

Prehistoric quartz quarries and quarrying in Eastern Middle Sweden

Christina Lindgren^a

In Sweden the flint mines of Ängdala have often been regarded as representative of lithic procurement. During recent years several sites in Sweden have been interpreted as quartz quarrying sites. Some of these sites are situated in eastern middle Sweden where flaked quartz is common on the Stone Age settlements. This article presents these quarrying sites and discuss some problems related to their interpretation, especially in relation to the Mesolithic period. There are several problems related to the study of quartz quarries, *e.g.*, the problem of dating them. The demand for raw material can be measured through the following variables: activities using stone tools, lithic technology and the efficiency of the stone tools. Some of these variables give contradictory results when used in analysis of flaked quartz in the region. The quarrying sites are however an important source of information for studies regarding lithic strategies in stone Age society.

KEY-WORDS: quartz, quarry, lithic reduction.

All over the world and during all times mankind has used a variety of lithic material for tool production. May it be flint, chert, obsidian, quartzite or quartz, man has always been able to locate raw material that satisfied his intentions. The traces of this extraction of raw material are sometimes visible, sometimes not. Some of the more spectacular traces left are the great flint mines in Poland, Denmark and England. More vague remains are the quartz quarries in parts of northern and middle Sweden. The traces left of the raw material procurement can be difficult to observe, as the knowledge of such sites is dependent on special archaeological knowledge of the region, site visibility, as well as a bit of luck.

In large parts of Sweden quartz is the dominating raw material used during the Stone Age (Fig 1). Flint is used more in the southern and western parts, as well as on the islands of Gotland and Öland in the Baltic. The flint from southern Sweden is of Senonian (Maastrichtian) origin (Rudbeck 1986:39). As in Denmark flint mines have been known in south Sweden since the beginning of the century (Althin 1951:142). In

