A Wasted Effort at the Quarry: Wear Analysis and Interpretation of an MSA Lanceolate Point from Taramsa-8, Egypt

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ABSTRACT

The results of a wear analysis on a broken lanceolate point from an early Upper Pleistocene workshop site at Taramsa 8 (Upper Egypt) are presented. The point was found in the fill of a chert exploitation pit, in association with its shaping flakes. Our analysis leads to the conclusion that this item was hafted before it received its final shaping. At this stage in its production sequence, the point was accidentally fractured at the edge of the hafting arrangement and was, consequently, never used. This single activity event provides evidence for the inclusion of composite tool production in the *chaîne opératoire* at early Nubian Complex workshops. Some larger implications, such as the evolution of socio-economic organization and behavioral complexity during the Middle Stone Age of Northeast Africa, are discussed.

INTRODUCTION

Raw material quarries and workshops for blank production are abundantly documented in the Middle Paleolithic archaeological record of the Lower Nile Valley (Chmielewski 1968; Vermeersch 2002; Wendorf and Schild 1992). This is due to the ubiquitous availability of quality raw materials, such as chert and sandstone, in river terrace deposits or on inselbergs, which have endless exposures in the present landscape. Absolute age estimates are available only for a few sites (Vermeersch et al. 1998) and they fall in the later part of the early Upper Pleistocene.

The lithic assemblages from these late Middle Paleolithic workshops mostly belong to the Nubian Complex, a Northeast African industrial unit characterized by the abundant use of Nubian Levallois methods for points (Guichard and Guichard 1968; Van Peer 1992). While formal tools at the workshops are extremely rare, as they were probably exported, it would seem that such blanks often were used to make various retouched point types. At the site of Taramsa-1, near Qena in Upper Egypt, there is evidence for technological change in the Nubian Complex, involving the adaptation of the traditional Levallois concept to continuous blade production (Van Peer 1992). Most likely this process of change began in OIS4 and gave way to Upper Paleolithic-type industries. For these transitional assemblages, the name of Taramsan has been proposed (Vermeersch et al. 1997).

It has been argued that the workshops, and the activities carried out there, form part of a larger spatial *chaîne opératoire* in which planning and anticipation are involved and where behavioral complexity is evidenced (Van Peer 1998, 2001; McBrearty and Brooks 2000). Both the Nubian Complex and the Taramsan are archaeological reflections of a complex behavioral system with an efficient lithic economy based on anticipation, and operating on the principles of the division of labor and perhaps even craft specialization. While the capacity of laying out large, up to 2m deep extraction features creating semi-subterranean vertical exposures of chert pebble deposits is in itself an obvious indication of behavioral complexity, more support for this comes from spatial and technological analyses (Van Peer 2001).

Contra an intuitive expectation, a remarkable degree of spatial organization in raw material processing activities is observed. At workshops, with only the initial stage of a regional lithic *chaîne opératoire* or, in techno-economic terminology (Geneste et al. 1990), the 'acquisition stage' represented, little structure is expected—very basic activities only were carried out there. Indeed, we tend to think of the acquisition stage as a simple process that can be performed by one individual at one spot during a very limited period of time. Yet, in Sector 91/04 at Taramsa-1, for example, it was observed that this acquisition process is partitioned in a number of spatially distinct sub-stages. It was inferred

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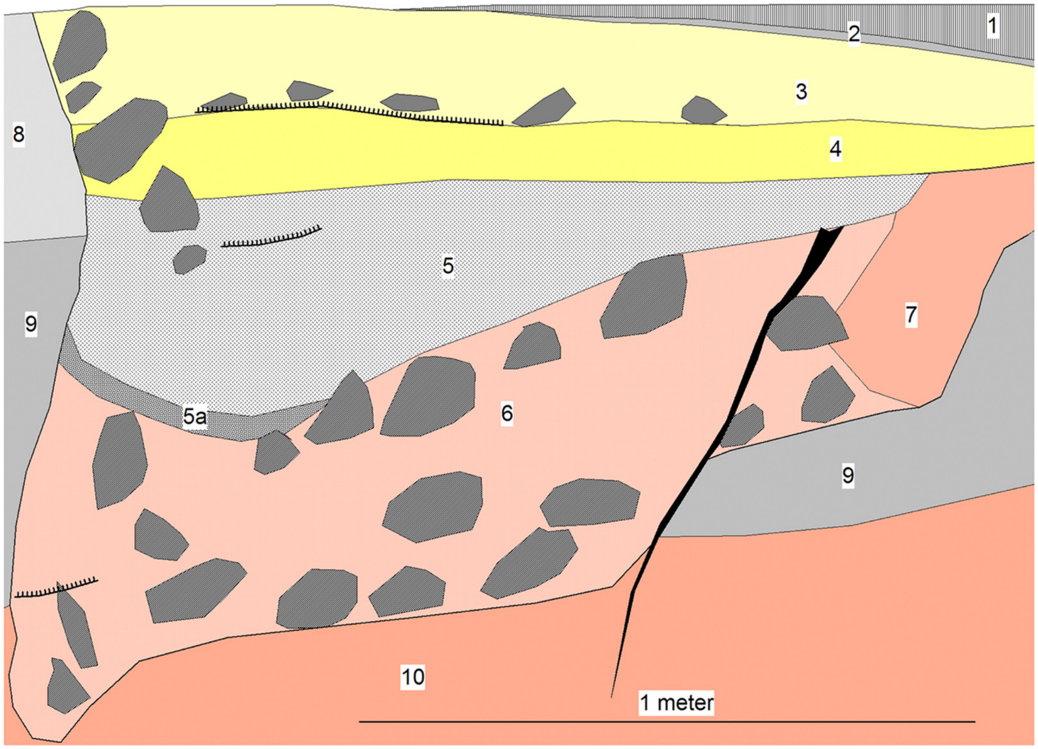

Figure 1. Section of the prehistoric extraction pit at Taramsa-8.

that a number of individuals co-operated in the performance of the acquisition and this led to the interpretation of a specific task group being present here (Van Peer 2001: 58). The latest evidence would even seem to suggest that specialist chert knappers were among this party (Van Peer 2007).

At Taramsa-1, it is clear that the Upper Pleistocene extraction pits and ditches were cut through older features, destroying them in the process. Up until now, no early workshop situation has been found in primary context here. In early 2003, a three-day preliminary excavation was carried out at the newly discovered site of Taramsa-8, situated on an isolated hill of similar appearance to Taramsa-1 and a few kilometers to the south of it. The presence of a strongly weathered desert pavement consisting of large chert blocks and artifacts including a few bifacial foliates, suggested that old, i.e., older than those at Taramsa-1, undisturbed contexts might be recovered. Test trenches in various areas of the hill confirmed that Paleolithic extraction features were indeed present.

In this paper, we present the wear analysis results on a broken lanceolate point found within one of these features. We furthermore discuss some possible implications of this item in its context, with reference to the socio-economic organization described above and to the emergence of behavioral complexity in the earlier Middle Paleolithic of northeast Africa.

CONTEXT OF TARAMSA-8

In a section at the eastern side of the hill, resulting from recent mechanical quarrying activities, an apparent prehistoric ditch was visible (Figures 1 and 2). Starting from this section, we set out to retrieve and excavate its horizontal extension. The lanceolate point, broken into two fragments lying some 20cm apart, was found in the top of coarse sands underneath 20cm of slope wash deposits, in association with its production flakes. Several of the latter were refitted onto the basal part of the point. Typologically, the upper level point is reminiscent of the bifacial foliates that are present in early Nubian Complex assemblages such as those from Bir Tarfawi (Wendorf et al. 1993). At the same time, a vertical excavation of the section was performed. At the base of the fill deposits of the prehistoric ditch, another lanceolate fragment and a bifacial axe with a wide bit, somewhat reminiscent of a core-axe, were found. The lanceolate fragment represents the distal part only and it fractured during initial shaping. The fracture was initiated from the central dorsal ridge on one face and it terminates on the opposite face in a distinct feather. Fine regular retouch that "smooths" the edges is absent.

