An Experimental analysis of quartz scrapers: results and applications
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Experimental archaeology has become an important corollary to Stone Age research. Experiments involving the making and using of stone tools have been carried out for many years and the amount of literature on the subject is substantial. Well known in the area of experimental reproduction of stone tools are Crabtree (1964, 1966, 1968), Bordes (1970), and in the Scandinavian area, Kragh (1964). A more recent trend has been the microscopic examination of edge wear arising from the use of such tools and the application of this information to the analysis of real find materials. In the area of edge-wear analysis can be mentioned Semenov (1973), Keller (1966), Witthoft (1967), Frison (1968), Wilmsen (1968), Kantman (1971), Nance (1971), and Brose (1975). A summary of literature prior to 1967 has been presented by Heizer and Graham (1967) and later by Hester (1972).

The results of most of these experiments are very interesting indeed for researchers dealing with the classification and analysis of stone tools and they have opened up new possibilities for interpreting the functions of ancient stone implements. One frequent drawback has been the lack of adequate documentation and proper controls, which has limited the usefulness of the results for application to actual archaeological find situations. A critical survey of recent experimental micro-wear studies has been published by Keeley (1974). He points out how poor technique and inadequate methodology have detracted from the value of many experiments. The various investigations have often been too limited in scope and disjointed. Micro-wear examinations have been published without an adequate discussion of the methods used or the interpretative basis from which the conclusions were drawn. Even when careful experimentation has been carried out, the results are not put into a cultural or environmental context or based upon any real material. What is needed is a more integrated approach, combining experiments with good scientific technique. The ideal would be to carry out well documented experimentation, supported by ethnographic information, if possible, and geared to a specific archaeological context in which the raw materials involved are determined and subsequently used. The final step would be to apply the results of the experiments to the real finds, using the whole archaeological material as a unit of study.

The present authors have carried out an experimental series using quartz scrapers. Our goal has been to establish a basis for making a micro-wear analysis of these, and eventually other kinds of tools, from the Lundfors settlement, a Mesolithic site complex in Västerbotten, Northern Sweden. This area is devoid of natural flint resources and our problem has been to collect data which can be used for analyzing the quartz implements from Lundfors, and other parts of northern Scandinavia and Finland. We have found that nearly all the literature dealing with similar analyses has been based upon experiments using flint or other cryptocrystalline stones. It was not known to what extent the differences between these raw materials would...
alter the wear manifestations or if such wear could be distinguished at all on quartz implements. A secondary goal has been to determine the effective lifespan of individual implements which is of direct relevance for interpreting the numbers of tools found on working sites. We have modelled our experiments after the technological and resource framework of Lundfors, reproducing the equipment and using raw materials determined at the sites.

The Making of the Scrapers

The starting point for the experiments was the manufacture of the quartz scrapers which were to be used. Raw material was obtained from the Varuträsk Mine near the town of Boliden in Västerbotten. This quartz is of a homogeneous appearance and structure and is light gray in color. We chose this material partly for its uniformity of color and nontranslucency enabling easier examination of eventual wear, and partly because it could be easily worked. It is directly comparable to the Lundfors quartz in structure and hardness but better for our purposes and limited ability in making stone tools.

Primary flakes were struck off amorphous chunks of the quartz and suitably sized pieces were given pressure retouched convex edges using a bone pointed flaker. All of our scrapers are convex-edged end scrapers. The exact measurements, edge angle and weight were recorded for each specimen we made. Approximately fifty scrapers were made in this manner and after microscopic examination of all of the edges, twenty-three were selected for use on the basis of sharp, clean (non-crushed) edge rims. One section of each edge was chosen for closer study and repeated photographic registration. These points were marked with black ink on the ventral surface of each edge and coated with lacquer to insure they would last. The morphology of the magnified edges was seen to radically change in many cases and it would have been impossible to relocate the edge areas without such markings. This was vitally important for the interpretation of the photographs which covered only a very narrow area of each edge.

