blanks. Typology is concerned with tool production and the techniques of retouch, including such aspects as pressure flaking, burin technique and the differences in retouch; both of placement (direct, inverse, etc.), and type (abrupt, invasive, etc.).

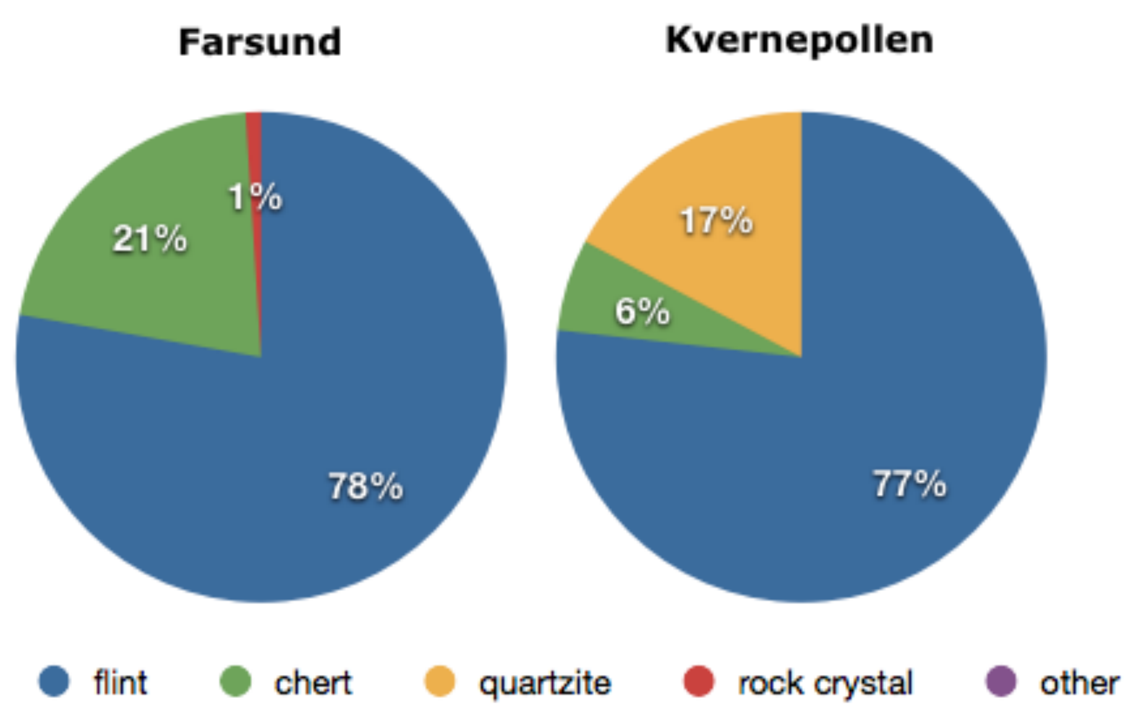
Figure 4 illustrates this reduction sequence. In the example, primary reduction is by direct percussion to remove the cortex and shape the core. Secondary reduction is by punch technique to produce blades. Tool production is by pressure flaking to produce, for example, a bifacial lanceolate point (see Helskog et al. 1976, 33).

Figure 4: technological reduction sequence



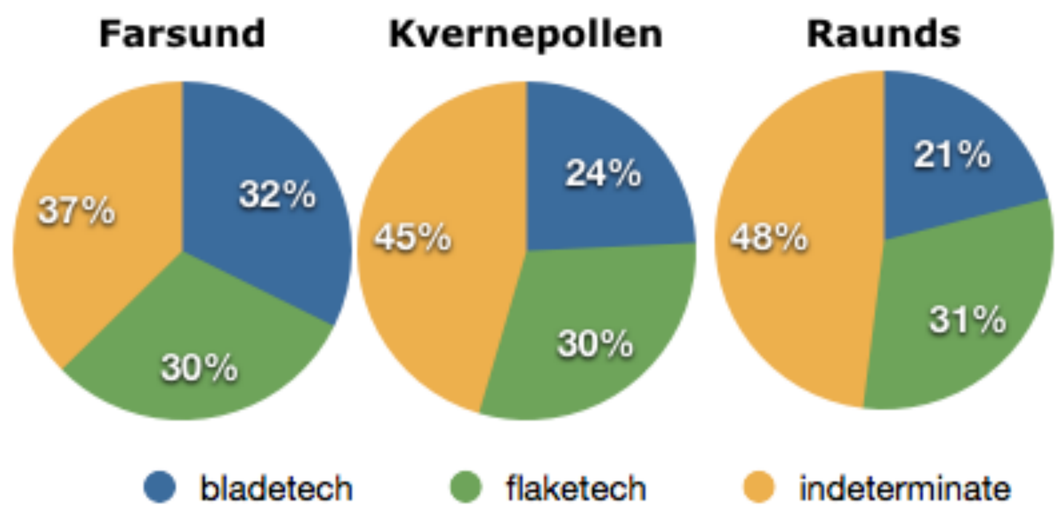
For a comparison of technologies, between Farsund and Kvernepollen, the discussion will be limited to flint because the presence of a significant amount of quartzite at Kvernepollen (17%) as opposed to its absence at Farsund (Fig. 5), effects the overall technology. The technology used with quartzite is effected by the nature of the raw material so that comparison between technologies on different raw materials is less reflective of cultural choices. For example, it is difficult to use blade technology with quartzite, so blade technology is less likely to be 'chosen'.

Figure 5:raw materials



The technologies used are similar a with a slight preference for blade technology at Farsund (Fig. 6) and both sites have 2 crested bladelets (ryggflekke) demonstrating the deliberate preparation of cores for bladelet production. Carefully made conical and cylindrical bladelet cores were found at Farsund whereas only core fragments were found at Kvernepollen (complete cores perhaps being removed for later use).

Figure 6: flint technology

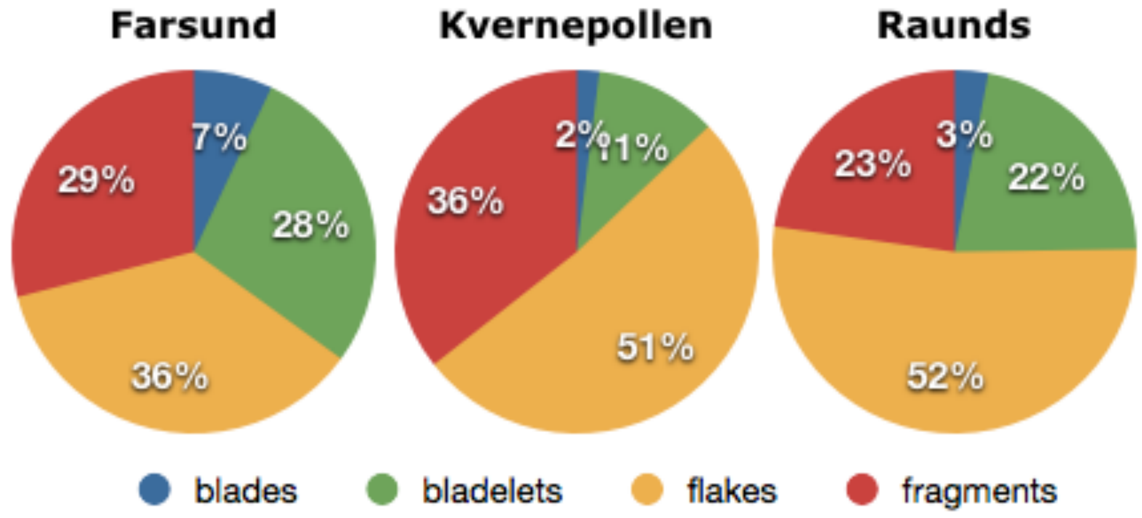


Blade technology simply means the deliberate production of blades. A 'technological' blade must be at least twice as long as it is wide (i.e., the definition of a blade blank). In addition it must have parallel sides and parallel dorsal ridges and (if the platform is intact) a prepared platform. The parallel dorsal ridges mean that it is within the process of reduction of a number of blades rather than a being a 'one off'. Broken pieces, if they have the above technological criteria but are not twice as long as they are wide, are considered as broken 'technological blades'. Flake technology can produce blanks with a length:breadth ratio >2, and therefore are blade blanks, but if they do not have the above technological features they are a product of flake technology even though they are blade blanks. This avoids using such cumbersome terms as blade-like flakes. Such a piece would be a blade blank made with flake technology. These criteria are applied by the use of an expert system (Grace 1993), so that the amount of blade technology at different sites is directly comparable, and not influenced by any a priori expectations of what kind of technology should be found at a site of a particular period.

Blade production can be carried out in a number of ways; by direct percussion with hard or soft hammer, indirect percussion, punch technique (see Fig. 4), etc. Often a combination of these techniques is used to accommodate the vagaries of individual stone nodules. Technological comparison is limited to secondary reduction techniques because of the lack of complete cores at Kvernepollen and the small numbers of typological tools at both sites (Kvernepollen n =12, Farsund n = 20).