The presence of artifacts in various stratigraphic positions demonstrates that the mining activities at this spot were intermittent, but probably within a rather restricted period of time. The physical appearance of the uppermost artifacts, in absolutely fresh condition but showing a deep reddish-yellow patina, indicates that they are likely to be of Middle Pleistocene or early Upper Pleistocene age. At nearby Taramsa-1, later Pleistocene artifacts never show any patination at all. On the contrary, those recovered from reworked, secondary contexts such as at Sector 91/06 have

Figure 2. View of the upper portion of the infilling of the extraction ditch, containing artifacts.

precisely the same yellowish patina (Van Peer 2007). Seemingly, its development is related to pedogenetic processes occurring during OIS5 humid conditions.

DESCRIPTION OF WEAR ANALYSIS

ANALYTICAL METHOD

A macroscopic low and high power wear analysis were combined. For low power analysis, a stereoscopic microscope Wild (M5-22827, magnifications 6x–100x) was used according to the principles set out by Tringham et al. (1974) and further elaborated by Odell (1977, 1981). We focused on tool damage mainly, but other kinds of wear- like polish, rounding and striations were examined as well. For high power analysis, tools were analyzed with a metallurgical microscope Olympus BX60M (magnifications 50x–500x), using bright field illumination, according to Keeley (1980). Polish, rounding, striations, and scarring were examined. Polish refers to an altered zone on a stone tool that is visible as a shinier or rougher area in comparison with the surrounding surface. Striations are linear features that occur on a flint surface (Mansur-Franchomme 1986). Rounding refers to the abrasion or dulling of an edge. Generally the most prominent points are preferentially affected. Damage is used as a synonym of scarring or microchipping and refers to the small stone particles that are removed from the edge due to a given cause (e.g., Odell 1981). The relative importance of these kinds of wear and their exact location and pattern over a stone tool allow the interpretation of their cause. Sufficient reference data for the identification and interpretation of production (Rots 2002a), use (e.g., Keeley 1980), and prehensile wear, referring to both hand-held and hafted use (Rots 2002a, 2002b, 2003a, 2003b, 2004, 2008; Rots et al. 2001, 2006), were available from previous studies. In short, production wear is always associated with a technological feature (i.e., butt, bulb, retouch). Use-wear is concentrated in a particular part of the stone tool and generally several kinds of trace types (i.e., polish, damage, rounding, striations) are associated. A use polish has a clear impact on the edge and a directional aspect. Prehension wear consists mainly of polish. The material worked determines the kind and intensity of the prehension polish formed. Hafting wear always shows a distinct patterning over the stone tool, generally in the zone opposite the working edge. A limit between the used and hafted tool portion can be identified based on, amongst others things, the start of a distinctively different polish or scarring, or the occurrence of isolated well-developed polish spots, so-called "*bright spots*" (often in association with scars: Rots 2002b). Polish and scarring form the most significant kinds of wear for identifying hafting. For more detailed indications about how prehension and hafting wear can be distinguished, refer to Rots (2004). For more comprehensive data about how prehensile wear can be distinguished from all other wear on a stone tool, refer to Rots (2002a, 2002b, 2003a).

During the microwear analysis, the tool was cleaned with alcohol in order to remove remains of grit, grease, or plasticine (used to fix the tool under the microscope). The analysis focused on potential wear from each stage of the *chaîne opératoire* of the tool, including production, resharpening, use, hafting, and de-hafting. Interpretations of prehensile wear relied on a reference set of about 400 experimental tools that was created during a large-scale systematic investigation of hafting traces. This reference set allows the differentiation of prehensile wear, i.e., the distinction between wear resulting from hand-held, wrapped, and hafted use (Rots 2002a, 2004).

DESCRIPTION AND INTERPRETATION

Based on the observed macro- and microscopic wear evidence, the lanceolate point (maximum length 148mm, maximum width 51mm, maximum thickness 16mm) is interpreted as a piece that fractured during final shaping of the distal tip while the piece was hafted. The evidence that forms the basis of this interpretation is presented in detail below (Figure 3). For clarity, the macro- and microscopic wear is dealt with separately even though both should be viewed in combination.

MACROSCOPIC WEAR EVIDENCE

The medial fracture

The fracture is initiated from a dorsal ridge formed by one of the largest removals on the upper face of the lanceolate point. It is the most prominent ridge on that face. The thickness of the piece at the fracture is 10mm, the width of the fracture plane is 38mm. The fracture initiation shows a clear impact point as a result of the significant pressure that caused it (Figure 4: arrow). The distinctive character of the initiation suggests that the fracture was produced as a result of contact with a hard material, following a particular sudden pressure. The fracture plane is slightly oblique, but

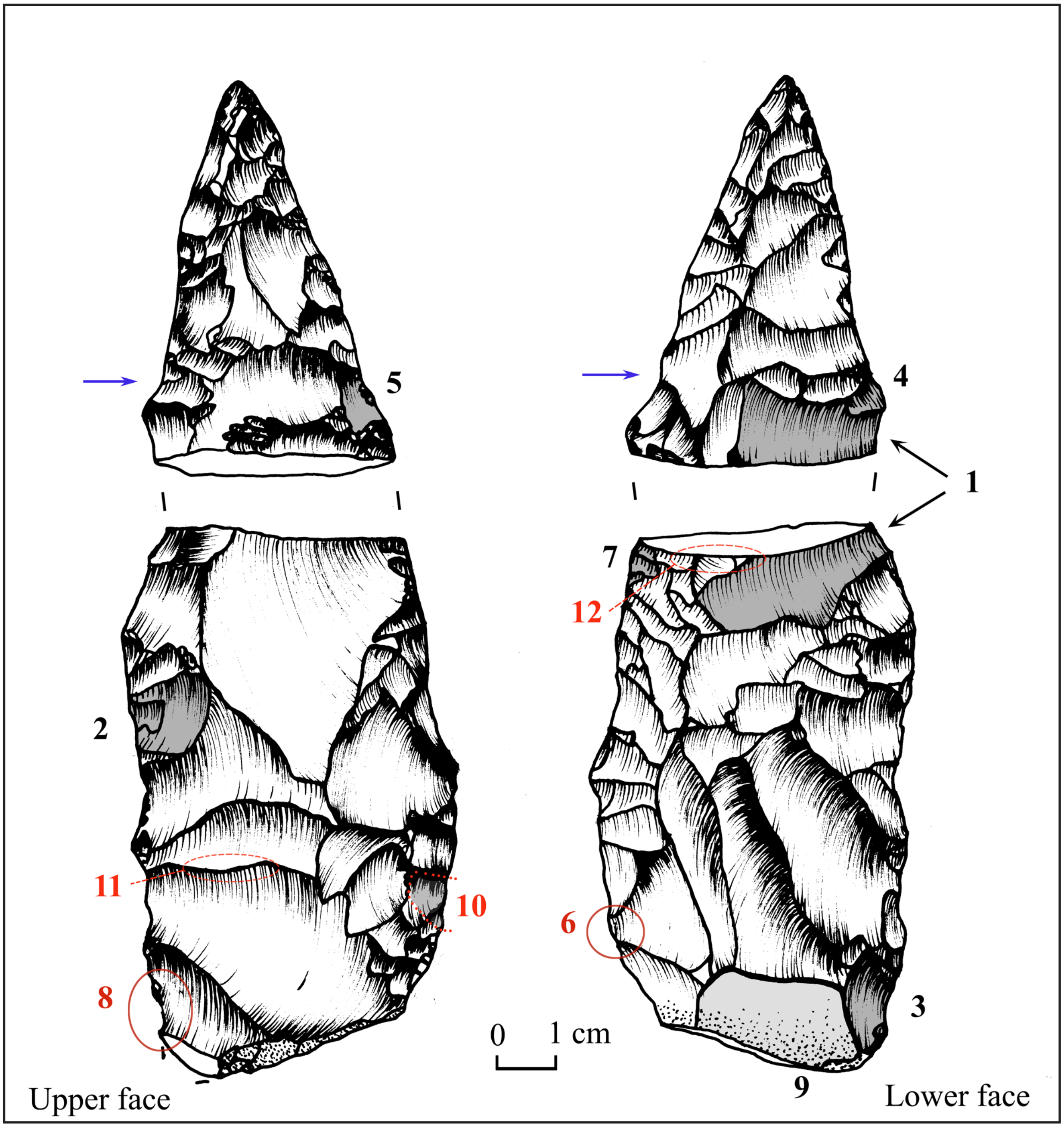

Figure 3. Drawing of the lanceolate point with references to the wear evidence.