Documentation

For the documentation of our experiments we used an Olympus Stereomicroscope Model X-2 with a magnification of up to 80×. We took microphotographs at different magnifications and found the most useful enlargements were at 10× and 20× (in the present paper the enlargements are about 7× and 14×, respectively). This allowed for adequate registration of the micro-wear with good depth of field. For photography we used a Mamiya-Sekor 1000DTL single lens reflex camera with spot metering and Panatomic X fine-grained film with ASA 32, 16 Din. The light source was a standard Olympus TE-II microscope lamp.

For each scraper experiment, 15–25 photographs were taken at circa five different intervals. The translucency of the quartz was neutralized using different agents. Magnesium powder was applied but we found this awkward to use. The best results were obtained using ammonium chloride (salmiak), which produced a fine dust upon heating that effectively coated the artifacts and could be easily removed. With high magnifications, diluted white ink was used as the ammonium chloride particles became too coarse. The tools were carefully washed in warm, soapy water before each coating and photographic phase. For a more detailed discussion of photographic techniques used in microwear analysis, refer to Semenov (1973, pp. 22–29), MacDonald and Sanger (1968, pp. 237–240), and Brothwell (1969, pp. 564–566).
Fig. 1. Photograph shows scraper being used on fresh cowhide. Polygrip pliers were used for hafting. The scrapers were bound in leather to prevent fracture and could be quickly removed and examined under the microscope. All sizes were accommodated by the pliers and a constant working angle of 80-90 degrees could be maintained.

The Hafting of the Scrapers

Although it may be possible that scrapers can be used without handles, we found, for our purposes, that we could not effectively carry out such tasks without them. Great pressure had to be exerted even on the softer materials in order for the tools to function effectively. The friction involved in scraping is very great and without proper leverage one became rapidly exhausted. We have also found evidence that many of the small scrapers at Lundfors had been hafted. We therefore chose to have some kind of handle for our experiments.

While it was fairly easy to reproduce ethnographically described scraper handles, which we tried (compare Boas 1901-7, Birket-Smith 1921-24, Murdock 1892, etc.), we were obliged to remove the scrapers so frequently for microscopic examination that this was not practical. We solved the problem by using polygrip pliers which also accommodated the varying sizes of the scrapers we used. A further methodological problem was solved with these pliers in that the canted grip made possible a constant working angle for our tests, a control factor of considerable significance (Fig. 1). The angle at which a scraper is held, no matter what its edge angle, gives quite different results. The greater the angle, the deeper the cut.
Scraper Utilization

The mounted scrapers were used by drawing the edges toward the operator with the ventral surfaces facing the direction of movement. A constant working angle of 80–90 degrees was maintained and the downward pressure was kept as uniform as possible. The length of each stroke for each experimental series was also kept constant. For wood and bone this was 10–15 cm and for hide 15–20 cm. Every stroke was counted and changes in the working edges were noted, i.e. chips off working edges, loss of cutting action etc. When subjective changes were noted, a careful microscopic examination was undertaken to establish the cause and, if possible, photograph it.

We soon discovered that the scraper edge planes had to be held obliquely to the material being worked. Wood fibers and fat quickly clogged the edges reducing efficiency and requiring constant cleaning. When angled, natural edge friction removed this material with each stroke. Another clear advantage was that the cutting action of the scrapers was greatly improved.

Semenov (1973, p. 87) and Rosenfeldt (1971, p. 178) have noted that many end scrapers are worn on their right sides and are lopsided in form. Eighty percent of the end scrapers were worn in this manner at Kostenki I, Timonovka, Mezin, Suponevo and Sakjia Cave, sites mentioned by Semenov. He interpreted this to mean that these scrapers, used in working skins, had not been hafted and by being hand-held had developed wear along their right-hand sides.

