An offprint from

Mesolithic Horizons

Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005

Edited by

Sinéad McCartan, Rick Schulting, Graeme Warren and Peter Woodman

ISBN 978-1-84217-311-4

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117. 'Rulers' of southern Sweden: technological aspects of a rediscovered tool

Arne Sjöström and Björn Nilsson

In the early 20th century the archaeologist Knut Kjellmark discovered a new artefact. It is best described as a flint blade segment with blunted lateral edges. Due to its shape, Kjellmark named the tool 'ruler', and he believed that it was used for retouching flints. The rulers were found in stray-find assemblages in Småland, southern Sweden. The discovery was hardly noticed by contemporary archaeologists and the tool has been neglected for half a century. Undisturbed finds of Mesolithic rulers have been made over recent years. Thus Kjellmark's find material was examined and re-interpreted. New finds were also made in museum collections. Through a technological/contextual perspective – combined with micro-wear studies, experimental archaeology and refitting – the authors propose that rulers played a significant role in bone and antler craft during the Middle Mesolithic. From a theoretical standpoint, the paper examines the importance of continuous re-evaluation and re-categorization of 'well-known' prehistoric technologies.

Keywords: use-wear analysis, Mesolithic, flint technology, southern Sweden, slotted bone point, Cambrian flint.

Introduction

The early 20th century was a relatively flourishing period for Swedish Mesolithic archaeology. One of the most skilled field archaeologists was Knut Kjellmark (1866–1944), and during the 1920–30s he worked as a school inspector in the province of Småland in southern Sweden (Figure 117.1), recruiting primary-school children to help map and survey their own neighbourhoods for Stone Age sites (Bagge 1944, 239). At the annual inspections, he collected the finds of the children, to great effect. Kjellmark mapped several new sites, especially along the Mörrum River, and its lake system, and these were summarized in an article, in 1944, some months after his death (Kjellmark 1944).

The surveys revealed a large quantity of flint artefacts, among which Kjellmark discerned some 'new' tool types. Many of them were given odd names, none of them in common use today. Even though his typology and ideas were not fully accepted, he had a detailed knowledge of flint tools. One of his peculiar tools was the 'linjal' (Swedish for 'ruler'), a blade segment with blunted edges and resembling an old-fashioned school ruler with rounded edges. At first Kjellmark (1924, 96 f.) thought that the rulers were used for retouching microliths and that the edges were deliberately polished, but he later abandoned this theory (Bagge and Kjellmark 1940, 90).

During excavations of the Mesolithic sites at the Ageröd-Rönneholm Bog in Scania in the late 1940s, Carl-Axel Althin found several rulers. In his summary of Stone Age Scania he refrained from using the term 'linjal' opting, rather, for 'blades with edges polished by use' (Althin 1954, 96 ff.). Since that time rulers have attracted very little attention, but recently new examples have been found at excavations of Middle Mesolithic sites in the area of Lake Ringsjön, close to the Ageröd Bog (Sjöström 1997; Sjöström 2004). These finds coincided with yet another excavation research project in Småland (Nilsson 2003), and a renewed interest in rulers has arisen. This led us to re-examine the old finds made by Kjellmark and Althin, as well as previously unknown examples of rulers in museum collections: not all of the old rulers inventoried were actually located. In addition, a skilled amateur archaeologist, Leif Arvidsson, made contact with us. During his extensive surveys in the area around Lake Hornborgasjön (Västergötland), he had discovered the largest assemblage of rulers known so far.

So far, more than 300 rulers have been found, distributed over 69 sites. A low magnification microscope was used to examine use wear. To understand the prehistoric application of rulers, we manufactured experimental examples and tested them, primarily, in connection with bone handicraft.

Our examinations show that rulers were blades deliberately polished at the edges. The items were used like burins to produce slots in bone tools, for example slotted