^a Department of Archaeology, University of Stockholm, Sweden

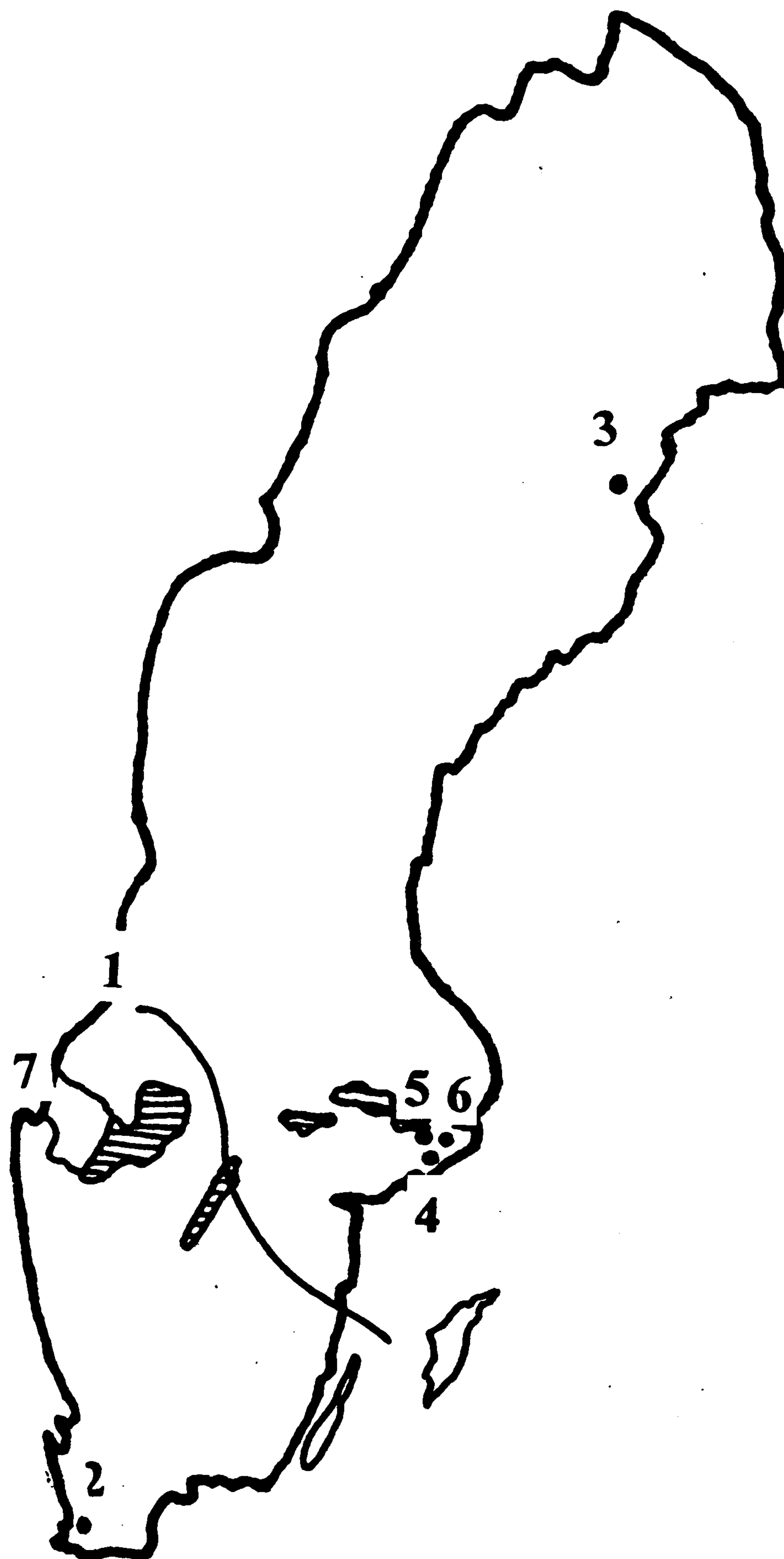


Fig 1. Map showing places mentioned in the text: 1 — The limit between a regular and abundant use of flint vs a regular and abundant use of quartz (from Welinder 1977:3 fig. 1); 2 — Ängdala; 3 — Lundfors; 4 — Fittja; 5 — Noling; 6 — Gladö; 7 — the province of Dalsland.

Ängdala, S Sallerup parish, in the south of Sweden over 400 flint mines have been found (Rudbeck 1987:151). As in the case of many of the European flint mines, the mines at Ängdala are dated to the Neolithic period (Rudbeck 1986:23f.). The knowledge of lithic procurement during the Scandinavian Mesolithic is however still very limited. The Mesolithic sites in Scania show a variety of different flint types while the flint found on Neolithic sites is more homogeneous. This has been interpreted as indicating a more local lithic procurement during the Mesolithic, in contrast to a more controlled lithic procurement, based on a few central places, in the Neolithic (Althin 1951:142).

Quartz can be found in veins or in nodules in eastern middle Sweden. Nodules are found in the moraine as well as in the glaci-fluvial deposits on which most of the Stone Age sites are located. The quartz found on prehistoric sites in this part of Sweden is often white, so-called “milky” quartz, but “smokey” quartz as well as pink quartz also occurs. The geological formation of this part of Sweden mainly consists of different kinds of gneissic rocks which are rich in quartz (Möller and Stålhös 1969:12).

EXCAVATED SITES WITH TRACES OF QUARTZ QUARRYING IN SWEDEN

One of the first studies of quartz quarrying was performed in Lundfors, Skellefteå parish, 850 km north of Stockholm (Broadbent 1979:99ff.). At Lundfors, four sites were found which were interpreted as quartz quarries (Locus I–IV), two of them (Locus I and II) were severely damaged by modern quarrying. Locus III consisted of a 1.6 m long and 0.75 m wide vein of quartz which contained small shallow pits. The area was covered with pieces of quartz. Close to the quarry was an erratic boulder under which there was found a collection of 15 chunks of quartz. Locus IV also consisted of a vein of quartz surrounded by flaked and crushed quartz (Fig. 2). Close to the vein was a horseshoe-shaped configuration of flaked quartz which was interpreted as a knapping floor. At Locus IV four hammerstones were found. None of the quarrying sites at Lundfors were dated by the radiocarbon method but the adjacent Stone Age settlement at Lundfors was dated to 5380–5155 BP (Broadbent 1979:47).