Figure 4. Detail of fracture.

there is no true feather or hinge. Damage is associated with the fracture, in particular on the right edge (both faces). We argue that this fracture is a result of a final shaping while the tool was hafted, based on the macroscopic fracture characteristics, including its initiation, termination, and the associated damage that are typical for hafting-related fractures, and particularly based on the associated microscopic evidence (cf. *infra*).

If the macroscopic fracture characteristics are compared with a reference set of about 241 experimental tools that fractured following a variety of causes (production, retouch, hafted use, transport, trampling) resulting in a total of 262 fractures (Rots 2002a), the characteristics nicely conform to what is expected from a hafting-related fracture. The majority of fractures in the reference set are a result of knapping (about 64%). Knapping fractures tend to be located either on the most proximal extremity (38%) or on the distal extremity (59%). Retouch fractures are less frequent in the reference sample, and predominantly occur in the same areas as production fractures next to the medial zone (23%). Fractures in the medial zone are no exception when a tool is resharpened in its haft; this was observed experimentally as well as ethnographically in Ethiopia (Rots in press). In the experimental set, only a total of 33 fractures occurred in the medial zone (cf. Taramsa lanceolate point), 18 of which occurred during hafted use (four due to knapping, seven due to retouching). Of the 33 medial fractures, 17 are initiated from the most prominent ridge, 10 of which are due to hafting (three due to knapping, one due to retouching). In addition, only the hafting-related medial fractures proved to be associated with additional damage on the edges, similar to what is observed on the Taramsa lanceolate point (Rots 2002a).

Binding scar

On the left edge, an exceptional scar is associated with the fracture. The scar is 1.3cm wide at its initiation and the initiation is bent (see Figure 3: 1). The scar is large and has a three-part termination (Figure 5). Towards the proximal end, the scar closest to the edge is straight and has a step termination. This termination is closest to the scar initiation. The middle termination is feathered and more irregular in morphology. The distal termination is a very gentle step and slightly curved in morphology. The fracture of the piece occurred in-between the latter two terminations. The furthest scar termination point is at nearly 3cm from the scar initiation. The most important aspect of the scar on an interpretative level is its initiation.

A curved initiation such as this one only occurs in specific circumstances and it is never linked with pure production. The most common occurrence is as a result of hafting, even more specifically when bindings are used (Rots 2002a; Rots et al. 2001). In experimental conditions, scar morphologies similar to the one in question occur on at least 51% of the tools that are hafted with the aid of bindings, largely independent of the exact haft type or tool use (Rots 2002a). Factors that influence their formation are mainly the amount of protrusion from the haft and retouch coarseness, as these determine the type and intensity of the contact between a tool's edge and its bindings (Rots 2002a). Similar scar initiations occur in at least 60% of the experimental tools that are hafted with bindings (Rots 2002a). The scar size depends on the amount of pressure that is exerted on the tool. Depending on the impact force, scars can be very large (e.g., in adze or hoe use). In particular, the larger scars often occur on the boundary of the haft.

Secondly, such scars occur as a result of the hafting technique in which the stone tool is inserted into a hole of, for instance, an antler haft, with the condition that the tool was rotated during use (i.e., perforating or drilling). This implies that use-wear evidence needs to be present to support this use, which is not the case here.

Thirdly, such scars can be formed during retouching, but only in particular conditions. We observed them experimentally on burins only—they resulted from the contact against the hand at the moment of burin spall detachment (Rots 2002a). In such cases, these scars are on average small and usually more than one is present. As no impact from one of the extremities took place (i.e., no scars were detached from the ends), this cause cannot account for the

Figure 5. Binding scar.

formation of the scar in question.

Fourthly, scars slightly similar to the one discussed here can form during use. In that case, they may have a similar initiation, but they always terminate close to the edge. They are never extremely bent like this one. In addition, they never occur isolated, and they never cause this kind of isolated concavity in the tool's edge. There is no evidence at all that this tool has been used in a cutting motion.

This implies that there is only one possible cause to explain this bending scar— hafting. However, this does not imply that the tool was necessarily used. Hafting traces, in particular scars, can form during the hafting process itself as a result of the pressure exerted on the edge, e.g., during the attachment of bindings (Rots 2002a). Another possible moment of production is during shaping or resharpening. In such cases, the pressure on the edges is high and the resulting scar formation can be significant. The scars thus are formed by the counter-pressure against the hafting material at the moment of hammer impact. Resharpening for this lanceolate point can be excluded as there is no evidence at all of use and production flakes were recovered around the lanceolate during excavation. These production flakes refit to the lanceolate point in several areas, i.e., both proximal and distal. Therefore, the only option that remains is shaping.

In support of this, there are several additional arguments. Next to the absence of evidence of use and the associated microscopic evidence (cf. *infra*), the most important macroscopic argument is the totally different aspect of the distal extremity, in particular its upper face. Immediately beyond the bending scar, the distal zone suddenly narrows after which it gradually converges towards the point (see Figure 3: arrows). This morphology is a result of scar removals on both lateral edges of the upper face, which were struck from the lower face. This is important as it explains the initiation of the fracture (from the upper face onwards) and the initiation of the bending scar (also from the upper face onwards). We believe that both the fracture and the scar originated during the shaping of the distal part (that protruded from the haft) while the tool was hafted. If not, the exerted pressure could never have been sufficiently high enough to result in the observed wear. There is also additional hafting wear in support of this interpretation on the remaining proximal part (cf. *infra*).

There is even more relevant evidence concerning the strike that caused the fracture and possibly other hafting scarring. On the right edge, beyond the inferred limit of the haft, a wide hinge-terminating scar can be observed (see Figure 3: 5). The scar is short and deep and the termination is very abrupt. It superimposes all surrounding negative scars and it did not serve as a striking platform for the removal of other scars on the opposite face. The strike that produced the scar was clearly aimed at removing a larger and more superficial flake aligned with the others on the distal extremity. The counter-pressure that resulted from the sudden, early interruption of the scar may well explain the observed damage. In addition, there is some damage associated with this scar on the opposite face that also can be understood as damage due to counter-pressure when this scar detached. That the scar is due to production and not to another cause (e.g., hafting) is supported by its clear initiation, even concavity, and the initiation damage. Apparently, the final shaping of the point while hafted was a risky enterprise and ultimately led to failure.

One smaller and very superficial scar (see Figure 3: 4) is superimposed on the bending scar (see Figure 3: 1). It was produced by oblique pressure from the distal end. The distal-most binding is responsible, as it exerted a counter-pressure at the moment of the formation of the binding scar.

Additional hafting evidence

On the proximal part, there are a few other scars that resulted from hafting. The first is located on the same edge as the binding scar, but on the opposite face, about two centimeters towards the proximal end (see Figure 3: 2). It has a gently dipping initiation without real initiation damage. Such scars are atypical for retouch, but they regularly occur as a result of hafting. Its location on the opposite face of the other scar is not problematic as it may have resulted directly from the pressure that was exerted by the hammer on the distal part where several retouch scars were detached. Furthermore, the pressure exerted on the hafted edges at the moment of a fracture is complex and consists of one or more cycles of pressure – counter-pressure.