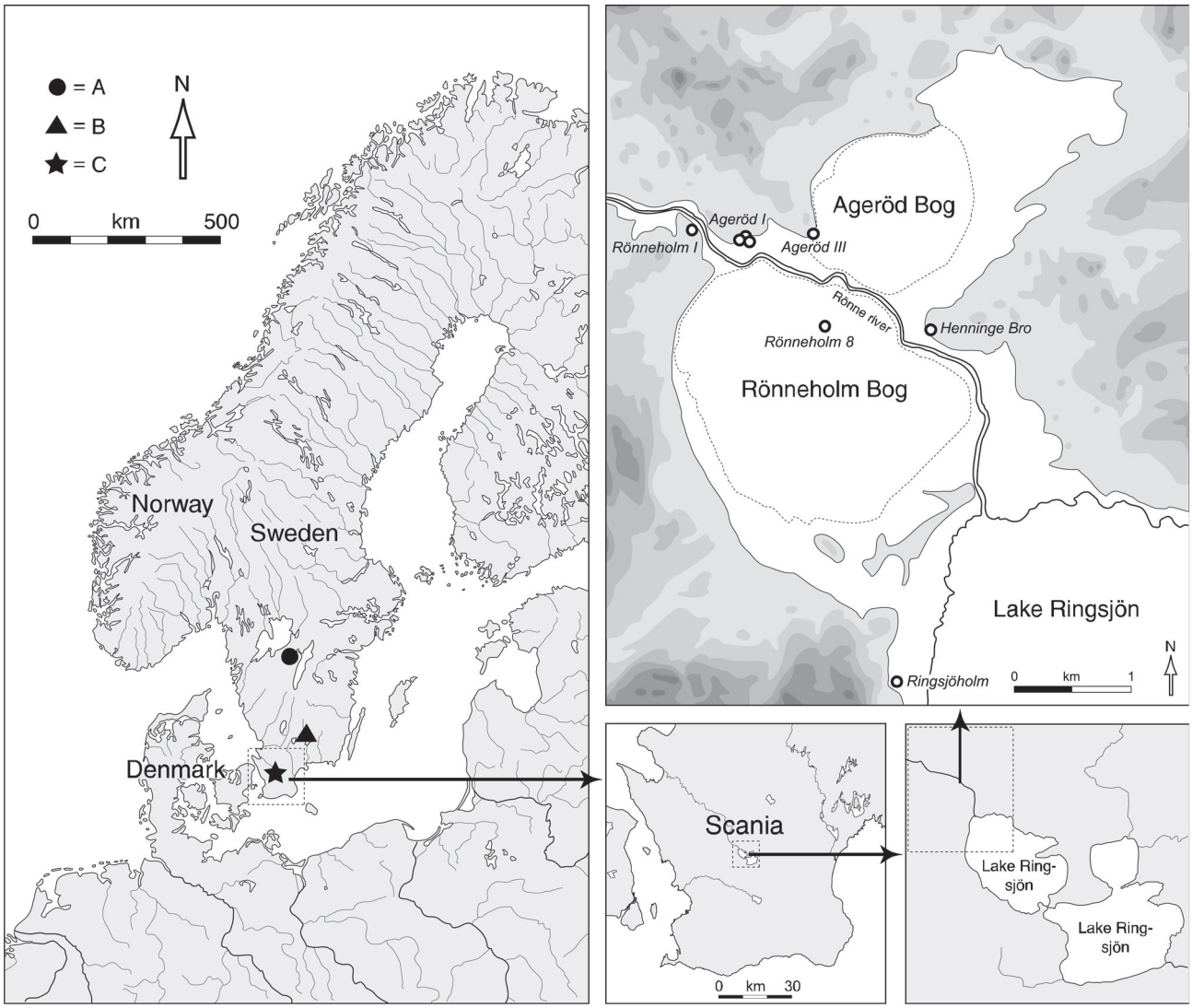

Figure 117.1. Maps of Scandinavia and find areas in southern Sweden. A: Västergötland; B: Småland; C: Scania, and sites with rulers in the Lake Ringsjö area. The white area north-west of Lake Ringsjön, on the enlarged map, shows the extent of the lake in the early Postglacial period. Elevation on enlarged map: 5m.

bone-points. The polished blade was sharpened and re-sharpened by breaking off several segments of the worn out distal part (cf. the principle of a modern segmented box-cutting knife).

Distribution and dating

All rulers, with the exception of one example from Scania, were found in the interior of southern Sweden. In total, we have examined 297 rulers found in the provinces of Scania, Småland and Västergötland (Figure 117.1).

The northernmost region where rulers have been found is in the province of Västergötland. The 171 rulers from this area are all surface finds. They were collected by Leif Arvidsson at 50 chronologically mixed sites, along the shorelines of lakes Hornborgasjön, Östen, Vristulven, and Lången, and also by the River Tidan. The rulers occur mostly at sites with Mesolithic artefacts. No more precise dating can be made.