A similar site has been located at Fittja, Botkyrka parish (RAÄ 280), 3 km south of Stockholm (Bennet 1977). The Fittja quarry was a 9 m long and 0.5–1 m broad vein of quartz. Traces of quarrying were found in the vein and approx. 62 kg of loose quartz was found, at least 7 kg of which showed bulbs of percussion and flaked surfaces. Most of the loose quartz was found in, or close to, the vein while only smaller amounts were found in the adjacent areas (Fig. 3). The covering soil contained small amounts of charcoal which were sampled for ¹⁴C dating. The result of AD 1320 was interpreted as dating a later fire horizon. No hammerstones were found, but among the flaked quartz a small scraper was found (Bennet 1977:10).

At Nölinge, Grödinge parish, 25 km south of Stockholm, another quarrying site (RAÄ 583) was excavated in 1987 (Olsson and Vinberg 1994). The site consisted of three 3 m long and 0.6 m wide veins of quartz. The veins had shallow pits in four places. The pits measured approx. 0.4 m in diameter (Fig. 4). Around the veins, large amounts of flaked and crushed quartz occurred. The ratio of flaked quartz was higher

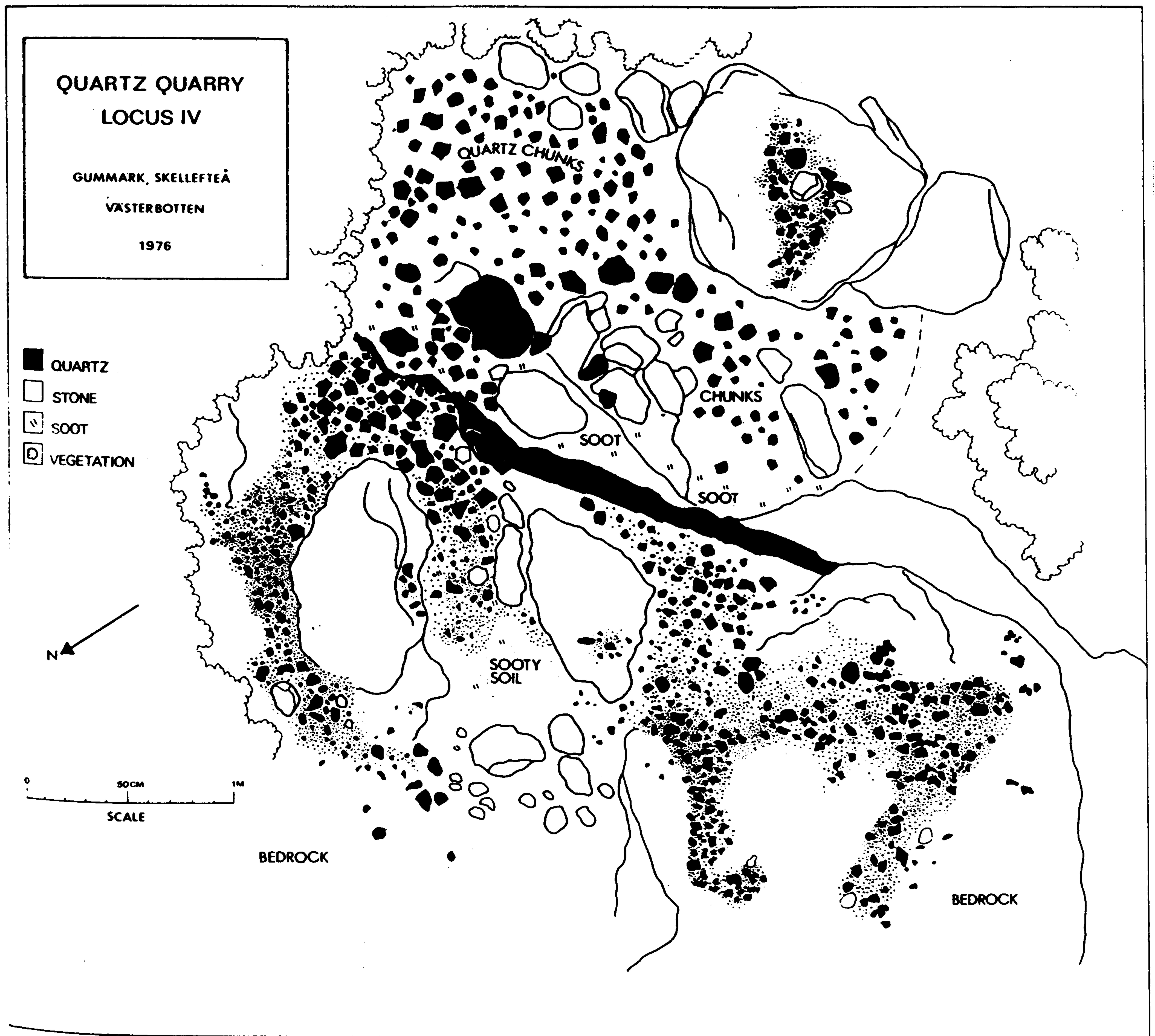


Fig 2. Map of Quarry Locus IV (Broadbent 1979:fig. 46).

closer to the veins, parts of the flaked quartz showed traces of a bipolar-on-anvil method of reduction. A greenstone axe, probably thin butted, was found close to the veins (Olsson and Vinberg 1994:15, 19 fig. 11).

Since the excavation of Noling in 1987 two more quarrying sites have been found south of Stockholm, in Gladö, Huddinge parish (RAÄ 277 and 278 — Kihlstedt 1992). These sites have not been excavated but show similarities with the sites mentioned above. During recent years some 50 sites interpreted as quartz quarries have been found during the National Survey of Ancient Monuments in the province of Dalsland in western Sweden (Lindman 1991:172). These sites have several criteria in common with the excavated sites mentioned above, for example the size of the sites and their location in the landscape.