We consider this interpretation to be theoretical and, based upon our experiments using end scrapers, very unlikely. We found it nearly impossible to effectively scrape fresh hide using hand-held scrapers. Even in currying, the softening of skins, this must be extremely difficult and small hand-held tools used on skins can hardly develop the wear as described by Semenov. From what we have observed, this type of wear occurs naturally when scrapers are used obliquely, which is quite simply the most efficient way to use them. A lopsided edged scraper would even facilitate such a working action. Figure 2 shows the proper way to use a scraper as clearly described.

Fig. 2a shows proper way to use a scraper according to the Illustrated Directions for Scraper Use as put out by the Skarvsten Manufacturing Co. Ltd., Welwyn Garden City, Herts, England, makers of modern steel scrapers. Fig. 2b shows angled use of edge with respect to working stroke. This method keeps the edges clean of debris and improves the cutting action. — Fig. 2a visar det rätta sättet att använda en skrapa enligt en modern skrap dullverkare. Fig. 2b visar den lämpliga vinklingen av skrapan vid användning, vilket förhöjer effektiviteten samt håller eggen ren.
by the Skarvsten Manufacturing Company, makers of modern wood scrapers.

The Experiments

Five experimental series were conducted using three types of raw material:

1) Wood Pine (Pinus silvestris) and Birch (Betula pubescens)
2) Bone (boiled cowbone)
3) Hide (fresh cowhide)

Two wood types of slightly different hardness and structure were chosen. These were the two most common sorts which have been determined at Lundfors as evidenced by charcoal analysis from the sites (Broadbent 1975).

Osteological analysis has shown that the Ringed Seal (Pusa hispida) was the main game type at the site. Numerous bone artifacts have been found in the Baltic area associated with similar seal-hunting cultures (Schnittger and Rydh 1940, Stenberger 1943, Clark 1946 and Janzon 1974). It is very probable that both hide and bone were worked at Lundfors (this, in fact, has been demonstrated by using the results of the experiments in this report). It was not possible or practical to use seal skin or bone for our tests, so fresh materials were collected from a slaughterhouse. The structure of these materials can be considered as being analogous for our testing purposes.

Series 1. Scraping of Pine

Six end scrapers (nos. 3, 8, 28, 29, 30, and 31) were used for working a pine log. Edge width ranged from 1.2 to 2.5 cm and edge angles from 60 to 85 degrees. A total of 3610 strokes were carried out. The experiments were continued until the scrapers ceased to function and only slipped over the surface of the wood.

The first observed change under magnification was the breakage of the sharp projections and channel ridges along the dorsal edge-rim thus making the whole form more even in outline and apparently stabilizing it. Figures 3a–d show this process in two stages. The stabilizing process was complete on all of these scrapers within a range of 100 to 175 strokes with a mean of 145. After this initial forming of the edges they gradually became more and more dull, cutting less and gliding more over the wood. The five to six centimeter long curled wood shavings which were produced during the stabilization process were replaced by shorter shreds and finally only dustlike material was removed.

In one of the experiments the scraper, (no. 28), was completely destroyed at 35 strokes when the whole edge broke off. On two others several larger chips were detached after stabilization. One 6×4 mm chip broke off no. 8 at 450 strokes and another large chip broke off no. 31 at 370 strokes. The occasional fresh cutting surface created by the removal of a large edge chip would rejuvenate that part of the edge adding as much as 200 cutting strokes (see scraper no. 31), but this was seen to be so uneven and uncontrolled that it cannot be regarded as having any real value. We concluded that this kind of wear did not result in any useful resharpening of our scrapers.

The wear resulting from the scraping of pine which we observed may be characterized as microretouch caused by friction and giving rise to small, wide hinge flake scars which run along the rims of the edges, ultimately undercutting them and giving them a stepped appearance. Most of the edge fracturing was seen to take place in the first 175 strokes. The scrapers ceased to function effectively within the range of 525 to 650 strokes, with a mean value of 600 strokes, after which they must be resharpened or rejected.