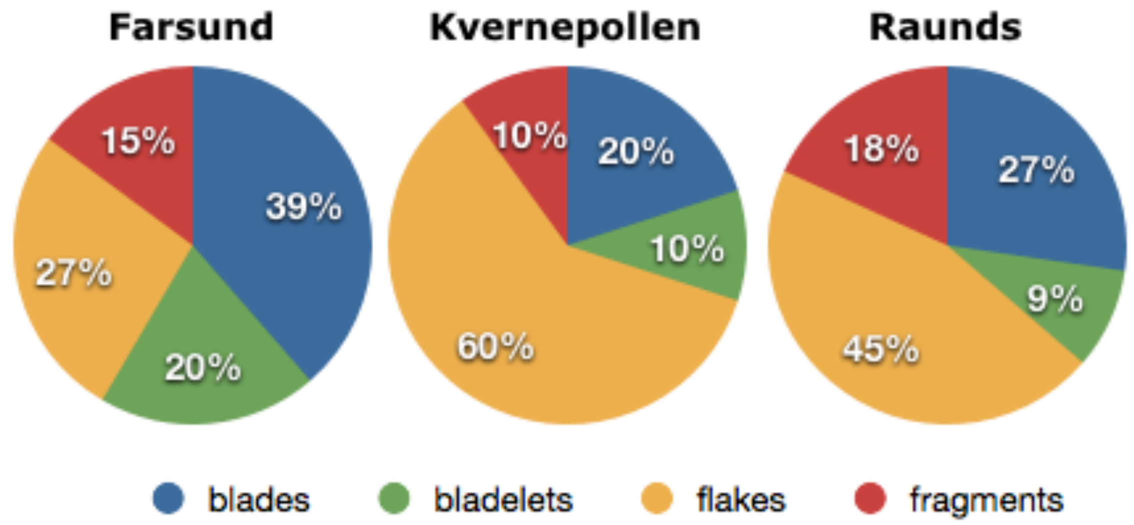
Considering blank types, more blades/bladelets were produced at the Mesolithic site of Farsund as might be expected (Fig. 7).

Figure 7: flint blanks



This pattern continues when considering which blanks were chosen for use (Fig. 8).

Figure 8: used flint blanks



The choice here is that though both groups possess the same technological capability, the knappers at Kvernepollen choose to produce proportionately more flakes and show an even more marked preference in choosing flakes for use. Perhaps this sequence is merely reflecting the time difference between a Mesolithic site and a Bronze age site following the general trend to produce larger flake tools in the Bronze age, rather than the production and use of blades/bladelets in the Mesolithic.

However, the Raunds Mesolithic site has a very similar technological configuration to Kvernepollen (Fig. 6), but the Raunds Mesolithic site uses the same technology to produce more bladelets as with Farsund (Fig. 7). When choosing which blanks to use the people at Raunds chose blades (as opposed to bladelets) and flakes, that is, the larger blanks in a similar way to the people at Kvernepollen, but different to the people at Farsund who choose relatively more bladelets as opposed to flakes to use (Fig. 8).

So though all three sites have similar technologies they use those technologies in different ways to produce different blanks and then choose different blanks to use. These choices are not related to chronological period.

It has been assumed that technologies developed in chronological sequence. In the post glacial period the Mesolithic is considered synonymous with bladelet production, followed by flake production in the Neolithic and Bronze ages. The example of Kvernepollen demonstrates that blade production was also carried out in the Bronze Age as well as in the Mesolithic. Also flake technology is used throughout the post glacial period. For the three sites mentioned here, the relative amount of flake technology remains consistent (Farsund 30%, Kvernepollen 30%, Raunds 31%). There may be a general trend towards flake production but a simple linear technological sequence is not the case.

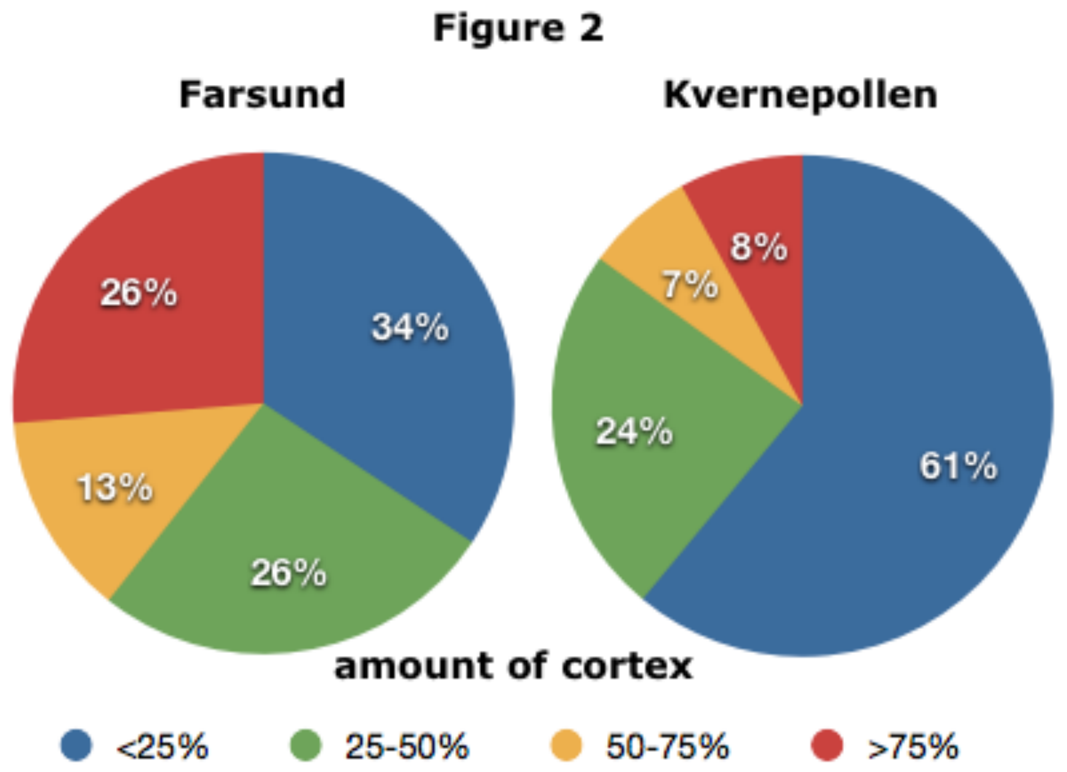
raw material procurement

Raw material procurement

Turning to Norwegian sites, raw material procurement is obviously an important factor as a variety of raw materials were used and often found on the same site. Not just flint but quartz, quartzite, rhyolite, rock crystal, slate, etc. Some of these non flint materials have specific sources, as in the case of rhyolite coming from the island of Bølmo in Western Norway. In terms of human choice, why do they choose to exploit rhyolite? This involves traveling to the source by boat, and transporting it as nodules or finished products throughout its distribution in Western Norway. Is the choice of rhyolite an ethnic marker in that a specific material was associated with a particular tribe? Does possession of rhyolite proclaim their origin in Western Norway as opposed to groups originating in Eastern Norway?

It could be argued that there is no choice involved, in that a scarcity of flint determined that rhyolite would be exploited, but why not use, for example, quartzite that was much easier to obtain. Looking at the next link in the chaîne opératoire, does rhyolite have any particular knapping properties that recommend it so that the choice is technological? Does rhyolite have advantages over other materials functionally, in that it is more efficient than, say, quartzite for specific tasks? This would be revealed by the uses of the tools at that phase of the operational sequence.

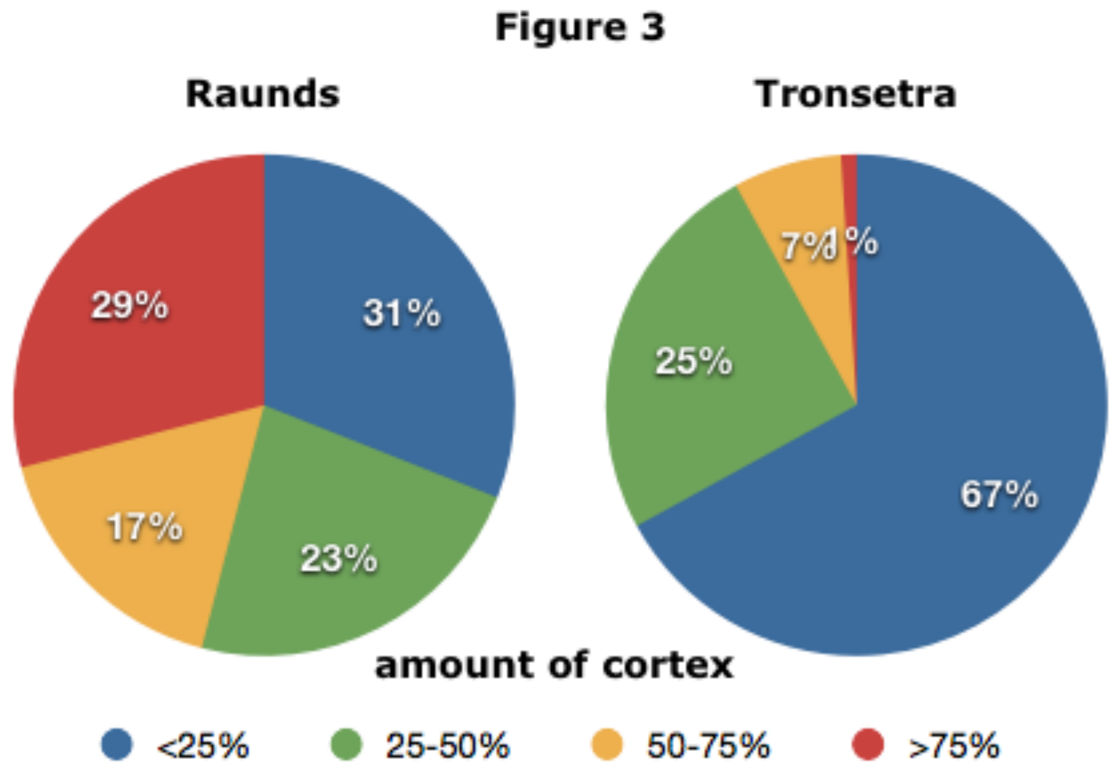
There are also choices in the means of raw material exploitation. The material can be processed at source, transported as nodules, pre-formed cores or as finished products. The two sites from Kvernepollen and Farsund can be contrasted in this aspect. Though both are coastal sites, exploiting similar environmental resources, there is a difference in that pre-formed cores were transported into Kvernepollen, whereas nodules were taken onto the site at Farsund.