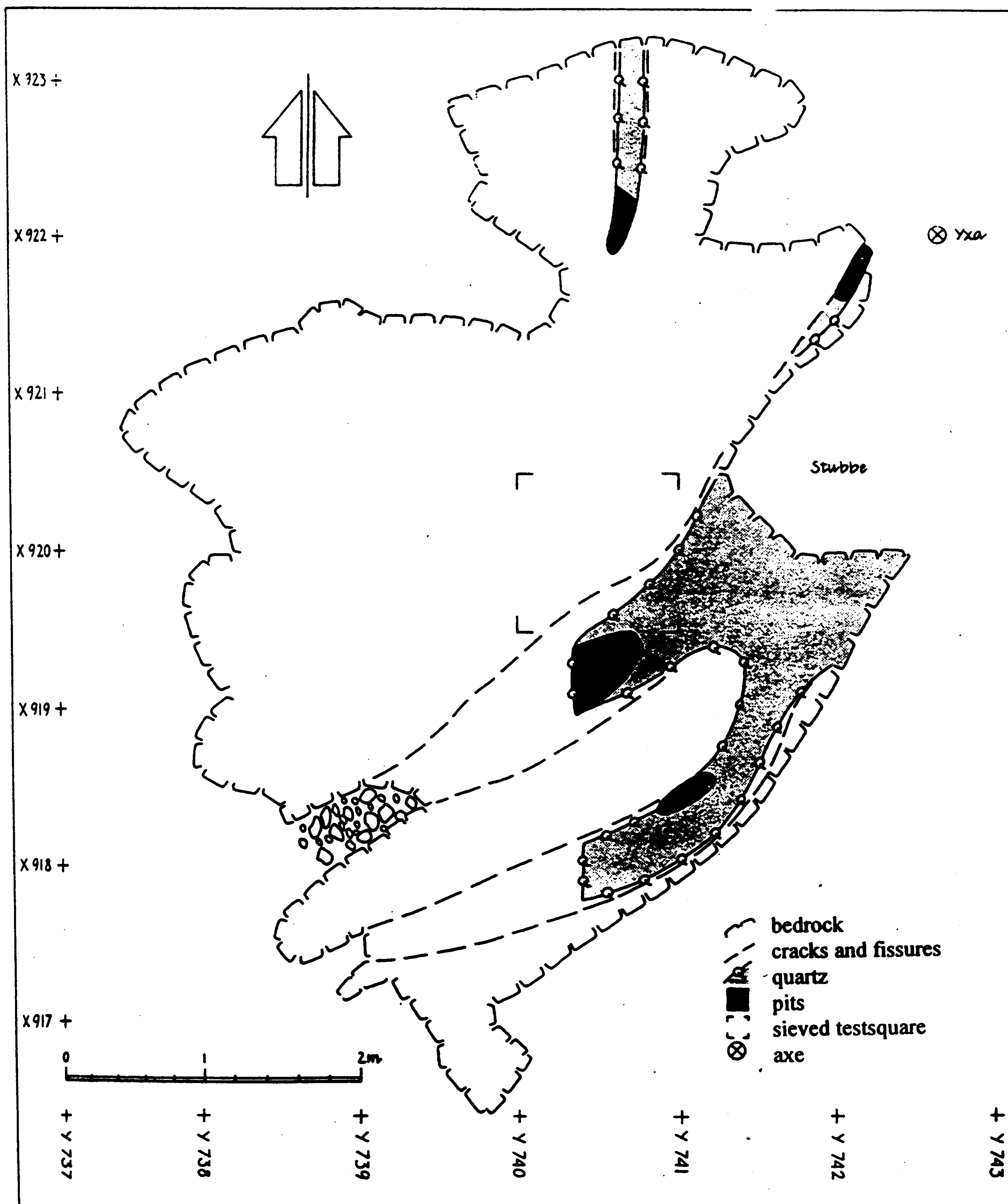


Fig 3. Translated version of map of the quarrying site at Noling (Olsson and Vinberg 1994:fig. 10).

The sites mentioned have several similarities which can be used for inferring some general ideas concerning the procurement and lithic strategy in the area. The quarry sites are not found in the actual settlements but within areas where Stone Age settlements are known. The sites consist of small flat outcrops of bedrock with visible

veins of quartz, 1–3 metres long and with a width of some tens of centimetres. The veins have been opened in one or more small and shallow pits and the area around the veins is rich in both flaked and crushed quartz. The Finnish sites at Kopinkallio show the same type and size of veins. The veins had been emptied of their content in several places. The site at Kopinkallio also lacks traces of settlement activity (Luhó 1956:52ff.). The similarities could indicate a similarity in time, but if these quarries were used during the entire Stone Age they show no sign of development within the lithic procurement process during this period.

SOME PROBLEMS RELATED TO THE STUDY OF SWEDISH QUARTZ QUARRYING SITES

Stone quarrying sites are still rare in the Swedish archaeological record. There are several problems associated with finding and recording such sites. None of the quarries mentioned above are situated on, or close to, Stone Age settlements which excludes the possibility of recording them during ordinary settlement excavation. As is the case of the quarries of both Noling and Fittja they were covered by a thin layer of soil and vegetation which makes them even more difficult to observe. The only chance to find this kind of quarry is to closely examine areas with exposed bedrock or places where the topsoil is damaged. This was also pointed out as an important factor at the survey in Dalsland (Lindman 1991:174).

Another aspect of these sites is the problem of dating. The date of the quarries to the Stone Age is simply based upon the probability that flaked quartz is mostly used during the Stone Age. The demand for quartz as raw material for tools was greater during this period than in later periods, and thus it can be inferred that the quarries mainly belong to the Stone Age, *i.e.