In Småland the find circumstances are very similar to those for Västergötland. 36 rulers were found at 11 mixed sites along the lake system of Mörrum River – from Hönshyltefjorden in the south, to lake Helgasjön in the north. Kjellmark also found one ruler during his excavations at the Draftinge site, located approximately 150km north-west of Hönshyltefjorden. This site is situated between Lake Bolmen and the River Nissan catchment area (Kjellmark 1924, 29). Although rulers in Småland are found at mixed Stone Age sites, a Mesolithic dating seems most probable.

In Scania 92 rulers have been found at 10 sites in the Lake Ringsjö area (Figure 117.1). The north-western shallow part of the lake reformed to a peat bog during the Mesolithic. Today the area consists of the Ageröd and Rönneholm bogs. During the Middle Mesolithic the shallow lake was very attractive for settlement, and is rich in finds from this period. In the late 1940s, Althin (1954) excavated several Mesolithic sites in the area. In total 29

Figure 117.2. One unbroken ruler blade and five refitted rulers from Ringsjöholm (scale 1:1).

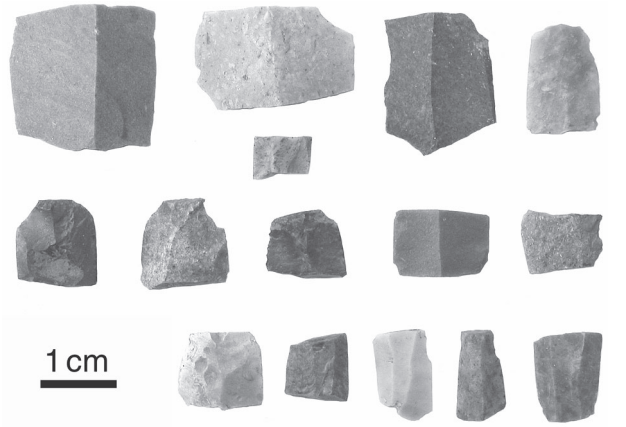

Figure 117.3. Ruler segments from the Östen 2, Västergötland (scale 1:1).

rulers were found at seven sites by the ancient shoreline. At the excavated sites of Henninge Bro and Rönneholm I rulers were found in mixed Mesolithic layers. At Ageröd I layers with rulers generally date to the Late Maglemose period, primarily with finds of narrow scalene triangle microliths of Sværdborg type and narrow trapezes. Early forms of broad trapeze microliths also help date the sites at Ageröd I to the earliest Kongemose period. Radiocarbon analyses at Ageröd I: B, I: D and I: HC, confirm the dating to the Late Maglemose (Larsson 1978). In the vicinity of the Ageröd sites, at Bollamöllan, eight more rulers were found in the early 20th century by an amateur archaeologist, Carl Stadler.

More than half of the Scanian rulers were found during excavations at the Ringsjöholm site between 1994 and 1997 (Sjöström 1997). The site is located on a 250m long, 10–20m broad, sandy spit by the ancient western shore of Lake Ringsjön. Thick cultural layers cover the narrow peninsular and vast refuse layers have been deposited along the two sides. In total 56 rulers were found on the peninsula surface, of which no more than 41 were found in connection with a hut floor layer. Of these, 25 rulers could be refitted to major parts of five blades; one unbroken ruler blade was also found at the site (Figure 117.2). According to the microliths and 13 radiocarbon datings, ranging from 7910±110 BP (7100–6500 cal BC; LuA-4260) to 7150±90 BP (6220–5840 cal BC; Lu-4023), the main occupation phase at Ringsjöholm can be dated to the Maglemose-Kongemose transition. The hut floor layer itself has not been radiocarbon dated, but one radiocarbon date from a hut posthole, gave the age 7750±120 BP (7050–6400 cal BC; LuA-4259). The microliths in the lowermost part of the hut floor layer – where most of the rulers were found – are dominated by scalene triangles of Sværdborg type and narrow trapezes. Only a few broad microliths of early trapeze type were found in the layer, indicating that the rulers from the hut could be dated to the very latest part of the Maglemose period. (All calibrated dates have been obtained using OxCal v. 3.10 (Bronk Ramsey 2005) and Reimer *et al.* 2004 for the calibration curve.)