Another large and very distinct hafting scar is located on the proximal extremity of the same edge, on the same face as the binding scar (see Figure 3: 3). It has the curved initiation typical of the use of bindings and it terminates in a hinge. Part of this termination was removed by a post-depositional heat fracture (see Figure 3: 9). The termination of the scar is complex, atypical of retouch scars and it is split up into different parts. The complexity of hafting scar terminations is a result of their formation within the hafting arrangement, where the surrounding hafting material exerts a pressure that brings about their particular characteristics.

On the proximal right edge, a small hafting flake was initiated but did not detach (see Figure 3: 10). It remained attached with its distal part against the stone tool in an area where a ridge was formed due to several superimposed and abruptly terminating scars. The fact that this small flake did not detach after deposition supports the idea that the preservation conditions were good. Small microscopically visible scars that formed due to pressure and counter-pressure in the haft removed part of the flake's butt and dorsal platform edge. Several of these show a bent initiation, as is typical due to their contact with the binding. Other scars with similar characteristics were formed on the hafted edges, but they are smaller. Several of those are only microscopically visible under a binocular microscope.

Patina

Interestingly, the distal and proximal part of the lanceolate point show different patinations (Figure 6). In most areas, a reddish-yellow patina is present that is associated with a brown spot-like patina on the distal part and limited areas of the lower proximal face, in particular, the edges. The upper proximal face hardly shows any patination at all. In this particular area, some remains of a red residue are present on a ridge (see Figure 3: 11, compare with Figure 6). While the latter could represent an ochrous resin or something similar, such an interpretation requires more detailed chemical analysis. Nevertheless, it does suggest that the non-patinated area could represent an area on which hafting material such as some kind of adhesive remained, as a result of which it was protected against patination. In this light, it is interesting to note that parts of the proximal edges of the upper face do show the brown spotted patina in an area about one cm wide. This supports the interpretation based on the wear evidence that these edges protruded from the haft (cf. *infra*).

MICROSCOPIC WEAR EVIDENCE

In agreement with the macroscopic evidence, no microscopic signs of use were observed. The absence of use implies that little friction occurred within the hafting arrangement, which significantly reduces the chances of clear microscopic hafting wear being formed. Based on our experiments, we know that scarring as well as some polish may form during the hafting process itself (Rots 2002a). In the case of additional use friction the probability of wear formation increases. However, resharpening or further shaping also may cause sufficient friction for at least some wear to form.

The preservation condition of the lanceolate point at the microscopic level is good; only some minor surface modification took place in the form of a light, rough, and general polish. The latter does not impede the interpretation of the wear, particularly not when low power and high power data are combined and compared with the macroscopic evidence. Moreover, all types of wear, such as polish, scarring, striations, and rounding, are examined. In this regard, associations between different trace types are particularly interesting. For instance, it has been demonstrated that an

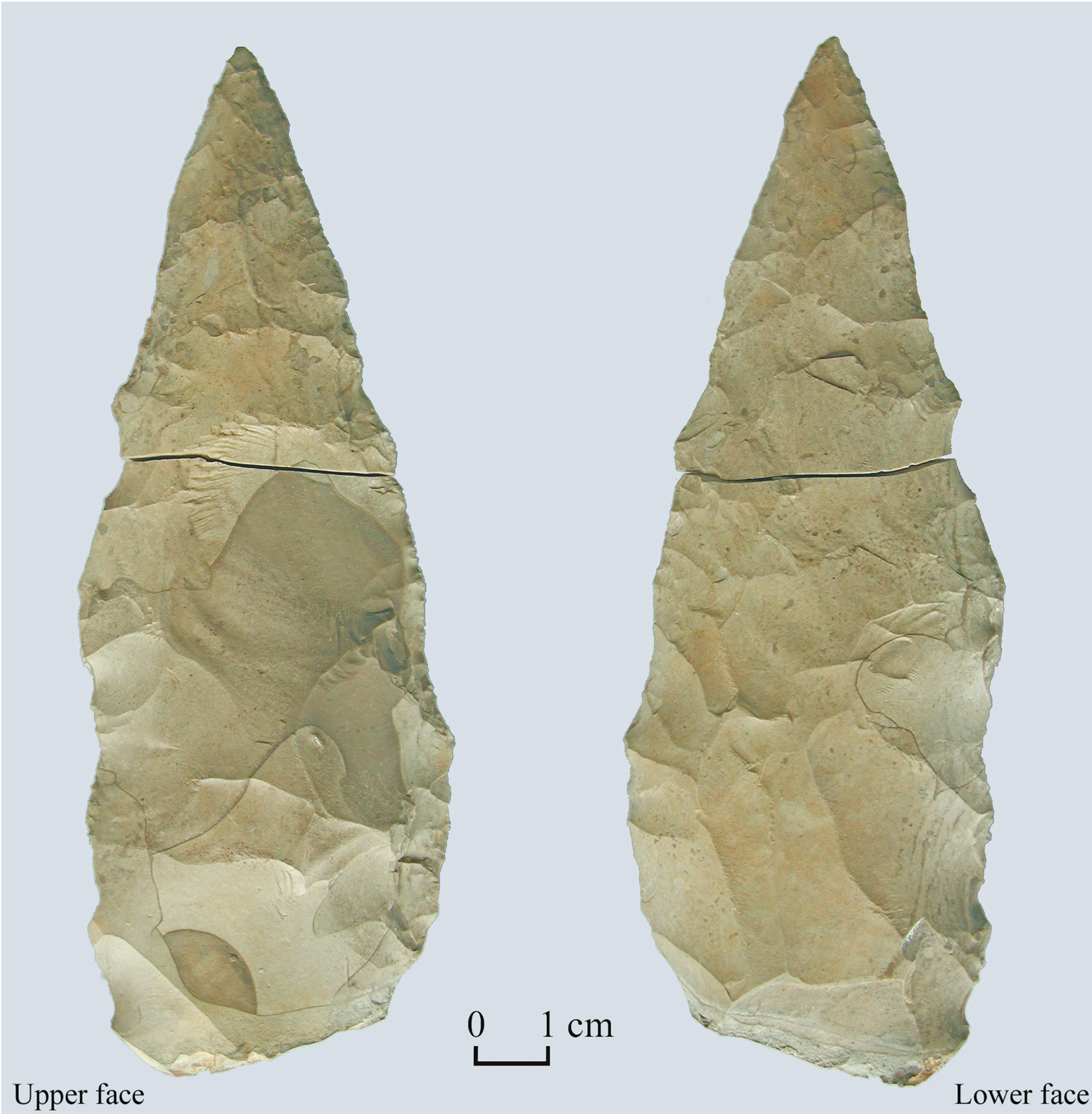

Figure 6. The complete specimen.

association between scarring and bright spots is indicative of hafting (Rots 2002b).

Distal part of the point

On the distal tip, there are no signs of use-wear. There is only a very light general polishing, slightly more intense on higher areas, which indicates its post-depositional nature. The polishing is continuous across any scarring, excluding the possibility that the latter are post-depositional.

Proximal part of the point

In contrast to the lack of signs of use, there is clear microscopic evidence of hafting. As the tool was not used, only little friction could occur within the hafting arrangement and, therefore, scars are the most prominent trace type. However some striations and bright spots (Rots 2002b) occur in an organized pattern.