*, 7000–2000 BC. The general knowledge of chronologically significant artifacts in quartz from this region is low. The only chronological difference known so far is the more common use of a bipolar method during the Mesolithic, while during the Neolithic there is a preference for a freehand platform mode of reduction (Lindgren 1994:80). This contrast should, however, be treated with care as the result is based on investigations of flaked material from settlements and the lithic strategy could very well have varied between quarrying sites and settlements. If the greenstone axe found at Noling is associated with the quarrying, this could indicate an early Neolithic use of the site. Radiocarbon datings are also connected with several methodological problems. The main problem is to find charcoal that clearly can be related to the quarrying phase of the site. In the case of Lundfors the charcoal horizon was interpreted as a part of the process of quarrying. At Fittja the charcoal, first interpreted as evidence of the quarrying process, after the results of the ¹⁴C dating was interpreted as the result of later forest fires (Bennet

1977:8). At sites where there is no evidence of burning, or where the quarry is located on exposed bedrock, this problem becomes even more pronounced. In eastern middle Sweden there is also the possibility to compare the altitude with the shoreline displacement. This area is characterized by a regression of the shoreline since the deglaciation. The quarry sites south of Stockholm are situated in areas between 40 and 50 metres above present sea level. This altitude corresponds with the shoreline of approx. 8000 to 6000 years BP (Risberg, Miller and Brunnberg 1991:35). The Mesolithic sites in the region are all closely related to the shoreline (*ibid.*:36) which has both economic as well as communicative reasons since the landscape is an archipelago during this period. The waterways were surely of importance in giving access to, and transport of the material from the quarries. In this respect the shoreline displacement can be of relevance in discussing chronology. The altitude of the quarries does not exclude that the sites could have been used in later periods. If quarrying sites could be found at lower altitudes, under approx. 35 metres above sea level, this would clearly imply that the sites should be of a date not earlier than the Neolithic period.