One ruler find was made during excavation of the Mesolithic site complex in the Rönneholm Bog in 1997–1998 (Sjöström 2004). The sites, which can generally be dated to the Middle Mesolithic, were situated in the middle of the reforming lake, south of the Ageröd site complex. The ruler was found at Rönneholm 8, a 12 × 6m flint concentration, with a central hearth, interpreted as a habitation area. The four radiocarbon datings – ranging from 7075±100 BP (6210–5730 cal BC; LuA-4917) to 6690±100 BP (5790–5470 cal BC; LuA-4916) – and finds of rhombic microliths of the Villingebæk type all date the main occupation to the Middle Kongemose period. However there are indications of Late Maglemose occupation at the site, indicated by a few fragmented narrow microliths.

Description, production and application

The 297 rulers examined consist of 73 proximal parts (shorter and longer segments with bulb and butt), 206 medial, and 12 distal blade segments. Six rulers cannot be entirely metrically analysed due to damage. The rulers are primarily made of south Scandinavian flint, but in Västergötland they also used Cambrian flint (65.5%). Both blades and micro blades (blades < 10mm in width) of this flint type were utilized for ruler production (Figure 117.3). A higher quality of Cambrian flint was preferred for narrow micro blades. In Västergötland only 8.5% of the micro blade rulers are made of south Scandinavian flint, compared to 50% of the blades. Micro blade rulers have not been found in Småland and Scania.

The fact that distal parts are limited, compared to proximal parts, is not only due to the possibility that the blade tips were broken off before the polishing process started, but also that they can be hard to distinguish among the find material. When looking for rulers we have mainly focused on rectangular blade segments: short distal parts

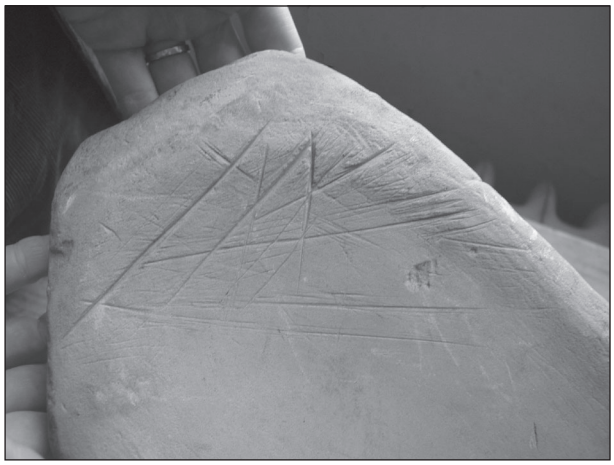

Figure 117.4. Grooved polishing stone, found at Ageröd I: D.

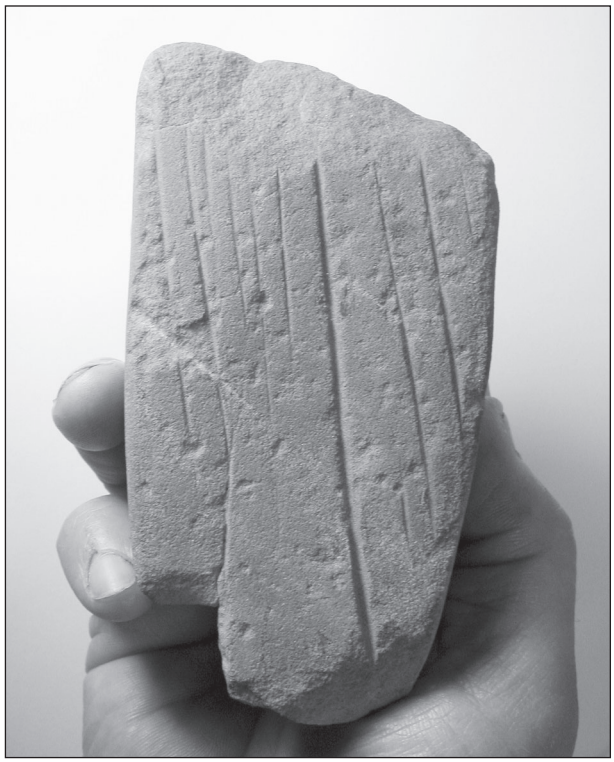

Figure 117.5. Grooved polishing stone, found at Östen 1, Västergötland.