On the edge of the fracture plane, exactly at the fracture's initiation point, a small, distinct and well-developed

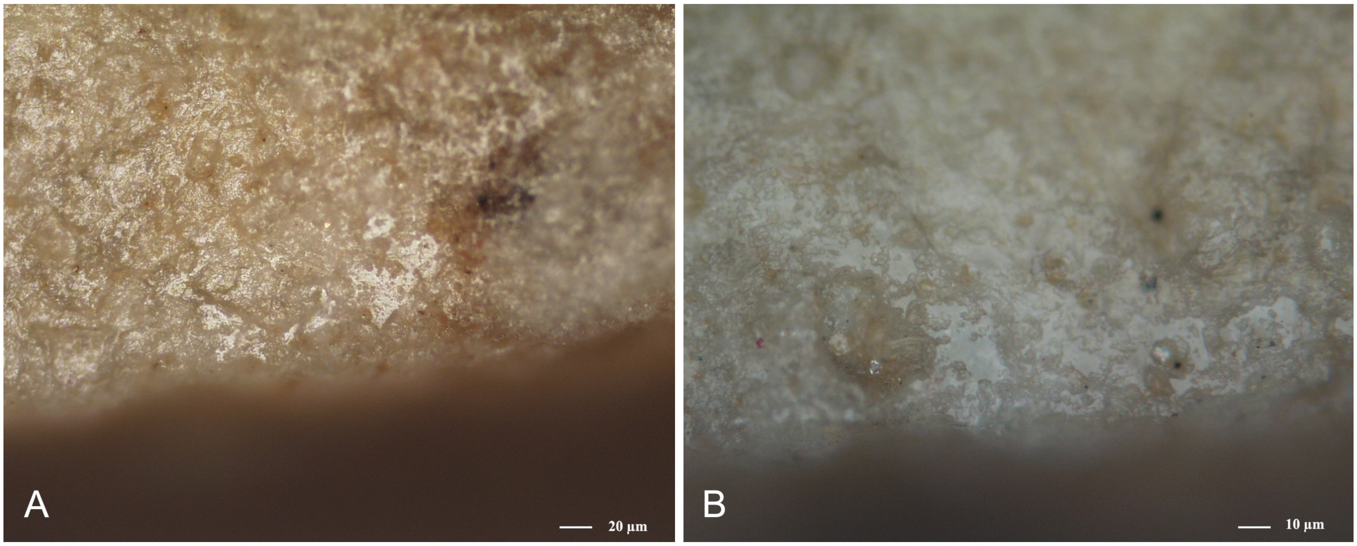

Figure 7. Detail of the polish spots around the termination of the fracture (left: 100x; right: 200x).

polish spot or bright spot is visible. It is due to an intense localized friction against a hard material, finally resulting in a fracture. Around the fracture's termination, well-developed bright spots are visible (Figure 7), as well as a fine, well-developed polish line on prominent parts of the same edge (see Figure 3: 12). The former may have partially formed during shaping in the haft, but most of these spots and, in particular, the polish line, were formed at the moment of the fracture as a result of the friction of the distal part against the fracture edge. These kinds of traces and trace distributions have been observed regularly on experimental tools when fractures occurred at the haft limit (Rots 2002a). On fractures that occur during the knapping process (i.e., of non-hafted implements), this association of a polish spot at the point of initiation and friction polish on the fracture edge, is never present. Even though minor friction occasionally may occur between the two tool pieces, a polish at the initiation point of the fracture never does.

On the large bending scar (see Figure 3: 1), a long striation is visible just before its termination in the axis of the scar. It consists of a rough groove with patches of intense polish spots. It is no doubt a striation that was formed as a result of an intense friction. Given that there are only two striations on the entire tool (cf. *infra*) and given its specific and organized location and orientation, a post-depositional origin can be excluded. The striation is no doubt a result of the friction of the detached flake with the tool. Due to the presence of a hafting material, the flake got stuck in between the latter and the tool itself, and caused an intense local friction.

On the right side of the lanceolate, close to the fracture, a series of small scars formed when the point broke (see Figure 3: 7). They were initiated under an oblique angle from a small protrusion and they show a minor curve at their initiation, which is typical for certain hafting scars. In addition, bright spots are associated with their termination, confirming that the detached chips caused an intense friction within the hafting arrangement.

On the proximal scar (see Figure 3: 3), an isolated bright spot is visible towards its termination that also can be attributed to an analogous localized friction on the scar.

On the left proximal edge (see Figure 3: 8), a second striation is visible. It is shorter than the one described earlier and it is slightly different in character. It appears as a rough groove within the concavity of the scar, with an oblique orientation on the tool's edge and with bright spots around it. These traces must be associated with the previously mentioned hafting scar on the opposite face (see Figure 3: 3). This association of microscopic wear on one face and a scar on the opposite face often recurred during our experiments (Rots 2002a). The pressure exerted on one face leaves wear traces on the latter while at the same time forming a scar on the opposite face.

On some ridges, isolated bright spots are visible. These cannot be attributed to post-depositional processes, as they are not randomly distributed all over the stone tool. Moreover, some of them are clearly associated with scars resulting from hafting as suggested by their morphology, initiation, termination, and distribution patterns.

It is important to stipulate that the microscopic hafting evidence described above could not have formed due to holding the tool in the hand, be it for use or for shaping purposes. The impact of the hand on a stone tool is quite well understood (Rots 2004) and even when the hand is gritty, it would never result in the trace pattern mentioned above. Striations and bright spots rarely form as a result of simply holding the tool in the hand (even when the grip is firm) and they never show this kind of organized pattern that is linked with scar formation. In contrast, scars and polish may form, but no traces were observed on the tool that could possibly be seen as due to hand contact.

RECONSTRUCTION OF THE HAFTING ARRANGEMENT

Even though the amount of hafting wear is quite low because of the limited friction between the lithic tool and the hafting material(s), an interpretation of the hafting arrangement is possible. Admittedly, the evidence is limited due to the absence of well-developed polishes and other wear for which tool use is a prerequisite for their formation.

As mentioned above, very characteristic scars with curved initiations form an important line of evidence in this regard. Based on our experiments, we know that such scars are a result of the contact with bindings (Rots 2002a, 2003a). Bindings exerting an obliquely directed pressure on a particular face, resulting in scars with a curve at the initiation on the other face (cf. *supra*). The presence of these scars in different zones of the proximal edges indicates that there was a contact between the stone tool's edges and the bindings, implying that the edges protruded at least minimally from the haft. Based on the patina distribution, it is suggested that the edges protruded up to 1cm in some areas (cf. *supra*). Given the converging edges, the limit of the haft represents the area where the haft width and lanceolate width are more or less comparable.

The occurrence of bright spots on the ridges is an indication of contact with a hard material. This is because a hard material contact results in a concentration of the pressure on the most prominent parts of the tool's surface and bright spots are likely to form in those zones. Given that the bright spots are present on both faces (but not on the edges), the haft was most likely split in nature. An insertion into a hole would prevent a contact between the edges and the bindings. As wood is the most likely candidate for the haft material, the tool would have been fixed within a split wooden haft with bindings.

COMPARATIVE EVIDENCE

Experimental evidence

In the descriptions above, we have frequently referred to experimental evidence used in guidance of the interpretation of the wear on the lanceolate point. Here, we offer a more systematic description of experimental prehensile wear tracess as documented on over 400 experimental tools (Rots 2002a).

The experimental reference consists of tools used barehanded, with a leather wrapping, or in a hafting arrangement. The latter included insertions into a hole or cleft of a handle, or mounting next to a handle with a fixing of, for instance, bindings. Hafting materials included wood, bone, antler, leather, etc. Worked materials included wood, bone, antler, plants, earth, hide, etc., and actions included adzing, chopping, chiseling, shooting, scraping, grooving, perforating, drilling, cutting, sawing, etc. The investigation also included a consideration of the role of other variables such as raw material types, retouch, morphology, etc.

This experimental work showed that both the process of mounting a tool in a haft and the friction in the haft during subsequent use, result in specific wear traces (Rots 2002a: 165). Use obviously is the main source of hafting wear; during the making of the composite tool, e.g., in the application of bindings, scars are the most prominent traces (Figure 8).

The importance of scarring for the identification of hafting is fortunate, as many lithic assemblages deposited under arid or semi-arid conditions have been affected by aeolian erosion, which hampers the investigation of polishes, rounding, and striations.