This can easily be illustrated by looking at the cortical element of the debitage (Fig. 2). The pattern from Farsund is typical of knapping from cortical nodules. The pattern from Kvernepollen illustrates a lack of cortex that indicates primary reduction took place elsewhere.

Also there were 10 primary flakes (flakes with 100% cortex) at Farsund and some of the cores are merely nodules with a few flakes removed. The knapper appears to have been testing the nodules for suitability and in some cases rejected them at that stage. This would suggest that there was a local source of flint. The pattern from Farsund is similar to the English Mesolithic site of Raunds where cortical nodules were also being knapped (Fig. 3). It could be suggested that these different patterns are a result of scarcity of flint in the later period when Kvernepollen was occupied.

However, the site of Tronsetra which is dated c.7250 BP has a similar pattern to Kvernepollen. Transporting pre-formed cores would seem a preferable strategy at Tronsetra, which is located in the mountains at c.800m above sea level and 100 kilometres from the coast.



The significance is that the differences are not necessarily related to time, but also to choice. Other sites (for example from Songa, Telemark, in Coulson 1986) in the mountains have cortical nodules, so not taking them to Tronsetra was from choice, not necessity.

Quartzite was extensively used at Kvernepollen (see Fig. 5), whereas it is virtually absent at Farsund, even though quartzite is available locally in both areas and throughout the chronological period. Is this from scarcity of flint or a choice? The choice being not to use quartzite if sufficient flint is available. Alternatively, if the social dynamics and subsistence strategy involved small highly mobile groups (such as on hunting expeditions), the choice was to take flint as pre-formed cores and use quartzite as required, as opposed to occupying sites where flint was available. This choice of raw material procurement strategy may be a cultural marker rather than a necessity forced on the people by the availability of flint. Sites are found were flint is brought in as nodules and where quartzite is used (Songa, Telemark), suggesting that different strategies of raw material procurement are chosen, rather than simply determined by available resources.

Section 3

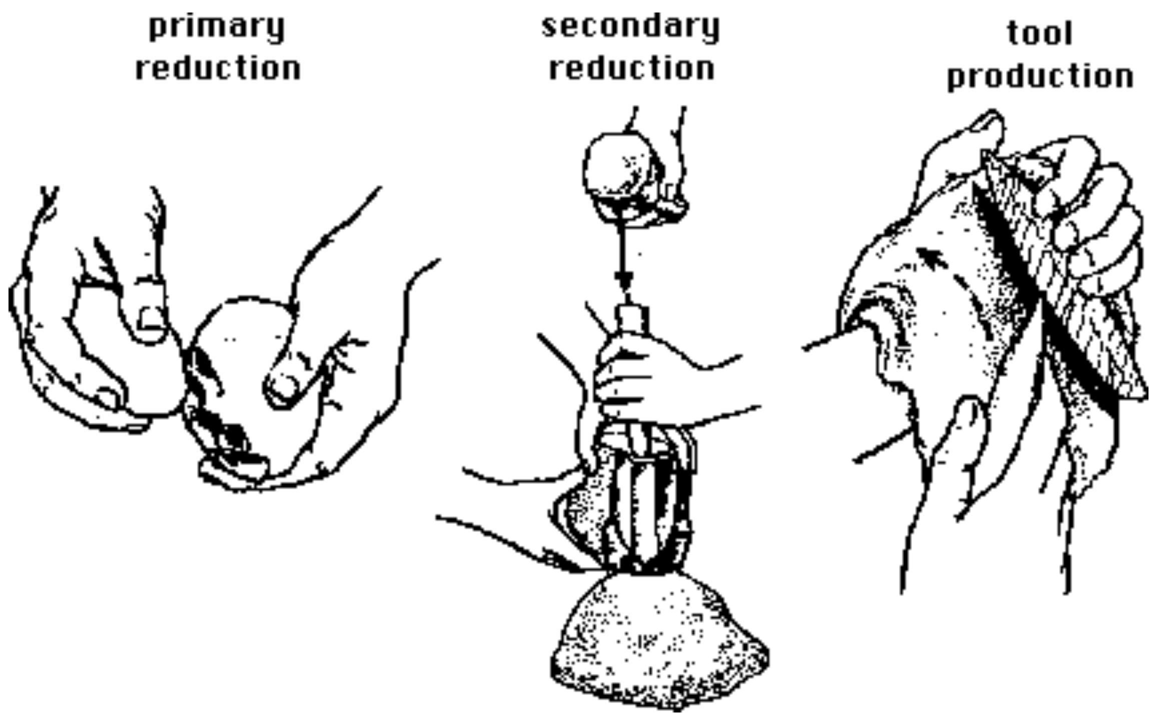
technology

Technology

Technology is divided into primary reduction, secondary reduction and typology. Primary reduction techniques are concerned with the reduction of nodules to cores, the kind of cores produced and the technology involved, for example the use of anvil technique to produce bi-polar cores. Secondary reduction techniques are those involved in producing blanks from cores and include such aspects as blade and flake technology, use of hard or soft hammer and micro-burin technique for the production of microlith blanks. Typology is concerned with tool production and the techniques of retouch, including such aspects as pressure flaking, burin technique and the differences in retouch; both of placement (direct, inverse, etc.), and type (abrupt, invasive, etc.).

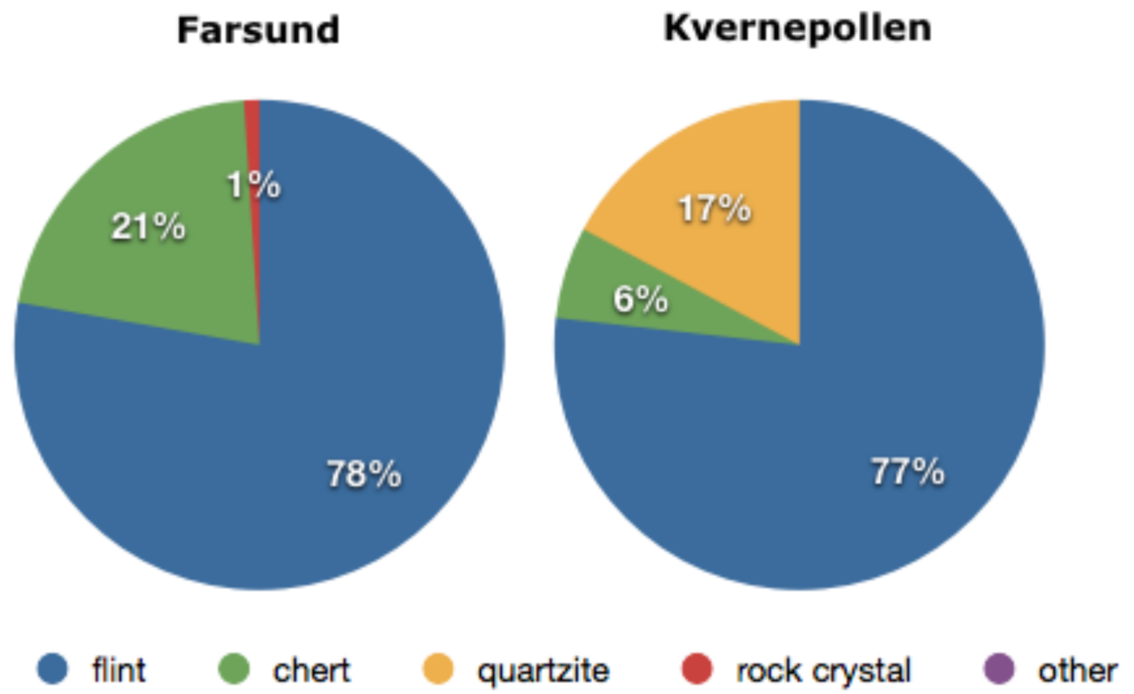
Figure 4 illustrates this reduction sequence. In the example, primary reduction is by direct percussion to remove the cortex and shape the core. Secondary reduction is by punch technique to produce blades. Tool production is by pressure flaking to produce, for example, a bifacial lanceolate point (see Helskog et al. 1976, 33).