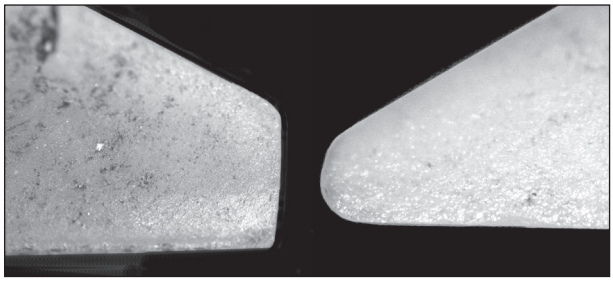

Figure 117.6. Profiles of transversal breaks on rulers from Ringsjöholm. The straight edge was polished on a flat surface and the rounded edge in a groove. The left ruler is the same as in Figure 7 (scale 16:1).

have been more or less neglected. Additionally, they were not always polished along the whole length of the edge.

The blades selected for ruler production were symmetrical and had straight longitudinal profiles (curvature) and even edges. The maximal width of the examined rulers is 21.3mm, the mean 12.1mm, and the minimum width 5.5mm. When both edges of the blades have been polished, the original blade width is decreased by *c*. 0.5–1.0mm.

Before the polishing process began the blade tip was often broken off. This is not only indicated by the small number of polished distal segments, but also by the fact that some medial segments have polished corners on one of the transversal breaks. This is evident on the longest refitted ruler from Ringsjöholm, where the segment has this type of polish on the outermost break (Figure 117.2). The blade tip was probably broken off, because of its curved profile, thus facilitating polishing on grooved stones.

Grooved polishing stones occur in the same contexts as rulers; two polishing stones with grooves have been found from the Ageröd sites. A characteristic example is a large (42 × 23 × 6cm) sandstone from Ageröd I: D. It has a flat polished surface and 20 shallow grooves concentrated on the edge of the stone (Figure 117.4). The most distinctive grooves are *c*. 0.5–1.0mm deep and some have profiles with a leaning V-shape, most likely made with a flint blade. Larsson (1978, 129) suggested that the grooves on this polishing stone were caused by polishing pointed bone tools. Our experiments with bone tools show that this is not probable. By Lake Östen (Västergötland), amateur archaeologist Leif Arvidsson also found a small polishing stone with grooves (Figure 117.5). It has flat polished surfaces on three sides and 11 grooves, of which the longest is 90mm, 2mm deep, and V-shaped in profile. At the Ringsjöholm site three small polishing stones with grooves have been found: two were located in connection with the hut floor layer.

Some rulers have retouch on their edges, which apparently were made prior to the polishing. It is possible that these blades had some other function before they were transformed into rulers, e.g. knives. They could also have been deliberately retouched before polishing, in order to facilitate and speed up the polishing process. If the edges were not completely straight, and having a wavy shape, it was necessary to remove the convex parts so that the whole edge came in contact with the stone and was thus evenly polished. The best way to carry out the retouching is to alternately press and drag the blade against an even stone surface, in order to remove the brittle convex parts of the edge: a ruler with an uneven and partially polished edge is less effective.

Our experiments show that it is possible to see if rulers were polished in grooves or not. If polished on a plane surface the edge profile becomes flat or faceted, and thus the polishing striations on the edge are not completely parallel to the length axis of the blade (Figures 117.6 and 117.7). If

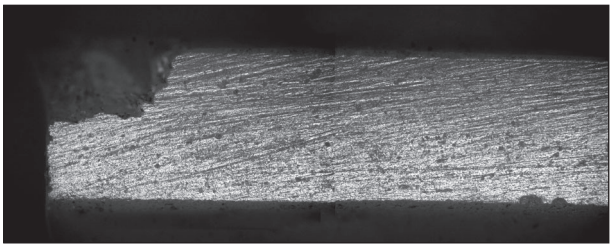

Figure 117.7. Polishing striations on a flat edge. The same ruler as in Figure 117.6, left (scale 16:1).

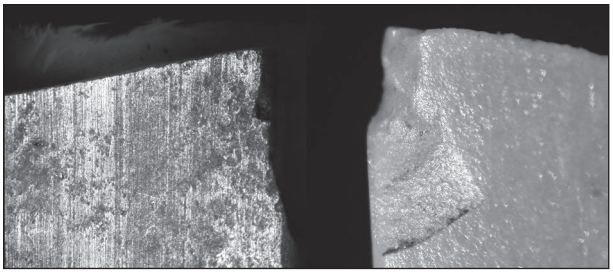

Figure 117.8. Corner damage on two rulers from Ringsjöholm. View from the dorsal and ventral side. Note the striations on the one to the left: the result of polishing in a groove (scale 15:1).