Several factors have an influence on the visibility of hafting damage and the formation of other trace types,

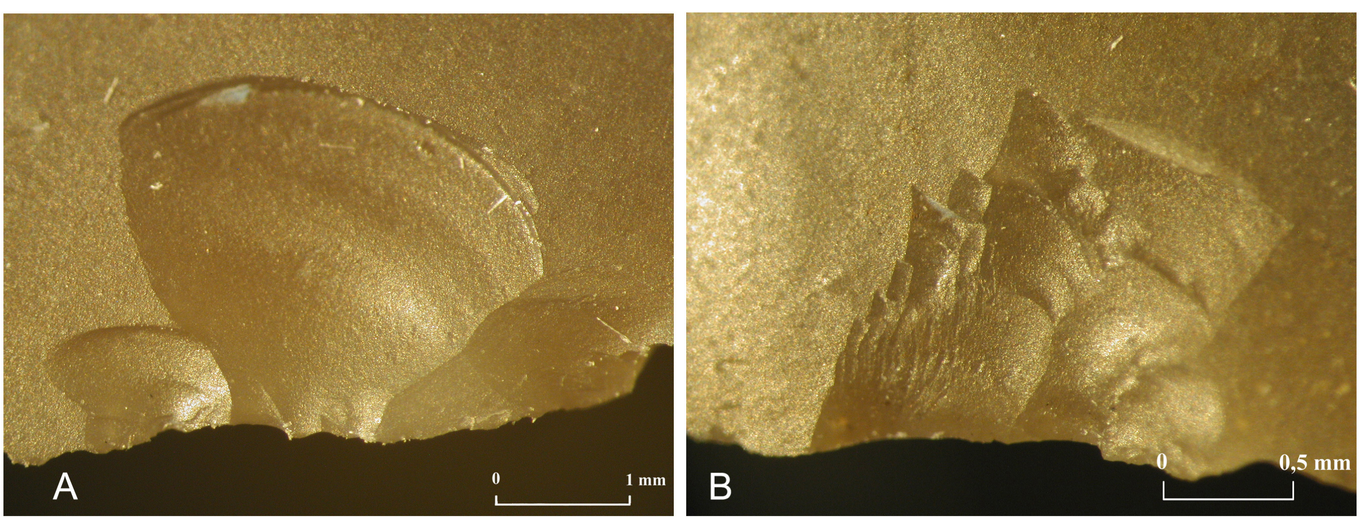

Figure 8. Examples of experimental hafting scarring.

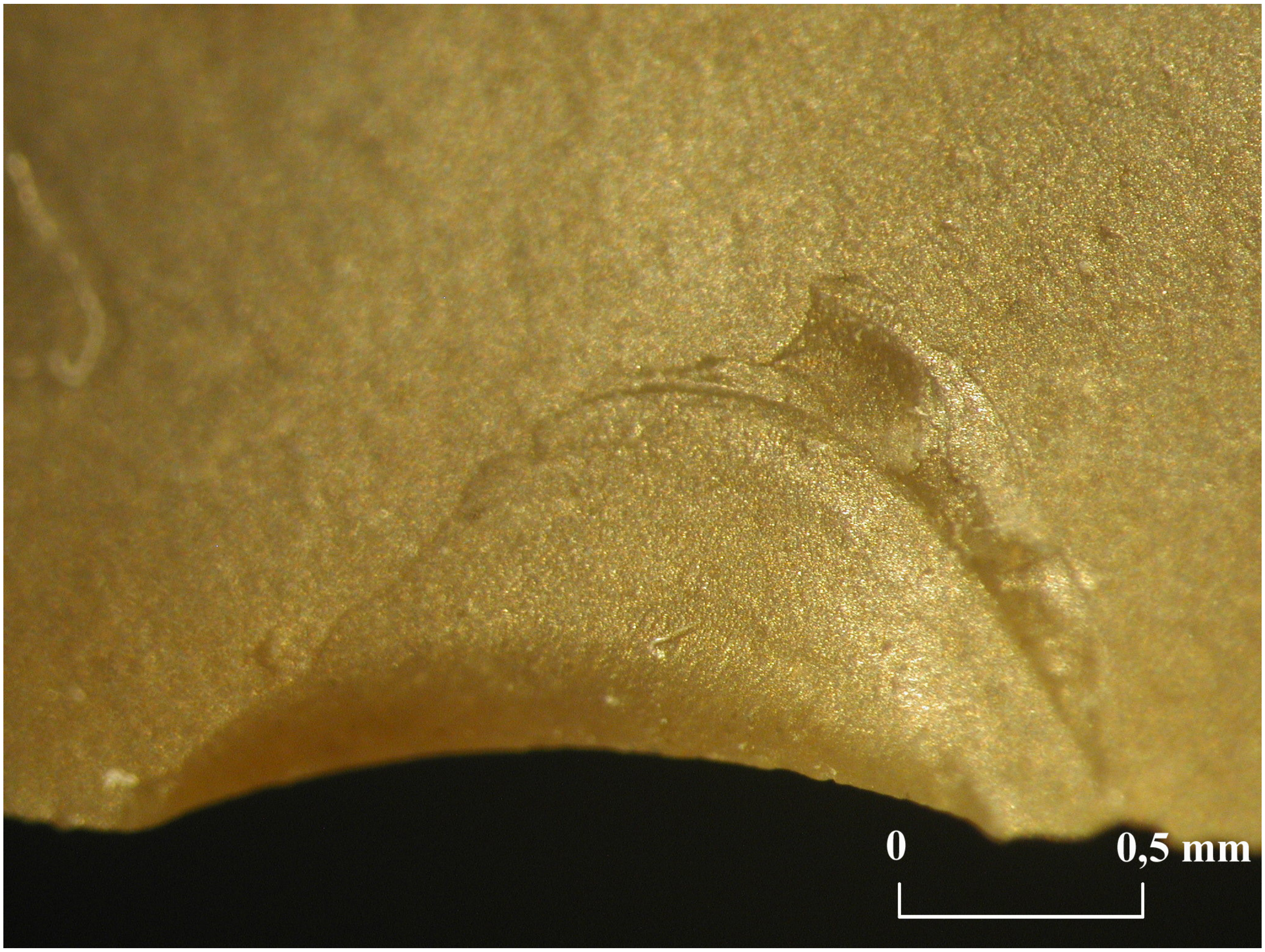

Figure 9. Experimental hafting scarring from the contact with bindings.

some of which are relevant here. First, scars are formed more easily and are better visible on unretouched edges. Second, some hafting arrangements lead to more distinctive scar types than others. In particular, the use of bindings entails a very distinct scar type (Figure 9, compare with Figure 5) (Rots 2003a; Rots et al. 2001). Third, the size of hafting scars is correlated with the amount of pressure exerted on the tool. This is most obvious in the case of use (Rots and Vermeersch 2004), but it also implies that both the shaping and the resharpening of the lithic tool in its haft enhance the formation of large scars. Such lithics, therefore, will bear very straightforward hafting wear traces. The exertion of a pressure will also increase the chance of other trace types to form, such as polish, including bright spots (Rots 2002b), striations, and rounding (Figure 10).

Both the occurrence of bright spots or striations in association with scarring (Figure 11) and fractures are very informative. The former are due to a flint particle that is detached within the haft, causing an intense localized friction (Rots 2002b). Hafting fractures are very distinct and occur at the haft limit or within the haft. The location of the fracture determines the kinds and intensity of other damage associated (Rots 2002a). When a fracture occurs in the haft itself, it is associated with a high amount of scarring, generally in association with bright spots (Rots 2002b). A fracture at the haft limit or, in actual fact, a few millimeters below the haft's upper end, occurs in a very fragile area. Indeed, the haft's edge functions as a kind of lever when pressure is exerted on the non-hafted extremity. The friction of the latter, while breaking away, against both the edge of the hafted tool and the hafting material, causes scars and bright spots to develop around the fringes of the fracture, similar to what was observed on the Taramsa lanceolate. These wear traces tend to be initiated from the most protruding ridge on the tool's dorsal face and the initiation is generally marked with a point of percussion or a slight dip, which is also the case on the Taramsa lanceolate (see Figure 4). Damage is obviously more limited than for fractures within the haft.