Series 2. Scraping of Birch

Six end scrapers were used on birch (nos. 4, 6, 11, 12, 15, and 17). Edge width was from 1.7 to 3.3 cm and edge angle from...
Fig. 3 shows scraper edge used on pine. a. Edge of scraper no. 3, unused. Arrow shows ridges and channels on fresh edge (ca. 7×). b. Scraper no. 3 after 100 strokes. Sharp projections and channels have been broken away. c. Same as b (ca. 14×). d. Scraper no. 3 after 150 strokes (ca. 7×). Edge stabilized, all sharp projections completely broken away and edge more uniform in outline.  

55 to 90 degrees. A total of 1910 strokes were made.

The scraping of birch resulted in much the same wear patterns as were noted for pine but the harder, more rigid material structure increased the friction and shortened the usefulness of the tools. Stabilization was seen to occur between the range of 70 to 125 strokes, with a mean of 97. The same course of wear development as seen for pine was taken: stabilization and gradual dulling. The period of usefulness was nevertheless considerably shorter, and the loss of function was
An Experimental Analysis of Quartz Scrapers

between 170 and 375 strokes, with a mean of 228. Five of the scrapers could be used until the functional limit was reached, but one scraper, (no. 12), was destroyed at 170 strokes when it broke in two. No larger chips were detached after stabilization on any of the specimens.

Conclusions Regarding Wood Scrapers
Edge wear similar to that which we have observed has been described by other researchers using other types of stone such as obsidian, chalcedony and quartzite. Keller (1966) and Crabtree and Davis (1968) have performed experiments scraping wood which led to comparable wear and edge damage. Gould, Koster and Sontz (1971) have made a study of tools used by Australian aborigines for working wood. The same damage was observed. In brief, they all describe small hinged flake scars and edge nibbling which often occurs in several rows along the edge rims giving such edges a stepped and undercut appearance. This pattern therefore seems to be the same regardless of the stone type and may be considered as diagnostic for tools used to work wood or raw materials having a similar structure.

Series 3. Scraping of Bone
Five scrapers were used to scrape boiled cow bone (nos. 5, 7, 14, 20, and 21). The bone was softened somewhat through boiling. Boiling or soaking was undoubtedly practised in prehistoric times. We considered this important for effective scraping. Edge width for these tools ranged between 1.0 and 2.2 cm and edge angle between 70-80 degrees. A total of 1800 strokes were carried out.

The edges of these tools were seen to react initially in the same way as the wood scrapers in that the projecting points along the working edges were broken off and the forms stabilized. One crucial difference was that the downward pressure of the scraper upon the hard, unyielding bone caused larger chips to detach from the ventral surfaces creating a form of bifacial wear. This was seen to occur on all five of these scrapers. This was not observed, by comparison, on any of the scrapers which were used on other types of raw material (wood or hide).

The stabilization of the scraper edges
used on bone was complete between 75 to 150 strokes, with a mean of 100, corresponding to the wear on the birch scrapers. The bone which we used was quite hard and the scraping produced only a shaving of the bone surfaces and lots of bone dust. One scraper, (no. 21), which had a more serrated edge, cut more deeply as the pressure was concentrated on a few points. The functional limit for these tools occurred between 200 to 325 strokes, with a mean of 250, after which they only slid over the bone.

The hard, homogeneous structure of the bone caused the edges to develop very distinctive wear with continued use after stabilization which was quite unlike that of the wood scrapers. All of the tiny projections along the edge plane which had been broken off in the first ca. 100 strokes became completely crushed and rounded. This development can be seen in Figures 5 a–c. This dullness is so great that it can be seen with the naked eye and easily felt with the finger tip.

Semenov (1973, pp. 143–196) devotes a whole chapter of his book Prehistoric Technology to the subject of ancient bone working. He does not mention scrapers in this connection, however. While a number of authors have been interested in the type of scraper wear which would arise from working bone, we have found very little discussion in the literature (usually mentioned in connection with wood working), and no wear descriptions comparable to what we have observed.