WHY BOTHER?

Which information about Stone Age societies can then be inferred from this kind of sites? Apart from technological and functional information, manufacturing of stone tools can also contain information on, for example, social organisation (Holm 1994:152). The archaeological record shows that during the Stone Age quartz is the most dominant raw material used in the region. The amount of flaked quartz varies from 245 gr at one Neolithic site (Kihlstedt in prep.) up to 180 kg found on one Mesolithic site (Gustafsson and Lindgren in prep.). The amount of flaked quartz found on the settlements has been interpreted as a result of an organized effort on a regular basis (Broadbent 1979:99). If veined quartz is as common in the area as indicated by the geological information, there is reason to believe that the mere location of veined quartz has not been singled out as a determining factor for settlement location. Another indication of good access to quartz is the fact that in the quarries no vein has been completely emptied. Since the amount of quartz on the excavated settlements varies, there is also reason to believe that the demand for raw material varied during the Stone Age.

The manufacturing process starts with the demand for good raw material. This demand for lithic material can be seen as a function of three different variables: the activities requiring stone tools, the lithic technology and the efficiency of the stone tools (Luedtke 1984:65). It is difficult to single out activities requiring stone tools due to the fact that in many cases tools made of wood or bone could have been as effective. Such tools are on the other hand rare in the archaeological material. Another problem

is that the choice of raw material used for tool production is not always determined by pure functional factors. The lithic technology is an easier problem to tackle. During the Stone Age in eastern middle Sweden the lithic technology is a mixture of three different methods of reduction, bipolar-on-anvil, freehand and platform-on-anvil. These three methods of reduction are used during both the Mesolithic and the Neolithic period (Callahan 1987:60). There are some indications that the bipolar-on-anvil method is more common on the Mesolithic sites than on Neolithic sites. On the other hand, there is a difference between Mesolithic sites regarding the ratio of bipolar-on-anvil and freehand platform methods (Lindgren 1994:82). The bipolar-on-anvil method has been interpreted as a method which is very economic and therefore well suited for areas with low access to raw material (Thorsberg 1986:10). This explanation is however hardly relevant in this case, as the area is rich in quartz. The reason for choosing the bipolar-on-anvil method is not merely an economic or functional question. The efficiency of the stone tools has previously been studied in terms of curated and expedient technology (Binford 1973; Olausson 1986:7). One of the characteristics of the stone inventory on sites in the area is the lack of formal, retouched tools (Lindgren 1994:79). Another factor of importance is the nature of the quartz, which is easily fractured and means that flakes, modified or not, could easily break when used. This could be seen as an indication of a high demand for lithic material.

This brief analysis also shows that there are many problems associated with determining the demand of lithic material. As shown in the example of stone tools efficiency and lithic technology, the results are contradictory. These results, however, indicate that the lithic strategies can be complex and multidimensional. It is however important that the study of lithic strategies also includes the study of quarrying sites.

CONCLUDING REMARKS

The sites in eastern middle Sweden that have been interpreted as quartz quarrying sites are often small sites which are difficult to identify. They are probably more common in the landscape than previously known, although they do not seem to occur on the actual settlement sites, but in their vicinity. One of the major problems with this kind of site is the chronological framework. There are seldom datable artifacts, the radiocarbon dating is connected with major source critical problems. In the area of eastern middle Sweden the shoreline displacement can be of some, though limited use. In the region archaeological research is now beginning to study the raw material procurement, and the quarrying sites are more often noticed in different types of surveys. In the future these quarrying sites can be of use in analysis of the lithic strategies as well as of the subsistence within the Mesolithic use and perception of the landscape.