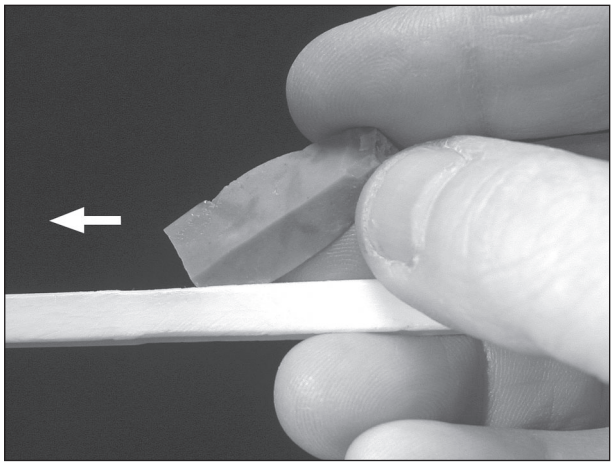

Figure 117.9. Production of a slotted bone point using the proximal part of a ruler. The arrow shows the direction of movement. The fingers are not shown in a working position.

Figure 117.10. Production of a slotted bone point. Notice the V-shaped slot profile.

polished in a groove, the striations run completely parallel to the length axis and the edge profile becomes rounded (Figure 117.6); the edge becomes smoother in a groove. Furthermore striations can occasionally be noticed on the dorsal and ventral side of the blade, a result of contact with the sides of the groove during polish (Figure 117.8). The width of this striated area shows that the grooves could be as deep as 4mm. Because of the length of the blade, and the degree of polish wanted, the process can take between 5 to 15 minutes, if both edges are treated. Polishing on a flat surface is faster and more effective, since the pressure is concentrated on the sheer edge and the blade can be moved in different angles; the striations on one ruler show that it was held perpendicular to the direction of movement when polished.

In some cases it is difficult to distinguish the polishing method used on rulers made of Cambrian flint, primarily due to the quality of the raw material. The majority of the flint rulers were polished in grooves, but the two methods could have been combined. Cortex is visible on the lateral edges of eight rulers. Of these, only three have polished edges on the cortex side. As well as the examples with cortex, a further seven rulers were polished on only one edge. They all originate from Västergötland and are made of Cambrian flint. A characteristic of these unpolished edges is that they have a very blunt edge angle, and impossible to use for slot production. Only one ruler with a blunt edge angle had been polished.

When the blade polishing was complete the distal part was removed, if not already done so in advance. The ruler, with its fresh transversal break, its corners and polished edges, was a perfect tool for making slots in bone, similar to a blade burin. It was probably held directly in the hand, since the precision and handling is better without a shaft. Uncontrolled force increases the risk of breaking or damaging the corners. Our experiments show that the ruler was pulled or pushed in the slot at an optimal angle of *c*. 35 degrees between the longitudinal axis of the ruler and the worked object (Figures 117.9 and 117.10).

Many rulers have use wear and damage on the corners of the transversal break, indicating the direction of force when used (Figure 117.8). If the edge at the transversal break was worn it could easily be temporarily sharpened by pressing the corner against bone or stone. In most cases this technique results in slightly jagged, occasionally burin-like, corners. Following this the ruler can be used again.

When both edges and the corners at the transversal break were totally worn out the ruler was sharpened by breaking off a segment of the distal part: a principle similar to that of a modern segmented box-cutting knife. This is easily done by holding the distal tip of the ruler blade in a firm grip, pressing with a bone against the edge on a flat stone

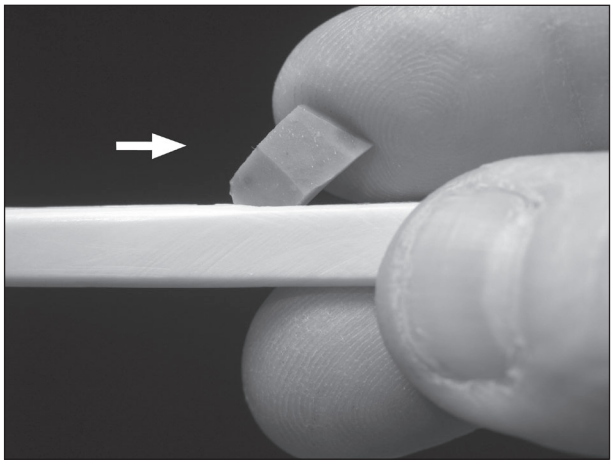

Figure 117.11. Utilization of a medial segment. The fingers are not shown in a working position.