Fig. 5 shows scraper used on bone. a. Unused edge of scraper no. 5 (ca. 7×). b. Scraper after 100 strokes. Arrow shows where flake channels have been broken away. Edge rim starting to display rounded and crushed appearance (ca. 7×). c. Scraper after 350 strokes. Edge rim completely crushed and flake channel ridges broken off into steps (ca. 7×). Fig. 5a. Eggen hos skrapa nr 5 före användning (ca 7×). b. Samma skrapa efter 100 drag på oxben. Pilen visar var retuschåsarna blivit avbrutna. Yttersta eggkanten har ett något rundat–krossat utseende (ca 7×). c. Skrapan efter 350 drag. Eggkanten fullständigt krossad, och retuschåsarna har blivit helt förstörda genom bruksreutuscheringen (ca 7×).
Series 4. Scraping of Hide

Six scrapers were used in this experiment (nos. 2, 9, 13, 25, 26, and 27). Edge width ranged between 4.10 cm and 2.69 cm and the edge angle between 55 and 75 degrees. A total of 5 100 strokes were carried out.

For these experiments we used fresh cowhide which was very fatty and had a thickness of ca 2 cm. We were primarily interested in the cutting action of the scrapers in this kind of work rather than for currying, which is meant to crush fibers and soften skin. The hide strips were tacked down on wooden boards without any sort of padding or soft foundation.

We immediately observed that the edge angles on our scrapers gave quite different results. We found that scrapers with edge angles of 70-75 degrees barely functioned for the removal of the fatty tissue layers on the undersides of the skins. The cutting action was simply not great enough. In our experiments, scrapers having edge angles of 55-65 degrees functioned very well and when drawn obliquely, half cut and half scraped away the tissue layers without damaging the skins.

The development of wear differed completely from that on wood or bone scrapers. The edges did not undergo any form of stabilization and no microretouching was seen to take place.

The scrapers were used without any noticeable change in function up until ca. 500-600 strokes. No observable change could be seen under magnification so this remains more of a subjective judgment. Four of the scrapers had a loss of efficiency and cutting action at ca. 800 strokes. This point was reached when the scrapers ceased to cut adequately and required too much energy. One scraper (no. 13) continued to work well until almost 1 000 strokes. Some sand grains were sprinkled on the skins in the experiments but this did not radically alter the wear or life span as this material was quickly cut away with the fat.

To summarize, we observed no edge damage on the skin scrapers: no microretouch, stabilization or undercutting. The only change was a dulling of the sharp edges which was drawn out over a relatively long period of time and observed...
only in its final stages as a very slight rounding of the edge rim seen under magnification (Figures 6a–b).

Very little discussion of wear resulting from the scraping of skins has been taken up in the literature and these results are somewhat vague. Crabtree and Davis (1968, p. 428) say in their experiments that, "no use flakes are pressed off when leather or hide is scraped". Keller says, "Hide scraping ... produced very little damage, only a few flakes being detached from the dorsal surface", (Keller 1966, p. 508). He used unretouched flakes in this experiment.

Conclusions

On the basis of our twenty-three experiments we were able to distinguish three diagnostically distinct types of wear resulting from use on different raw materials.

The scraping of wood produced a form of microretouch which we consider as being easily recognized. The scraping of bone led to the crushing of tool edge rims and the detachment of small flakes along the ventral surfaces. Such wear is also easily observed and can be distinguished from wear arising from woodworking. The scraping of skin produced no observable wear except a slight rounding of the edge rims which could only be seen under magnification. This, with respect to the other forms of wear, is also clearly distinguished. We therefore have concluded that it is not only possible to observe wear on quartz implements but that the wear can be divided into three main categories: 1. wear arising from the working of hard fibrous materials (wood). 2. wear arising from the working of hard, homogeneous materials (bone). 3. wear arising from the working of soft, fatty materials (hide). It is quite possible that more wear can be determined using more advanced techniques. We did not observe any striations, for example, as described by Semenov (1973, p. 88), or Brose (1975), who used a Scanning Electron Microscope.