Figure 4: technological reduction sequence



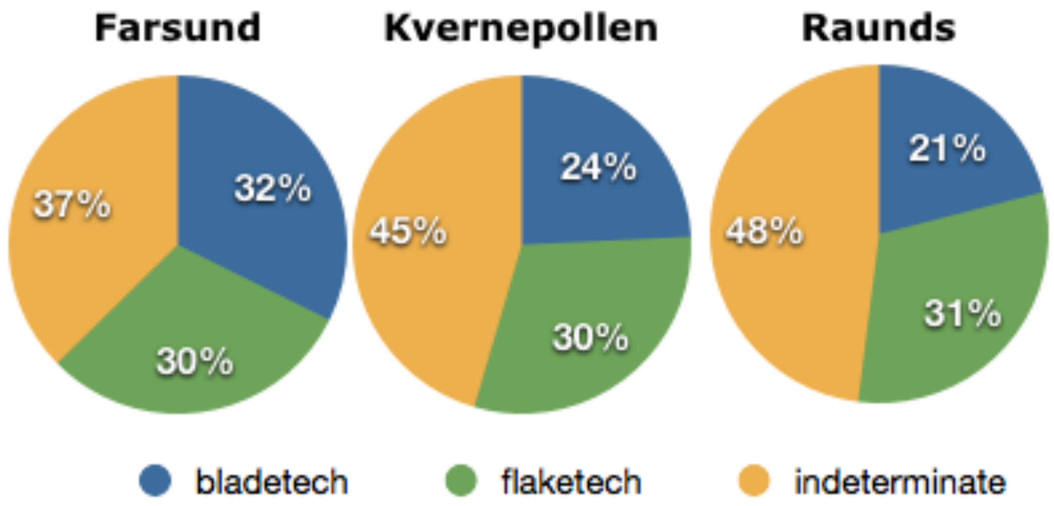
For a comparison of technologies, between Farsund and Kvernepollen, the discussion will be limited to flint because the presence of a significant amount of quartzite at Kvernepollen (17%) as opposed to its absence at Farsund (Fig. 5), effects the overall technology. The technology used with quartzite is effected by the nature of the raw material so that comparison between technologies on different raw materials is less reflective of cultural choices. For example, it is difficult to use blade technology with quartzite, so blade technology is less likely to be 'chosen'.

Figure 5:raw materials



The technologies used are similar a with a slight preference for blade technology at Farsund (Fig. 6) and both sites have 2 crested bladelets (ryggflekke) demonstrating the deliberate preparation of cores for bladelet production. Carefully made conical and cylindrical bladelet cores were found at Farsund whereas only core fragments were found at Kvernepollen (complete cores perhaps being removed for later use).

Figure 6: flint technology

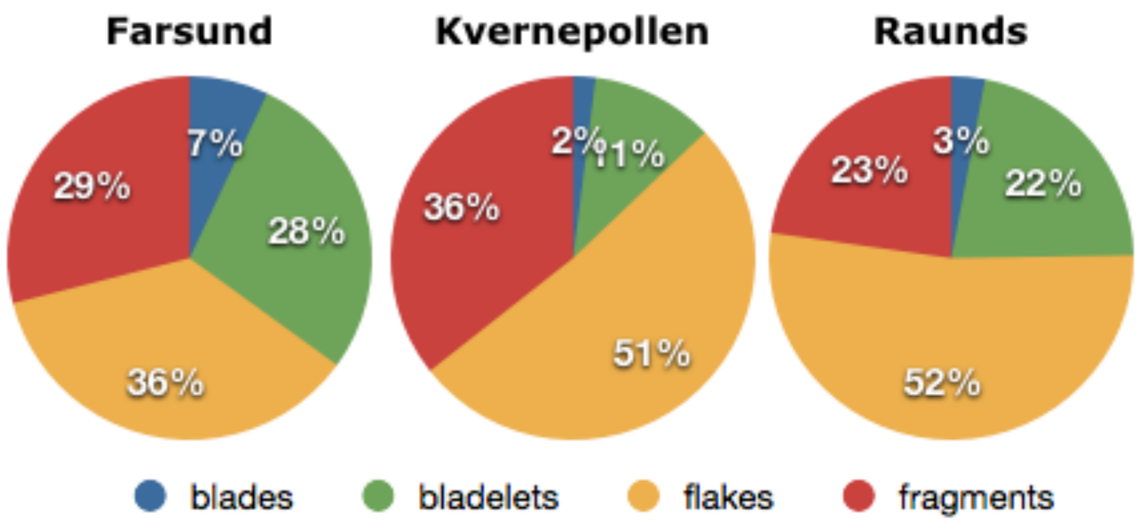


Blade technology simply means the deliberate production of blades. A 'technological' blade must be at least twice as long as it is wide (i.e., the definition of a blade blank). In addition it must have parallel sides and parallel dorsal ridges and (if the platform is intact) a prepared platform. The parallel dorsal ridges mean that it is within the process of reduction of a number of blades rather than a being a 'one off'. Broken pieces, if they have the above technological criteria but are not twice as long as they are wide, are considered as broken 'technological blades'. Flake technology can produce blanks with a length:breadth ratio >2, and therefore are blade blanks, but if they do not have the above technological features they are a product of flake technology even though they are blade blanks. This avoids using such cumbersome terms as blade-like flakes. Such a piece would be a blade blank made with flake technology. These criteria are applied by the use of an expert system (Grace 1993), so that the amount of blade technology at different sites is directly comparable, and not influenced by any a priori expectations of what kind of technology should be found at a site of a particular period.

Blade production can be carried out in a number of ways; by direct percussion with hard or soft hammer, indirect percussion, punch technique (see Fig. 4), etc. Often a combination of these techniques is used to accommodate the vagaries of individual stone nodules. Technological comparison is limited to secondary reduction techniques because of the lack of complete cores at Kvernepollen and the small numbers of typological tools at both sites (Kvernepollen n =12, Farsund n = 20).

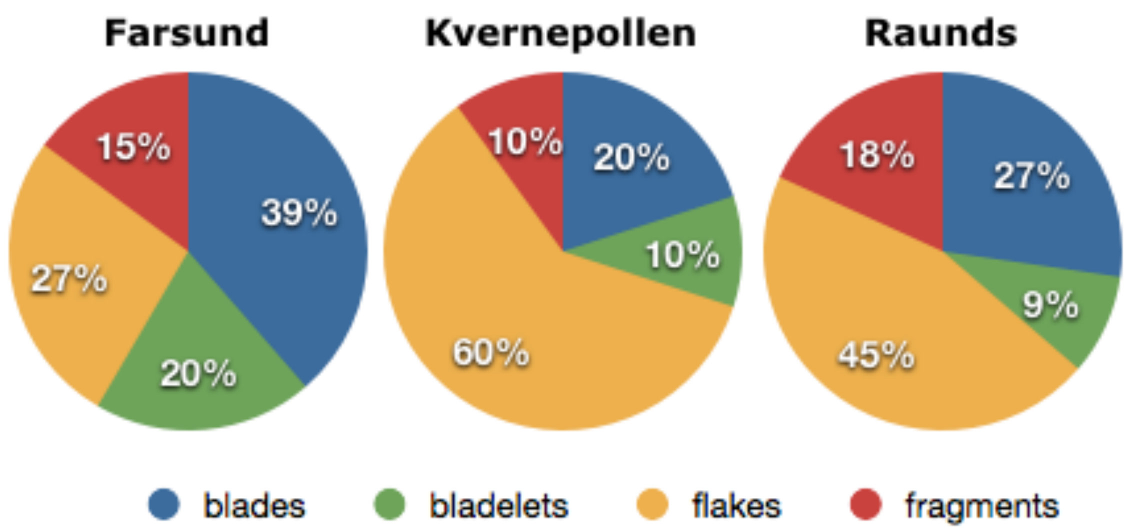
Considering blank types, more blades/bladelets were produced at the Mesolithic site of Farsund as might be expected (Fig. 7).

Figure 7: flint blanks



This pattern continues when considering which blanks were chosen for use (Fig. 8).

Figure 8: used flint blanks



The choice here is that though both groups possess the same technological capability, the knappers at Kvernepollen choose to produce proportionately more flakes and show an even more marked preference in choosing flakes for use. Perhaps this sequence is merely reflecting the time difference between a Mesolithic site and a Bronze age site following the general trend to produce larger flake tools in the Bronze age, rather than the production and use of blades/bladelets in the Mesolithic.

However, the Raunds Mesolithic site has a very similar technological configuration to Kvernepollen (Fig. 6), but the Raunds Mesolithic site uses the same technology to produce more bladelets as with Farsund (Fig. 7). When choosing which blanks to use the people at Raunds chose blades (as opposed to bladelets) and flakes, that is, the larger blanks in a similar way to the people at Kvernepollen, but different to the people at Farsund who choose relatively more bladelets as opposed to flakes to use (Fig. 8).

So though all three sites have similar technologies they use those technologies in different ways to produce different blanks and then choose different blanks to use. These choices are not related to chronological period.