with one hand, and then snapping it off by using a firm and powerful motion with the other. The limited width of the rulers can partly be explained by this breaking method. If they were wider, and thus often thicker, controlled breaking would have been much more difficult as it would have required too much force. Interestingly, the choice of narrow, easily breakable blades is obvious; wider blades with the same edge angles as rulers have been found at the sites. The broken off segment was discarded, or the new, opposite break used. If the ruler segment was large enough, it could be held between two fingers and used in the same way as the ruler blade (Figure 117.11). At first glance the segments seem too small to handle in this way, but they work perfectly as they do not require so much force. Damages and use wear on both the transversal breaks on several medial segments show that they were used in this way. The mean length of the medial segments is only 11.4mm, and they are more or less quadrilateral in shape.

The proximal parts are often longer, with a mean length of 17.6mm. This is probably not only because they were used as handles – and thus as end products themselves – but also because shorter ruler blades are more difficult to break in a controlled way, as the lever action is reduced. The mean length of the proximal parts at the Ringsjö area sites is twice that found at Småland and Västergötland: this has most likely to do with differences in technical tradition, where flint material was more economically used.

Interpretation and conclusions

The ruler is a sophisticated type of burin, whereby edge polishing was a controlled method of making the burin 'edge'. Compared to the common burin manufacture method, using a blow with a stone, the specialized polishing and breaking technique was more efficient and economical: one ruler blade can easily produce 28 burin edges, as every corner can be used (Figure 117.2).

The most probable use hypothesis is that they were tools for the production of slotted bone points and daggers. Accordingly, several of the slotted bone tools found at the Ringsjö sites have slots with a V-shaped cross section. It is also possible, of course, to make slots using an unpolished flint blade, and a transversal breaking method could also have been employed; nevertheless, unpolished blades are not that effective, as the sharp corners easily break, and sometimes even stick in the slot, making further work difficult.

Excavations in the Ringsjö area show that rulers can be dated to Late Maglemose and Early Kongemose period: it is most likely that rulers in Småland and Västergötland are contemporaneous. In this sense rulers, as well as polishing stones, can be used as diagnostic artefacts for the Middle Mesolithic. Furthermore, rulers indirectly indicate the manufacture and use of slotted bone tools. This is of great importance for the archaeology of Småland, where, for example, bone and antler artefacts are most rarely discovered.

The spatial distribution of rulers is also interesting, with the inland focus quite evident. The reasons why rulers, hitherto, are only found at inland sites are manifold. First, we lack coverage of further find material examination: there are probably more rulers in museums and collections. They are fairly hard to distinguish until you learn to 'see' them; this applies equally to those used to deal with flint professionally. It comes as no surprise that many of the rulers are found (and noticed as something extraordinary) by amateur archaeologists. It is well accepted that we – professional archaeologists – always know what to look for, thus limiting our scope. Second, it is most probable that the technique of making rulers was limited, or concentrated in areas where flint supplies were restricted. In addition to this economic factor, rulers should be regarded as a 'regionalization' of material culture. It is most probable that the 'ruler period' was quite limited, perhaps to only a few hundred years: those using the technique surely had tight bonds. Interestingly, ruler distribution does not coincide with the archaeological geography. They are spread over at least three areas, which, in archaeological terms, are often described as quite distinct.

The story of 'ruler research' is both interesting and educating. It tells that, on the one hand, archaeology knows little about prehistory, yet it does have the ability to get close to past activities. It tells that, no matter how well known a site is, very basic archaeological data can still be revealing. Most of the rulers known were found by one amateur archaeologist from Västergötland, and a group of school children from Småland in the 1920s. And in such ways can external interests develop archaeology. Ultimately it all is a question of finding new material patterns: sometimes the best method is simply to change perspective and see through the eyes of others.

Acknowledgements

We wish to thank Leif Arvidsson, Skövde, for providing us with valuable information and placing the Västergötland rulers at our disposal, and also Deborah Olausson for her valuable comments on this article.

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