The type of wear involved in these experiments is an abrasive form whereby a harder, rougher surface slides over a softer surface. This type of wear can be very damaging, not only in removing material from the softer surfaces, but by quickly destroying the usefulness of the tools (Rabinowich 1962, p. 128). This is most obvious on the bone and wood scrapers. One of the most important controls upon abrasive wear is lubrication. Abrasive wear can be reduced by a factor of at least 10, by animal fats for example, which increases the lifespan of the scrapers by effectively controlling edge damage and wear. This is one of the reasons why skin scrapers used on fatty hides do not develop heavy wear. Brose has recently brought up this factor in dealing with obsidian blades which were used in cutting experiments (Brose 1975). He noted that the accumulation of fats on the tool edges reduced wear striations, but also could have a negative effect in that the fat-clogged blades had to be rejected earlier. Perhaps in this respect we prolonged the use of our scrapers in that during experimentation we frequently cleaned the edges for microscopic examination.

Edge Stability

Numerous factors must be considered when making and using a scraper. Depending upon the material which is to be worked, one must choose an edge which is going to function effectively and, ideally, one which will work for as long as possible and with a minimum amount of energy. This is going to depend first upon the type of stone chosen to make the tool, and then upon the edge morphology.

Edge contours and edge angles are directly related to the ways in which scrapers can be used. In our experiments
we used entirely convex-edged scrapers so there is not much which can be said about this factor in this context except that it is the dominating scraper edge type found at Lundfors and seems to be universally so. Edge angle varied on our tools and we observed some important functional differences. We noted for the scraping of fatty hides, angles of 70 degrees or more functioned very poorly; the cutting action was not great enough to penetrate the fatty tissue. This seems therefore to represent an upper limit for edges suitable for carrying out such tasks. There is also a lower limit to be considered and that is set by the force involved in scraping. We found it necessary to exert great pressure, and a thinner edge although much sharper cannot withstand such force. Two of our scrapers were broken in woodworking. One of the wood scrapers (no. 6), which had an edge angle of 55–60 degrees, was seen to undergo great changes during the first 75 to 125 strokes. At least 10 small chips were detached from the dorsal edge surface which increased the edge angle to 78 degrees. After this angle had been created by the friction exerted upon it, no further chipping occurred and the edge was slowly dulled. This process of stabilization was seen to take place on all of the hard material scrapers and it helps...
to explain, at least in part, why scrapers were retouched in the first place.

Sollberger (1969, p. 239) says, "flaked edge scrapers . . . are quite satisfactory in working wood", but he adds that they don't function as well as unmodified flakes. Keller (1966, pp. 509–510) has made the same observation, and Crabtree and Davis have come to the conclusion that, "some of our best tools would be classed as junk or detritus", meaning that unretouched flakes work better (1968, p. 428). If this is true then it seems odd that so many scrapers are carefully retouched. Aside from specific edge contours which must be shaped to perform certain tasks and the rounding of edges to prevent damage of soft materials, there must be other reasons behind the practice. While unretouched flakes are clearly sharper, a distinct disadvantage is that they cannot withstand the force involved in scraping if they are to be hafted.

The question of whether or not end scrapers were hafted has been discussed by Rosenfeldt (1971, p. 180), McDonald and Sanger (1968, p. 237), Frison (1968, p. 152), Wilmson (1968, p. 157) and Semenov (1973, p. 87). The first four authors seem to be convinced that they were. They base this upon the heavy damage that they have observed on the scrapers' ends (round polishing, crushing etc.). Wilmson has found support through ethnographic parallels. Eskimo implements of end scraper type which had been mounted in the natural sockets of long bones develop lateral wear which he has found in his material. Semenov is not convinced, and finds support in that many of his end scrapers were made on long blades which could be hand held, and they display right-hand wear, a subject that we have previously discussed.