It has been assumed that technologies developed in chronological sequence. In the post glacial period the Mesolithic is considered synonymous with bladelet production, followed by flake production in the Neolithic and Bronze ages. The example of Kvernepollen demonstrates that blade production was also carried out in the Bronze Age as well as in the Mesolithic. Also flake technology is used throughout the post glacial period. For the three sites mentioned here, the relative amount of flake technology remains consistent (Farsund 30%, Kvernepollen 30%, Raunds 31%). There may be a general trend towards flake production but a simple linear technological sequence is not the case.

function

Function

The next stage in the operational sequence is site function, including the specific use of tools, both of motion and worked materials (scraping bone, whittling wood, etc.), the identification of activities (hunting, hide processing, etc.), and the interpretation of site type (hunting camp, home base, etc.). At Kvernepollen, 21 pieces had recognisable use-wear and Farsund had 48. In terms of site use it is interesting that there is a difference between Farsund and Kvernepollen even though both sites are coastal and exploiting similar natural resources. Kvernepollen has a limited range of activities (Fig. 9), consisting of processing wood and fish. It is suggested that the projectile points were not used in conjunction with the site (i.e., it is not a kill site), because of the distribution of the projectile points (see below). Farsund has a wide range of activities including processing wood and fish but also working bone, antler, hide and one case of scraping shell. This produces a different functional configuration (see Grace 1990), to Kvernepollen (Fig. 10).

Figure 9 Functional configuration:Kvernepollen

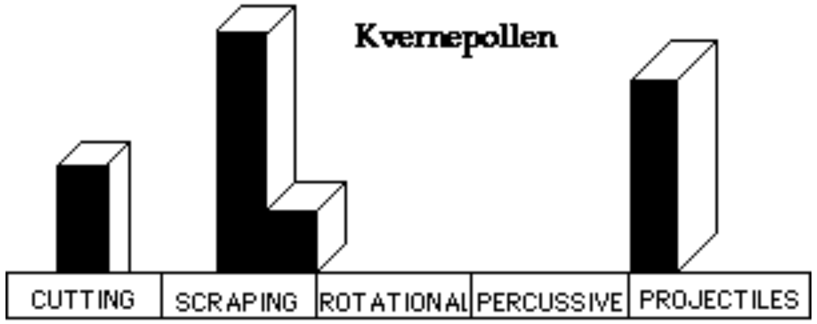
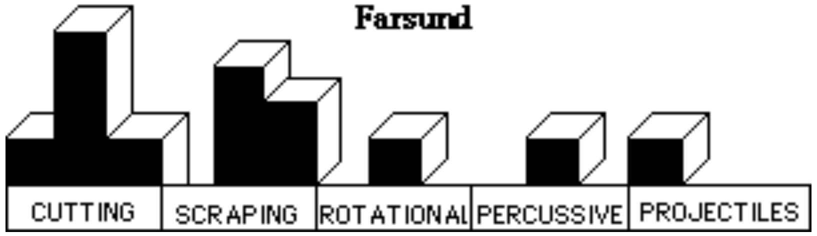


Figure 10: Functional configuration: Farsund



tools are displayed as being used on soft, medium and hard materials for each major motion category

Farsund is interpreted as a temporary home base because of the representation of a spread of activities. From this and the size of the site it was probably occupied by an extended family group. Kvernepollen represents a small group, possibly only one or two individuals, occupying the site for a short period during a hunting expedition.

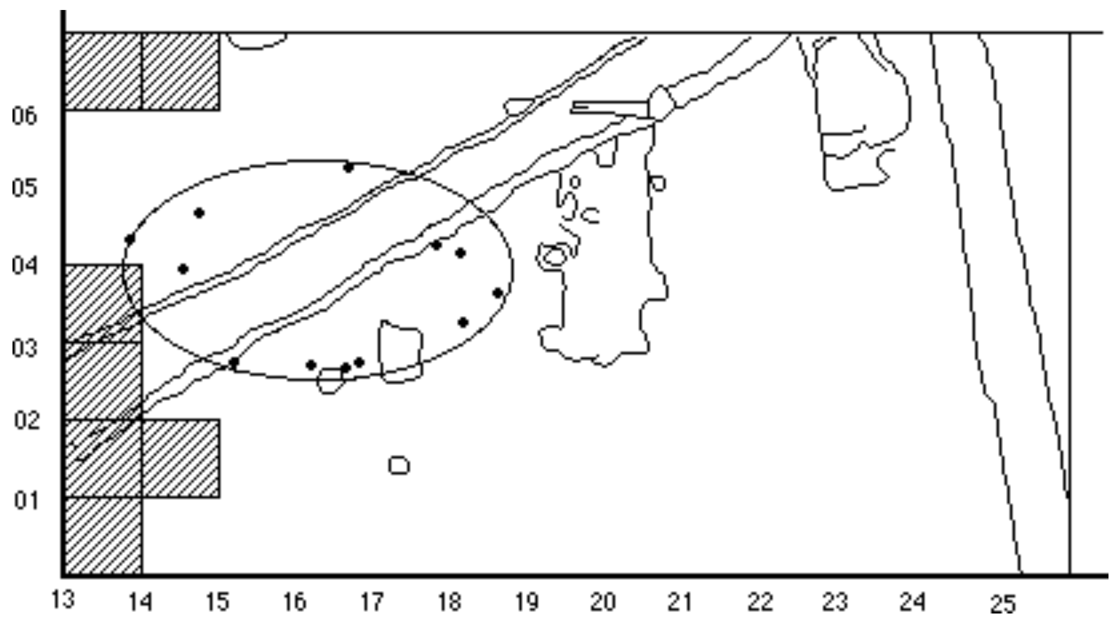
discard

Discard

The final stage is the discard of the material seen in knapping concentrations and clearance of areas with accompanying 'dump' areas. Curation of tools would be included at this stage in that the removal of material from the site, for use elsewhere, constitutes a form of discard.

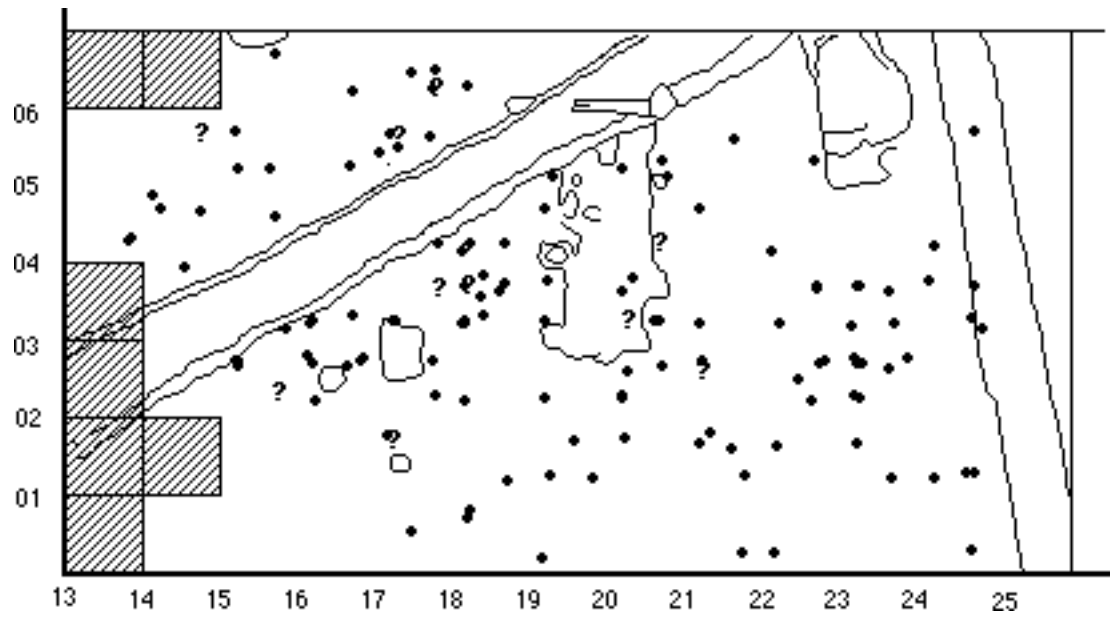
By incorporating use-wear analysis into the chaîne opératoire, activity areas can be located from the discard of used tools, These activity areas can be used to interpret the use of space on the site which can indicate such things as social differentiation within the group. For example, the location of specific activity areas is a prerequisite for the assignment of gender roles. With undisturbed sites such activity areas can be isolated. The early Mesolithic site of Three Ways Wharf in England has a concentration of tools used for adzing/chopping wood (Fig. 11), and can only be an activity area as the pieces used for adzing/chopping wood are of various types consisting of; 1 broken ax, 2 axe/adze re-sharpening flakes, 8 flake end scrapers and 1 blade end scraper.

Figure 11: tools used for adzing/chopping wood: Three Ways Wharf



Other tools of these types are distributed throughout the site and either have other functions or are unused, so that the concentration is only related to the activity of adzing and chopping wood. The adzing/chopping wood concentration is clearly separate when seen in contrast to the distribution of all used pieces from the site (Fig. 12 and see Lewis, in press).

Figure 12: all used tools: Three Ways Wharf



The spatial distribution of material at Kvernepollen shows clear concentrations of knapping debris with a separation between the quartzite (Fig. 13) and flint (Fig. 14), possibly representing separate knapping episodes.