Ethnographic evidence

Ethnographic evidence confirms that tools often are shaped or adapted while hafted (Rots in press; Rots and Williamson 2004). The Konso of Southern Ethiopia (Brandt 1996), for instance, select flakes with an adequate general morphology out of a series of freshly produced flakes in order to serve as scrapers. They are roughly shaped (sometimes no true scraper-end is produced at this time) and hafted.

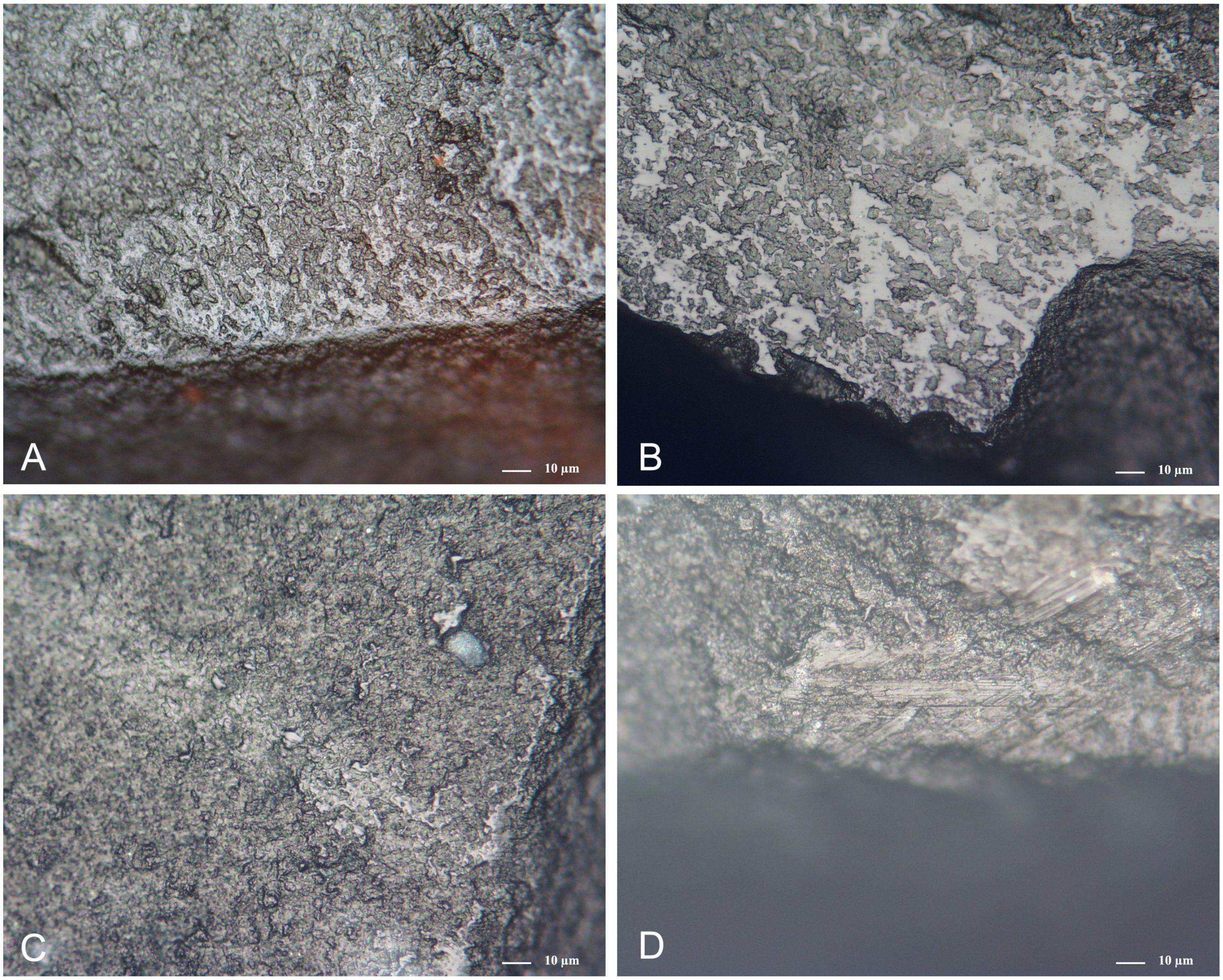

Figure 10. Other types of experimental hafting wear: (a) polish; (b) bright spots; (c and d) striations.

While some are immediately adequate for use, others are adapted after hafting, in some cases after a few test scrapes. For this further shaping, the stone tool is never taken out of its haft. Also, all resharpening takes place in the haft (Figure 12). Fractures regularly occur during this process—of the scraper itself or of the resin that is used to fix the stone tool in a concavity of the wooden handle. In the latter case, the stone tool "falls" out of its haft. Fractures of the stone tool are at the haft limit, leaving the proximal part within the resin. As for the experimental examples, scarring is associated with the fracture edges. This fractured hafted part is removed from the resin with a metal tool after heating and softening the resin in the hot ashes of a fire.

A SUMMARY OF THE LANCEOLATE POINT'S CHAÎNE OPÉRATOIRE

The lanceolate point from the upper level at Taramsa-8 entered the archaeological record after it had been broken in its haft while receiving its final shape. The associated initial production flakes, some of which were refitted onto the basal part of the point, and the presence of this assemblage within fill deposits of an extraction pit, evidence a long, complex, and yet uninterrupted *chaîne opératoire* for this tool.

A particular chert pebble was selected and bifacially reduced in the immediate vicinity of the place where it had been retrieved from its natural deposit. Although there is no evidence for this, we assume that an existing haft was brought along, ready for this pre-form to be inserted. It is alternatively possible that the haft itself was produced at the same spot as well. In principle, the presence/absence of tools with particular use-wear traces would constitute evidence in this regard. Such tools have not been found, but the excavation was far too limited to attach any weight to this observation. There is simply no evidence about the *chaîne opératoire* for the haft itself.

Next, the lithic point was fixed into the haft in a seemingly definitive manner, according to the evidence for bindings. We must, therefore, assume that the required technological means for hafting had been brought along as well.

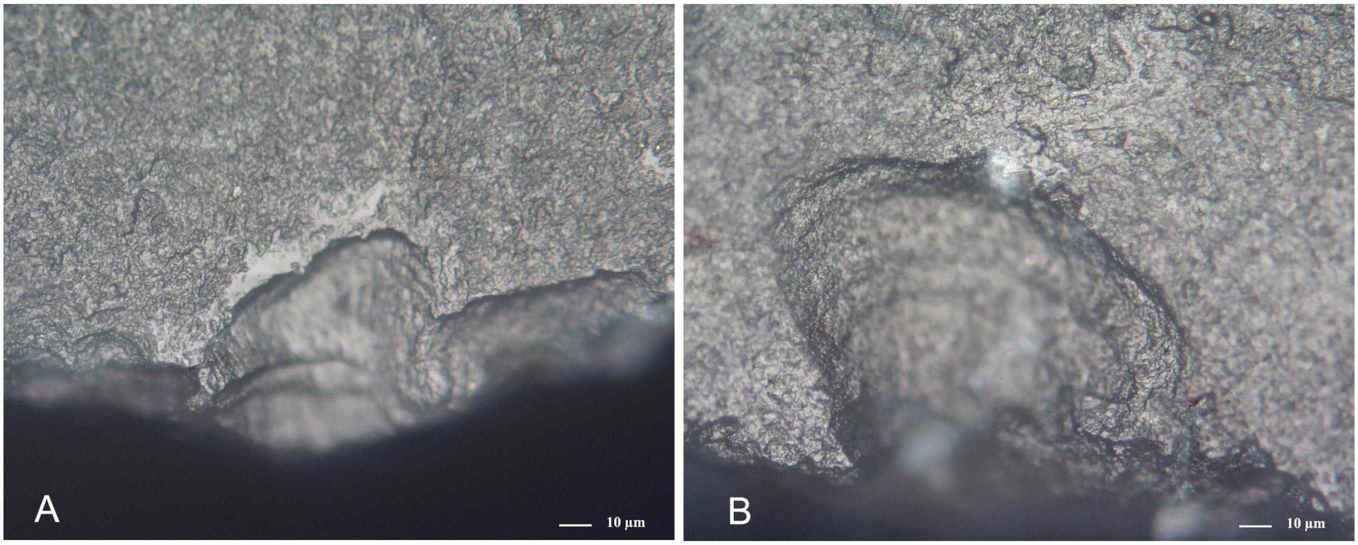

Figure 11. Associations of hafting traces (archaeological): (a) scar and bright spot; (b) scar and striation.