We believe that most small scrapers were hafted and base this partly upon the force we found necessary to use upon them, the heavy wear we observed and have found described in the literature, the frequency with which ethnographically documented scrapers are hafted, and unmistakable lateral wear traces and distinctive transverse edge breakage among the Lundfors material.

The final argument is based upon our observations concerning edge retouching. We see the retouching of scraper edges to be primarily an attempt to control edge wear arising from friction. We observed the detachment of numerous small chips from the retouched edges. On unretouched edges this type of wear takes place in a much more uncontrolled fashion which can totally destroy a smaller sized edge in a few strokes. Natural, unretouched flakes are much sharper but some of this sharpness must be sacrificed if an edge is going to last. Retouching does not add to the sharpness but stabilizes an edge, strengthening and forming it. The great predominance of retouched edges must therefore witness the pressure involved in scraping which is closely linked with hafted implements.

Retouching and Edge Angle

In our experiments using quartz scrapers, the best angle for working wood was seen to be between 70 to 80 degrees which was either achieved initially through retouch or naturally through frictional retouch during use. No scrapers with angles of over 80 degrees displayed any frictional retouch while all of those under 75 degrees did. The ideal for scraping fresh hide was seen to be between 55 to 65 degrees, an edge which could withstand pressure but was still sharp enough to cut flesh and fat.

Wilmson has made some observations concerning scraper edge angles on Paleo-Indian artifacts which agree with our conclusions. He postulates that angles of 66–75 degrees were best for working wood, bone, skin softening and heavy shredding, and that edges of 46–55 degrees were best used for skinning and scraping, sinew and plant fiber shredding and heavy cutting (1968, p. 156). He has based his conclu-
sions on micro-wear analyses of 1448 implements. Gould in his ethnographic studies, gives support to these conclusions. His documented aboriginal wood scrapers had angles of between 50–90 degrees while cutting implements were between 20–59 degrees (Gould, Koster & Sontz 1971).

We found through practical experimentation that these limits are not only based upon suitable cutting requirements but are necessary for edge stability and are partly created by frictional wear.

Table showing scraper numbers, scraper edge angles, the material which was worked and the edge stabilization and functional limits described in terms of numbers of strokes within which the changes took place.

<table>
<thead>
<tr>
<th>Scrapper Number</th>
<th>Edge Angle</th>
<th>Material</th>
<th>Stabilization</th>
<th>Functional Limit</th>
<th>Total</th>
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<td>3</td>
<td>75°</td>
<td>Pine</td>
<td>100–150</td>
<td>600–650</td>
<td>700</td>
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<td>125–175</td>
<td>575–625</td>
<td>650</td>
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<td>525–575</td>
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<td>600–650</td>
<td>800</td>
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<td>575–625</td>
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<td>Broken</td>
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<td>500–600</td>
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Applications

Turning from our experimental results to the real archaeological material from Lundfors, we can draw some preliminary conclusions which suggest the applicability of our results.

A preliminary microscopic examination of the scrapers from Lundfors has shown that all of the edge wear we have described is represented at the sites. The most common wear type observed is the microtoucing which was found to be caused by woodworking, but distinctively worn examples of bone and hide scrapers have also been recognized. Although numbers of implements are of one type or another, quite a few display multiple wear patterns indicating they had been used to perform several different tasks. Also, many tools are badly damaged and in some cases it is difficult to distinguish wear from damage caused by manufacturing. One way of distinguishing such traces from true
edge wear is by the distribution of damage along the edge rim. Some shattering resulting from pressure retouching was observed when we made our scrapers but this is limited in width and distribution and we feel we can distinguish it in this material. True wear has a more even distribution and follows the low and high contours of the edges. The final results of the microanalysis are to be published in 1976 and are being integrated with data concerning implement size, edge locations, contours and angles.