Figure 13: Kvernepollen-distribution of quartzit

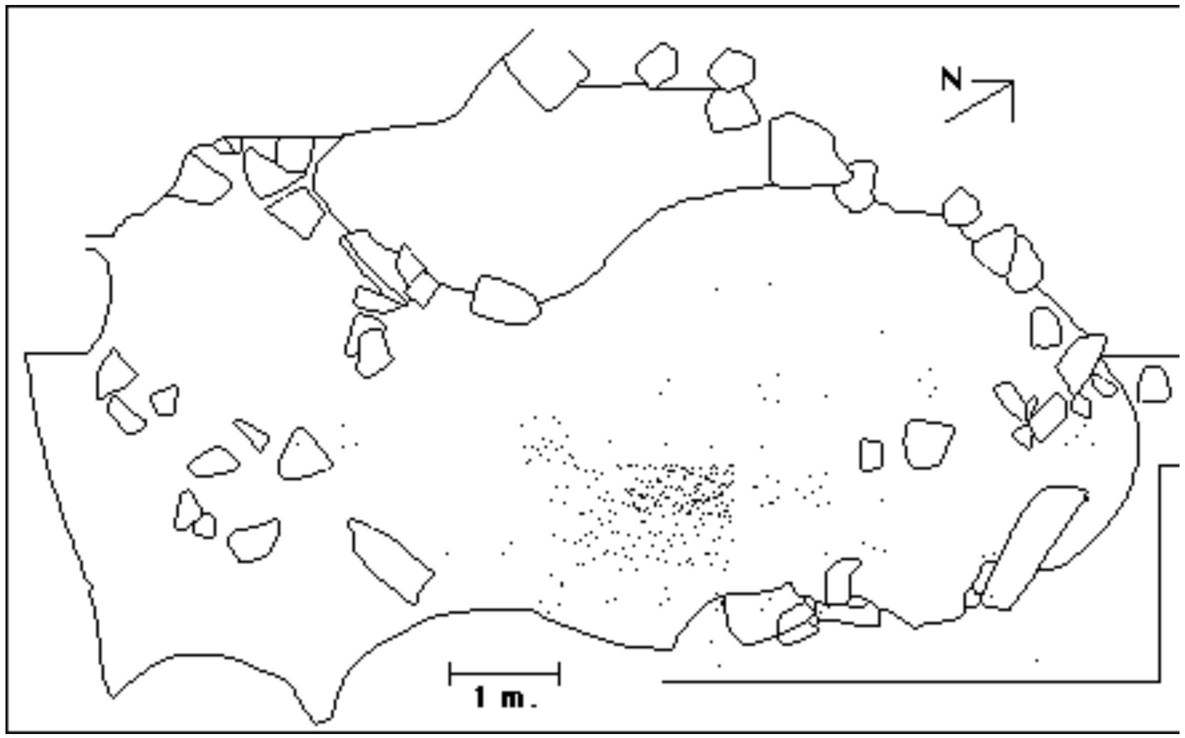
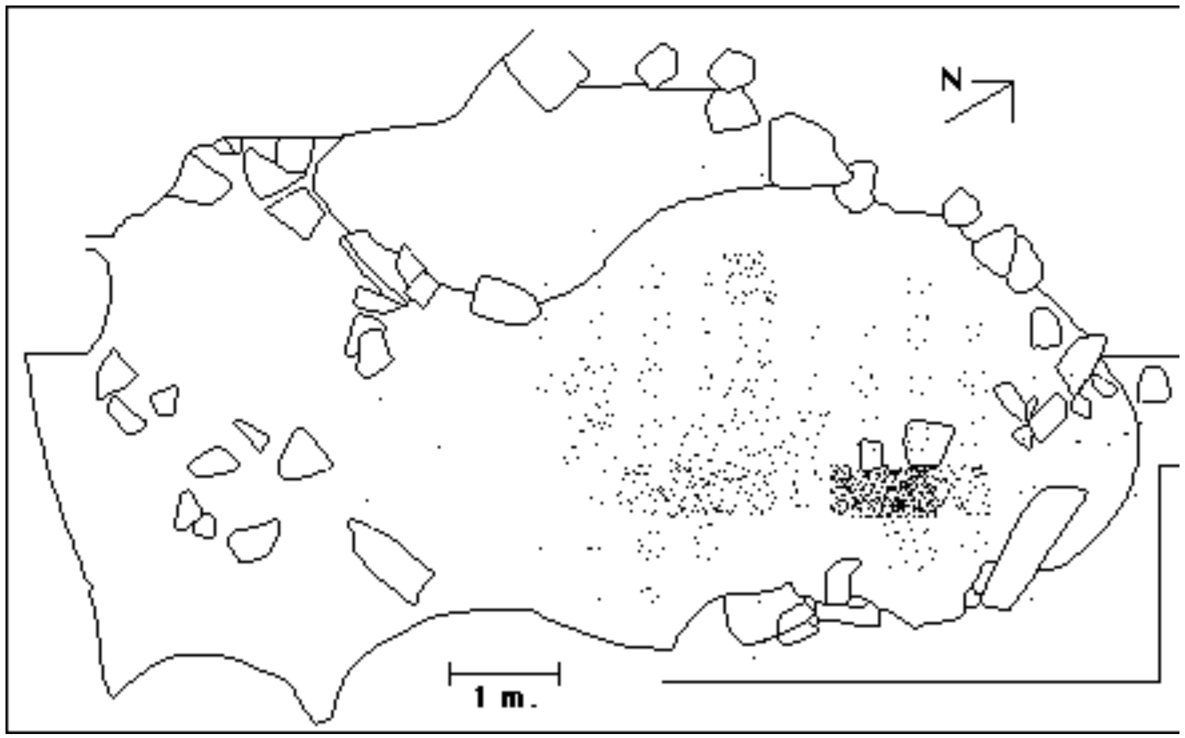
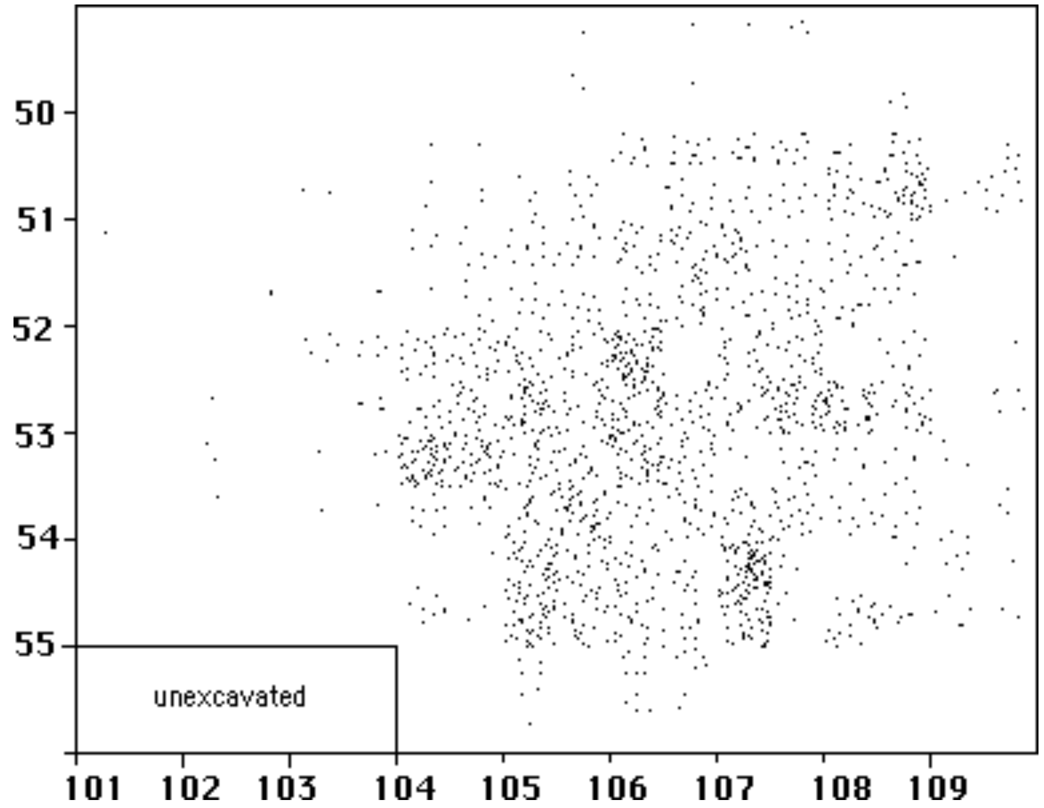