Indeed, there is nothing to suggest that the activities at the Taramsa-8 site, nor at Taramsa-1 or any other workshop in the area (Van Peer 2001), were concerned with anything else but lithic extraction and production. Taramsa-1 has been argued to be a functionally specific site that formed part of a wider settlement system involving residential settlements and special activity, e.g., hunting spots (Van Peer 1998, 2001).

Figure 12. Resharpening a hafted stone scraper with a metal hammer (Konso, Ethiopia).

After insertion, the final shaping of this—now composite—tool began. The protruding point was carefully trimmed. Upon near completion of the process, the point broke into the two fragments that were recovered at the excavation. The different degree of finishing of these two parts is completely obvious. This in itself is a good indication of the fact that the complete item was probably in a haft at the moment of its fracture.

The *chaîne opératoire* of this individual tool ended with the basal part of the lithic point being taken out of the haft immediately after the fracture, as it was found close to the tip. Again, this is an assumption and the possibility that the basal part was discarded in its organic haft cannot be refuted. It seems unlikely, however, as it is much easier to adapt a stone tool to a particular haft than to produce a new haft for each stone tool.

SOME SOCIO-ECONOMIC IMPLICATIONS

The Taramsa-8 lanceolate point provides further evidence for the presence of composite tools in the Middle Paleolithic of Northeast Africa (Rots and Van Peer 2006; Van Peer and Vermeersch 2000). Once this evidence established, it is not all that unexpected to find evidence for hafting at workshops. It is much more efficient to haft stone tools where they are produced. If lithic tools were first exported to another locale, e.g., a residential site, production problems may be much harder to overcome and a return to the workshop would be required. This provides empirical evidence for the production of composite tools at lithic production sites and it further sustains the conclusion derived from spatial analyses that the 'acquisition stage' represented at Middle Paleolithic workshops was not necessarily the simple *ad hoc* process of which we are inclined to think. To the contrary, an array of activities involving significant technological investment is performed at workshops in order to prepare tools for their future functions at other locations in the landscape. These activities include digging of exploitation pits, reduction of the volume of raw material present in nodules, and fixing of selected items into hafts. Such tasks are likely to call for division of labor among the members of a logistical collector system (Binford 1982; Gamble 1999). Task groups with appropriate gear probably came to such locales.

On the other hand, the complete *chaîne opératoire* of this item is spatially concentrated, in contrast to the observations at the Taramsan workshop at Taramsa-1, where different stages of the *chaîne* occurred at different locations. At Taramsa-8, the reduction of an extracted nodule, insertion into a haft, secondary working of the protruding tip, and de-hafting after failure, all seem to have taken place at the same spot and were possibly performed by the same individual. As Taramsa-8 is undoubtedly much older than the Taramsan assemblages at Taramsa-1, the interpretation of this pattern as an indication of increasing specialization through time seems straightforward. This would seem to find some support in the reworked, older assemblages from Taramsa-1 itself. In contrast to the later assemblages, various types of retouched tools, e.g., side scrapers, are present here in considerable frequencies. This was taken as an indication of a broader range than strictly production activities being carried out (Van Peer 2001). However, with this new evidence from Taramsa-8 available, it might indicate that not only lithic insets, but hafts as well, were produced in these early workshops. This issue will need to be addressed by future wear analyses, as well as the question of re-tooling of composite tools with a depleted active part. At present, there is no evidence for this at Taramsa, but the array of activities at workshops is likely to include de-hafting of depleted tools brought in from elsewhere in the logistical radius. The depleted tool part might serve as an example for the production of a morphologically similar item that would fit in the same haft. In addition, this would allow the re-use of hafting materials, like bindings or adhesives.

SOME SOCIO-HISTORIC IMPLICATIONS

Late Middle and early Upper Pleistocene lithic assemblages from Northeast Africa have been traditionally described as Middle Paleolithic (Caton-Thompson 1952; Guichard and Guichard 1968; Huzzayyin 1941; Marks 1968; Van Peer 1991; Vermeersch 2000, 2002; Wendorf and Schild 1992). Only occasionally has attention been drawn to typological similarities with the sub-Saharan Middle Stone Age (MSA) (Arkell 1949; Caton-Thompson 1946; Chmielewski 1968; Wendorf and Marks 1975). Clearly, however, the lanceolate point from Taramsa-8, as well as others from early Nubian Complex assemblages, are most similar to the large lanceolates which are the hallmark of the Lupemban industry, although they also occur in the Sangoan of western Africa (Clark 2001). Without going into the details of the taxonomic problems involved (for a discussion see Cahen 1978; McBrearty 1987), it is clear that both the Sangoan and the Lupemban are early developments of the Middle Stone Age where bifacial technology has been used in a very different way from the preceding Acheulian (Clark 2001).

In contrast to the idea that they are regional, Central African MSA facies, evidence has recently been brought forward for at least a Sangoan presence in Northeast Africa, at Site 8-B-11 on Sai Island in the northern Middle Nile Valley amongst others. Here, late Acheulian and Sangoan occupation levels are interstratified suggesting the contemporaneous presence of two behavioral systems during OIS7 (Van Peer et al. 2003). This situation, by the way, may cast some doubt on the purported association of the recently reported Herto fossils with a late Acheulian assemblage (Clark et al. 2003; White et al. 2003) and the possibility of mixing, especially considering the fact that most of the materials were collected on the surface, cannot be excluded. The Sangoan levels at 8-B-11 contain evidence of completely novel behaviors including the exploitation and processing of iron-oxide pigments and vegetal materials and, in the lithic domain, specialized re-tooling of composite tools with depleted core-axes (Rots and Van Peer 2006). Given the profound differences between the late Acheulian and the Sangoan and their interstratified occurrence, we may be witnessing an intrusive population eventually replacing the local one.

In the 8-B-11 sequence, lanceolate foliates show up in an OIS6 level overlying the Sangoan/Acheulian. Technologically as well, this assemblage evidences Lupemban features, such as the use of a complex blade reduction system very similar to the one documented in the Siszya Lupemban at Kalambo Falls (Clark 2001). In addition, Nubian Levallois methods for points begin to be modestly represented and this provides an obvious link with the early Nubian Complex. Although the lithic assemblage recovered from the exploitation pit at Taramsa-8 is small, the presence of bifacial foliates, in particular the lanceolate discussed here, strengthens this case for continuity between the Middle Pleistocene Lupemban and the Late Pleistocene Nubian Complex.

It is generally acknowledged that the early Middle Stone Age in Africa witnessed the emergence of novel behavioral features compared to contemporary Eurasia (Barham 2001; Clark 1988; Deacon and Wurz 2001; Lahr and Foley 1998; McBrearty and Brooks 2000; Van Peer et al. 2003, Rots and Van Peer 2006). The development of sophisticated hunting technologies is most certainly part of this. Barham (2000, 2001) has already drawn attention to the emergence, by perhaps 270 Ka, of composite hunting tool production in the Lupemban as a means to allow the exploitation of difficult environments, the equatorial rainforest in particular. The present evidence appears to suggest that this successful adaptation made its way into Northeastern Africa as a consequence of population dispersals during OIS7. A logistical economic system is established here with new features such as the use of sophisticated composite tools, sub-surface exploitation of organic and mineral resources, and the use of function-specific sites. During the next 100 Ka, these initial characteristics are amplified to include specialization and division of labor. Under this scenario, there is little reason to hold onto an inappropriate distinction between a Northern African Middle Paleolithic and a sub-Saharan Middle Stone Age. For far too long, the use of the different terms has been allowed to obscure behavioral and historic realities.

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