The scraper edge angles at Lundfors fall into distinctive groups which, against the background of our practical observations, correspond to different scraper-using activities. The convex-edged scrapers which have so far been measured are concentrated between 60–75 degrees: ca. 75% fall into this group, 14% have larger edge angles and 11% have less than 60 degrees. There were no convex scrapers under 50 degrees, however, and none over 85 degrees. This corresponds remarkably well with what we have observed concerning the lower limit of edge stability for hafted scrapers. The preliminary observation that most of the wear has resulted from woodworking is in line with the concentration of edge angles between 60–75 degrees. This same concentration has been noted by many authors dealing with finds from different time periods and environments. While in our case we can associate this group with the working of certain types of wood, the angles are as much a product of the requirements for edge stability and this must be fairly universal when similar types of stone are used.

The small percentage of edge angles over the 60–75 degree group implies that few of our scrapers have been resharpened. It is a commonly met with statement that stone scrapers were probably resharpened numerous times but there is reason to doubt this. We tried resharpening some scrapers and calculated the increase in edge angles which resulted. Not only did the angle increase by as much as 10 degrees with one retouching but with such an angle it became difficult to detach flakes using pressure techniques. If an edge angle must be maintained to perform a specific job, repeated retouching would not serve a useful function. A rejuvenated edge is not necessarily one which will work better.

We found that within the framework of our tests, scrapers, especially those used on hard materials, did not function for very long. If the archaeological scrapers had not been resharpened then they must have been rejected in great numbers and this goes a long way in explaining the hundreds of scrapers which have been found even on sites used only for a short time, such as Lundfors.

These relatively simple experiments have given us great insight into the workings of stone technology. By combining this information with real archaeological data it will be possible to take the functional interpretation of stone tools from pure guesswork to a more solid and scientific footing. This will add enormously to the possibilities for interpreting working areas within single sites and the classification of sites into different functional types. There may even be some chronological possibilities in that shifts to different environments, for example, tundra to forest, could be reflected by changes in scraper edge angles and forms.

The scraper has been shown to be a far more complicated implement than previously thought, used to perform many different tasks, and a valuable tool for archaeological analysis.
Experimentell analys av kvartsskrapor


Den kritik som anförts mot denna typ av forskning har främst vänt sig emot den dåliga dokumentationen av undersökningarna, samt avsaknaden av lämpliga kontroller. Denna underlåtenhet har medfört en begränsning av möjligheterna till applikering av resultaten på ett originalematerial.

Författarna till denna artikel har utfört experiment med påföljande mikroskopanalyse av experimentellt framställda skrapor av kvarts. Till grund för dessa experiment har legat ett artefaktmaterial från utgrävningar i Lundfors i Västerbotten, ett boplatskomplex från mesoliticum, daterat till ca 3500 f. Kr.

De tidigare försöken missgrepp har så långt som möjligt försökt undvikas. På basis av skrapning med 23 olika experimentellt framställda kvartsskrapor (samtanlagt ca 12 000 drag) på respektive tall, björk, ben och råhud, har följande slutsatser kunnat dras.

1. Trä, ben och råhud producerar clart åtskiljbara skador: För trä, avskiljande av små, breda mikrospån av avbruten karaktär, som utbreder sig utefter eggplanet ibland i flera eller avbruten karaktär, följt av krossning av egggens yttersta kant samt avskiljande av större retuscher från baksidan. För råhud (fettskrapning), inga noterbara skador utom i skrapningens slutskede då en mikroskopisk rundning av egggens yttersta kant kunde observeras.


4. Retuschering ger inte skraporna skarpare egg, den gjordes förmodligen för att stärka och forma den.

5. En skrapa fungerar bäst om den vid användningen hålls en aning vinklad mot skraprikten.

Efter en preliminär genomgång av Lundforsmaterialets skrapor, har det visat sig, att de vid försöken uppkomna bruksstatistikern har klart påvisbara paralleller i detta. En grundligare utförd applikering och dissussion på basis av experimenten kommer att utföras vid ett senare tillfälle, men det tycks alltså möjligt att med denna metod kunna utföra en mer ändamålsbaserad klassificering av stenartefakter.

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