Figure 14: Kvernepollen-distribution of flint



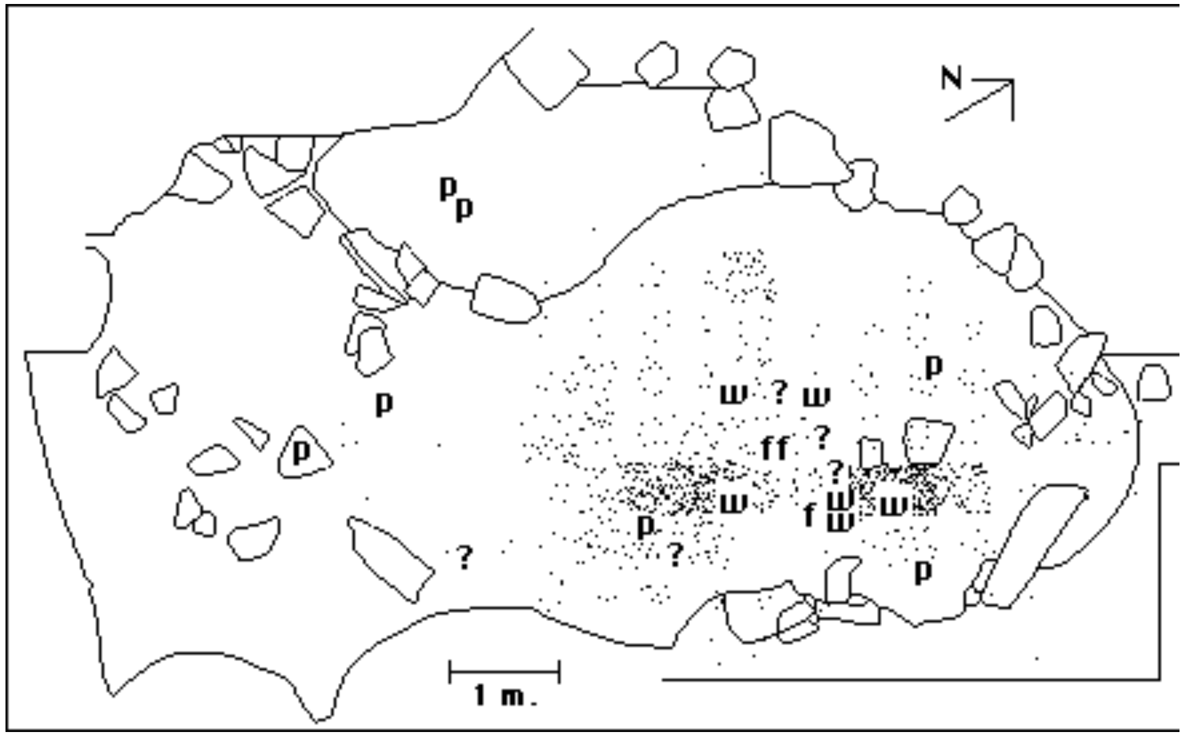
These concentrations imply that no clearance has taken place. The Farsund site has no such concentrations (Fig. 15), which could be due either to post depositional movement or by being spread about by prehistoric activity, which would imply longer occupation than the 'undisturbed' concentrations at Kvernepollen.

Figure 15: Farsund distribution of all lithics



The most striking aspect of the distribution of the used pieces at Kvernepollen is that the majority of the projectile points are outside the main concentration, some being several metres away (Fig. 16).

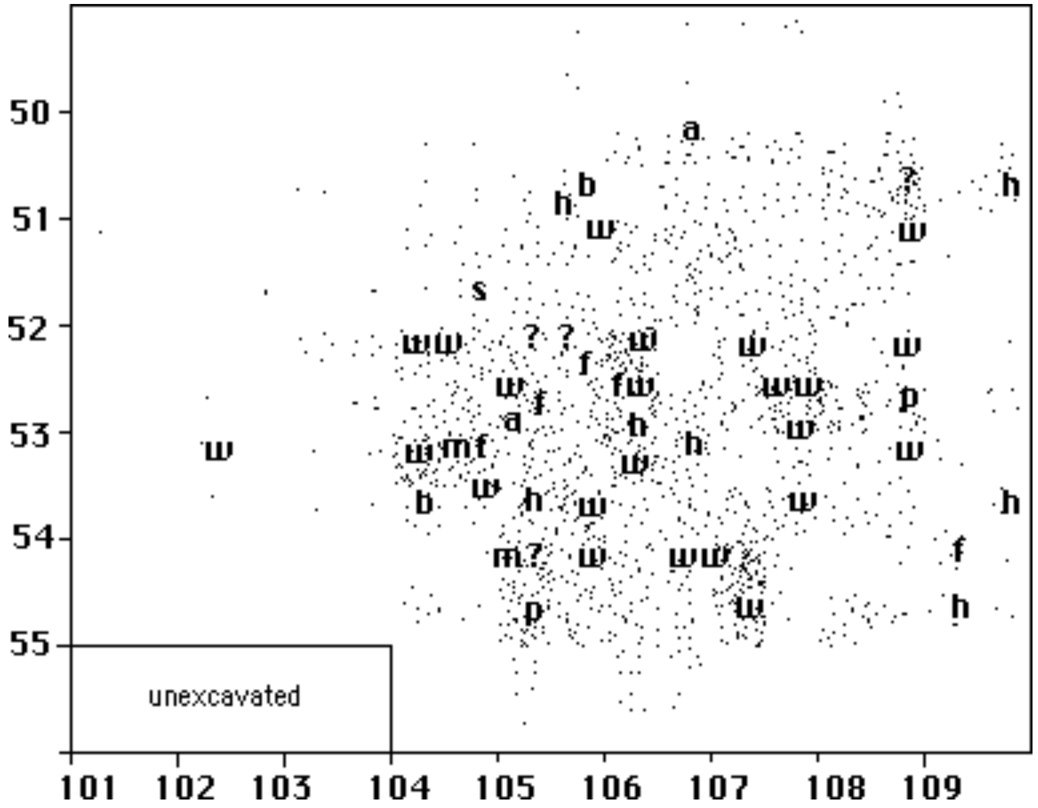
Figure 16: Kvernepollen-distribution of used pieces



The 'discarded' nature of the projectile point distribution, with the absence of butchery, suggests re-tooling. That is, replacement of projectile points and the repair and/or manufacture of arrow shafts. The presence of considerable flint knapping perhaps represents the manufacture of new projectile points in flint that were then taken away as new arrows from the site. This would partially explain the amount of knapping and the lack of used pieces. The remaining used pieces are near the centre of the concentration adjacent to the hearth and probably constitute a single activity area.

At Farsund there is no significant difference between the distribution of the used pieces and the distribution of all lithics (Fig. 17).

Figure 17: Farsund-distribution of all lithics and used pieces



Section 6

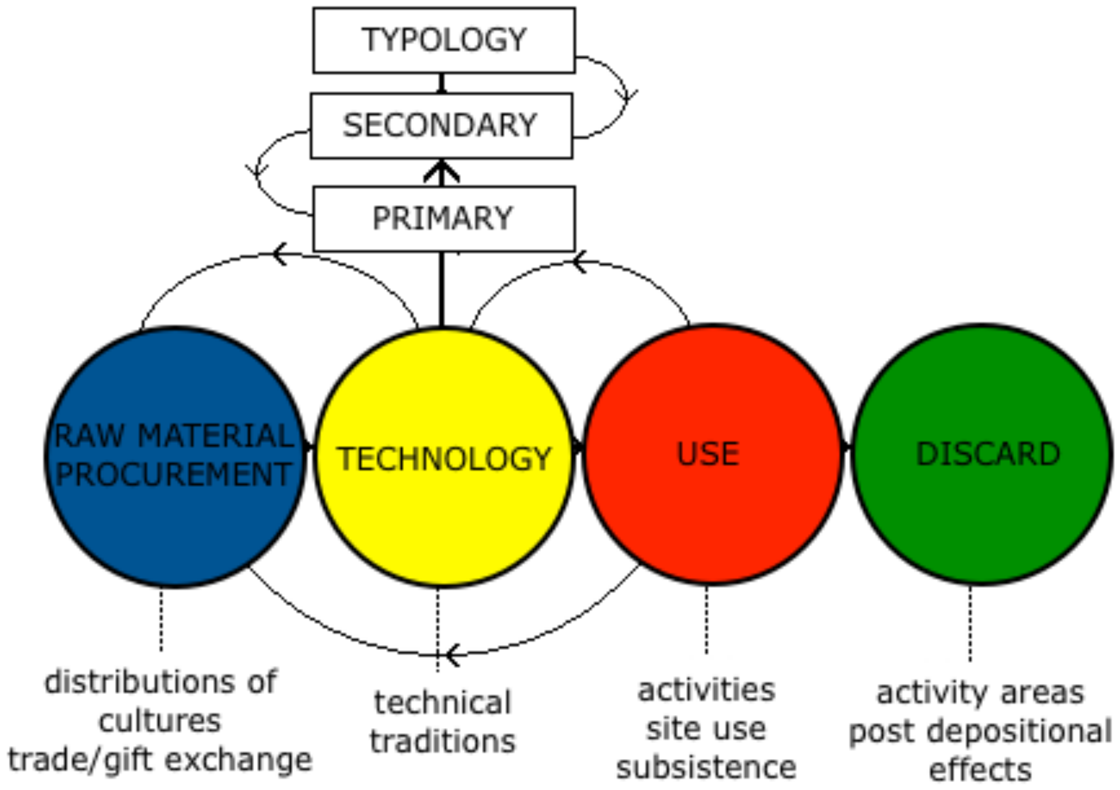
conclusions

Conclusions

The 'chaîne opératoire' approach provides a more complete picture of differences and similarities among human groups, rather than concentrating on single elements. With these sites typological analysis results in a very small data base, technology shows no significant difference, spatial analysis is difficult to compare because of the lack of patterns at Farsund. However by combining all these elements within the framework of the operational sequence a greater understanding of the cultural differences can be sought.

Figure 18 summarizes the 'chaîne opératoire' approach. The four basic links are raw material procurement, technology (separated into primary and secondary reduction and typology), use and discard.