REFERENCES

- Althin, C-A. 1951. The Scanian flint mines. *Meddelanden från Lunds Universitets Historiska Museum*, 139–58. Lund.
- Bennet, A. 1977. Fornlämning 280 förhistoriskt kvartsbrott? Fittja, Botkyrka sn, Södermanland. *Riksantikvarieämbetet och Statens Historiska Museums Rapport Undersökningsverksamheten* 27. Stockholm.
- Bínford, L.R. 1973. Interassemlage variability — the Mousterian and the functional argument. In *The explanation of cultural change*, C. Renfrew (ed). London.
- Broadbent, N. 1979. *Coastal resources and settlement stability. A critical study of a Mesolithic site complex in Northern Sweden*. AUN 3 Uppsala.
- Callahan, E. 1987. *An evaluation of the lithic technology in eastern middle Sweden during the Mesolithic and Neolithic*. AUN 9. Uppsala.
- Gustafsson, P. and C. Lindgren in prep. The Eklundshov site. In *Södertörn. Interdisciplinary investigation of Stone Age sites in eastern middle Sweden*, Å. Åkerlund, E. Olsson, P. Gustafsson and U. Miller (eds). Riksantikvarieämbetet Byrån för Arkeologiska Undersökningar.
- Holm, L. 1994. Stone artifacts as transmitters of social information. Towards a wider interpretation with a North Swedish example. In *Current Swedish archaeology*, M. Burström and A. Carlsson (eds), Vol. 2:151–8. Stockholm.
- Kihlstedt, B. 1992. Arkeologisk utredning etapp 1 Gladö Industriområde. Södermanland Huddinge socken Björksättra 1:4. *Riksantikvarieämbetet, Byrån för arkeologiska undersökningar Rapport* 1992:45 - in prep. The Kvedesta site. In *Södertörn. Interdisciplinary investigation of Stone Age sites in eastern middle Sweden*, Å. Åkerlund, E. Olsson, P. Gustafsson and U. Miller (eds). Riksantikvarieämbetet Byrån för Arkeologiska Undersökningar.
- Lindman, G. 1991. Småskalig utvinning av kvarts. In *Skärvor och fragment. Västgöta-Dal 1989–90*. Vänersborg.
- Lindgren, C. 1994. Ett bipolärt problem — Om kvartsteknologi under mesolitikum. In *Aktuell Arkeologi IV*. K. Hauptman Wahlgren (ed.). Stockholms Archaeological Reports 29. Stockholm.
- Luedtke, B.E. 1984. Lithic demand and quarry production. In *Prehistoric quarries and lithic production*, J. Ericson and B. Purdy (eds). Cambridge
- Luhó, V. 1956. Die Askolakultur. *Finsk Fornminnestidskrift* 57.
- Möller, H. and G. Stålhös 1969. Beskrivning till geologiska kartbladet Stockholm SO. *Sveriges geologiska undersökningar Serie Ae nr 3*. Stockholm.
- Olausson, D. 1986. Intrasite spatial analysis in Scandinavian Stone Age research. A discussion of theory. *Meddelanden från Lunds Universitets Historiska Museum* 1985–1986. Lund.
- Olsson, E. and A. Vinberg 1994. Boplatser i Nolingområdet. *Riksantikvarieämbetet Byrån för arkeologiska undersökningar. Rapport* 26
- Risberg, J., U. Miller and L. Brunnberg 1991. Deglaciation, Holocene shore displacement and coastal settlements in Eastern Svealand, Sweden. *Quaternary International* 9:33–7.
- Rudbeck, E. 1986. Ängdala. Flintgruvor från yngre stenaldern, S. Sallerup. Utgrävningar 1977–81. *Rapport Nr 1 Malmö Museum*.
- 1987. Flintmining in Sweden during the Neolithic Period. In *The human use of flint and chert. Proceedings of the fourth international flint symposium held at Brighton Polytechnic 10–15 april 1983*, G. de G. Sieveking and M.H. Newcomber M.H. (eds). Cambridge.
- Thorsberg, K. 1986. Bipolär teknik i flinta. Några funderingar. *Fjölur* 2. Uppsala.
- Welinder, S. 1977. The Mesolithic Stone Age of Eastern Middle Sweden. *Antikvariskt Arkiv* 65. Stockholm.