Figure 18: chaîne opératoire

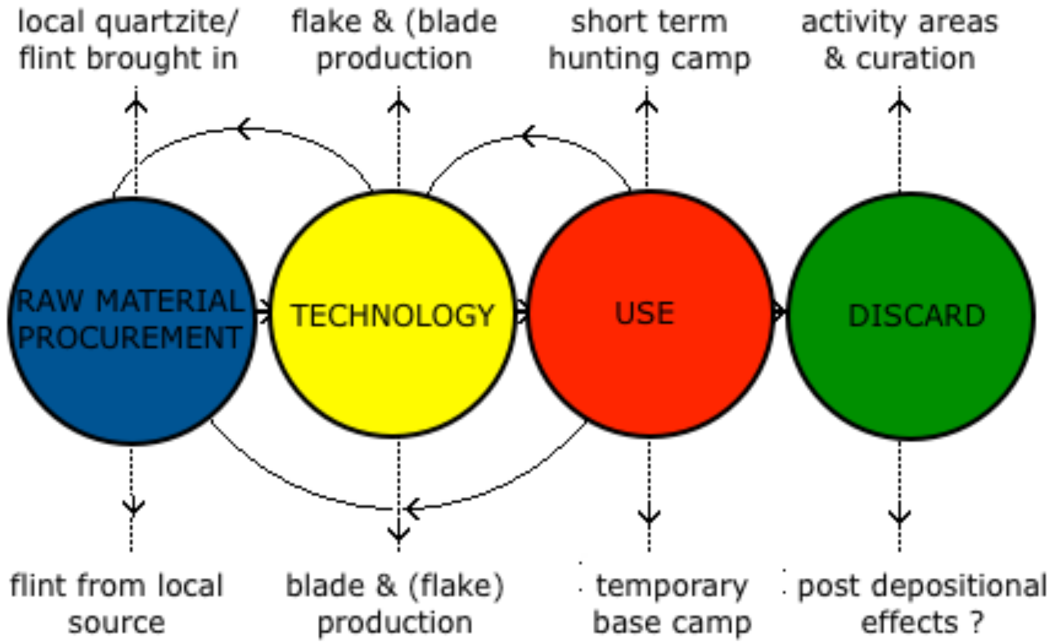


However the sequence includes feed-back loops in that, for example, the intended use of tools will affect the choice of technology and raw material. If the intent was to make projectile points for hunting this could influence the choice of technology. For example, tanged A points (see Helskog et al. 1976, 26), are made on blades, so that blade technology would have been chosen to produce the suitable blanks. Also function need not be limited to utilitarian use. If the intention was to make a flint copy of a bronze dagger for a status or ritual function, the procurement of raw material might be by trade, in order to obtain large pieces of good quality flint with which to make such a dagger. Thus the intended function of the tool can influence technology and the method of raw material procurement.

The dotted lines in Figure 16 indicate the kind of interpretations that can be made from the various elements of the operational sequence. Figure 19 indicates and compares the interpretations from Kvernepollen and Farsund.

Figure 19: Kvernepollen & Farsund compared

Kvernepollen

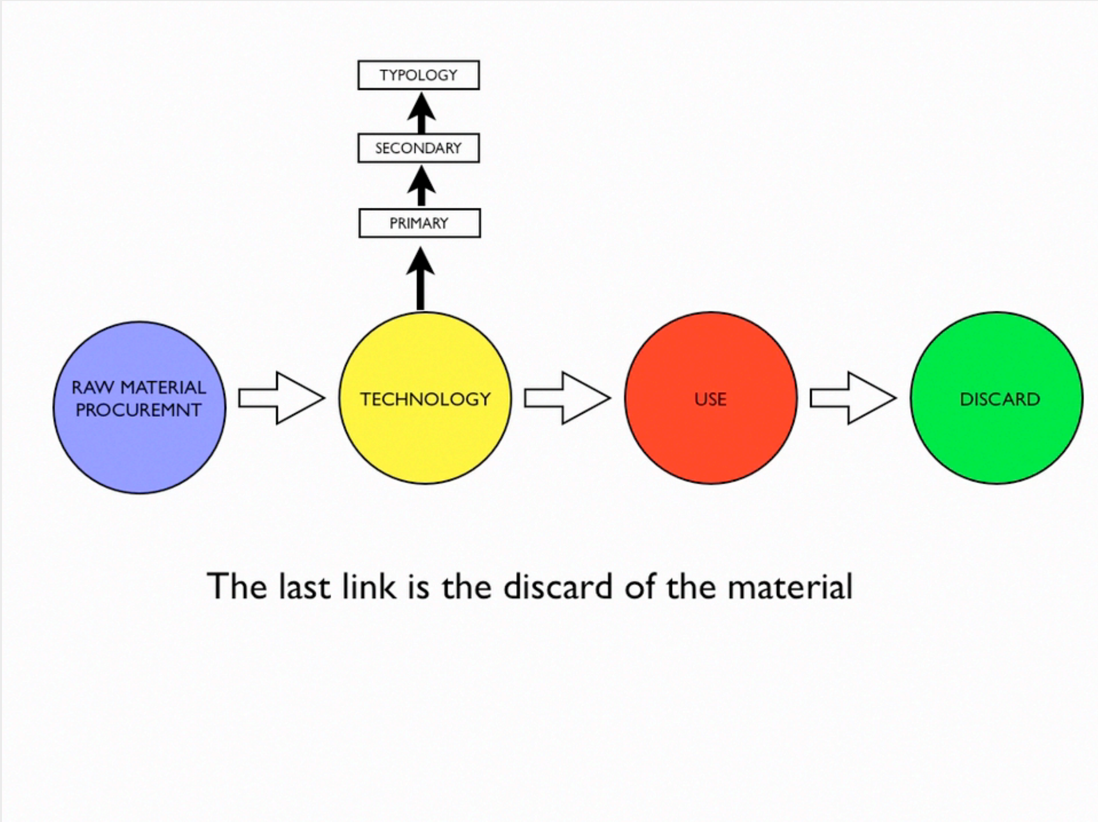


Farsund

These differences may reflect different social structures and subsistence strategies employed during different periods. If one assumes a larger population in the Bronze age then a pattern emerges of larger base sites from which small groups (or individuals) go out from on hunting/fishing expeditions, as opposed to small family groups moving around together. These different strategies are chosen as the preferred means of exploiting similar environmental resources, rather than being adaptations to different environments. Basing ethnic or chronological divisions on typology and/or technology alone is a crude devise that ignores much of the evidence of choice that reflects the social structure of human groups. Archaeological sites are the product of dynamic interaction between individuals within the social group, rather than static structures to be simply classified by typological lists or by measurement of debitage. This dynamic interaction can be studied with the chaîne opératoire approach that allows for a greater understanding of the complex human behaviour that lies behind the archaeological data.

The analysis presented in this paper is the product of the author's own research and does not necessarily agree with the excavators of the sites. The methods used for the lithic analysis are explained fully in Grace 1989 and Grace 1993.

MOVIE 1.1 chaîne opératoire



references

Touch references to return to text

references

Ballin, T. B. & Jensen, O. L. 1995
Farsundprosjektet- stenalderbopladser på Lista. *Varia 29*. Universitetets Oldsaksamling

Bar-Yosef, O., Vandermeersch, B., Arensburg, B., Belfer-Cohen, A., Goldberg, P., Laville, H., Meignen, L., Rak, Y., Speth, J. D., Tchernov, E., Tillier, A-M., and Weiner, S. 1992. The Excavations in Kebara Cave, Mt. Carmel. *Current Anthropology, vol. 33*, no. 5, 497-550.

Clark, J. G .D. 1954
Excavations at Star Carr. Cambridge University Press. Cambridge

Coulson, S. 1986
Refitted flint nodules from Songa, Telemark. *Universitetets Oldsaksamling Årbok* 1984/1985. Oslo 1986

Gamble, C. 1986
The Palaeolithic settlement of Europe. Cambridge. Cambridge University Press. 1986

Grace, R. 1989.
Interpreting the Function of Stone Tools: The quantification and computerisation of microwear analysis. B.A.R. International series 474.

Grace, R., 1990, The limitations and applications of functional analysis. in The Interpretative Possibilities of Microwear Studies. Proceedings of the International Conference on Lithic Use-wear Analysis, 15th-17th February 1989, (eds. Gräslund, B., Knutsson, H., Knutsson, K., and Taffinder, J.) Aun, 14, 9-14.

Grace,R. 1993.
The use of expert systems in lithic analysis. Traces et fonction: les gestes retrouvés' *Eraul 50*, vol. 2, 389-400. Liege 1993

Helskog, K., Indrelid, S., and Mikkelsen, E. 1976.
Morfologisk klassifisering av slåtte steinartefakter. Særtykk fra *Universitetets Oldsaksamling årbok* 1972-1974 Helskog et al. 1976

Lewis, J.S.C. in press.
A late glacial and early post glacial site at Three Ways Wharf, Uxbridge, Middx, England.

Mellars, P. 1989
Major Issues in the Emergence of Modern Humans. *Current Anthropology v.30* no. 3 June 1989 pp. 349-385

Nærøy, A. J. 1994
Troll-Prosjektet: Arkeologiske undersøkelser på Kollsnes, Øygarden K,Hordaland, 1989-1992. *Arkeologiske Rapporter 19*. Arkeologisk Institutt, Universitetet i Bergen

Roebroeks, W., Conard, N. J., and van Kolfschoten, T. 1992
Dense Forests, Cold Steppes, and Palaeolithic Settlement of Northern Europe. *Current Anthropology vol. 33*, no. 5, December 1992.

Stringer, C. & Gamble, C. 1993
In Search of the Neanderthals. Thames and Hudson.