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ARTEFACT–GEOFACT ANALYSIS OF THE LITHIC MATERIAL FROM THE SUSILUOLA CAVE

Abstract

The excavations of Susiluola Cave in 1997–2000 and 2003–2006 provided evidence of human occupation in eastern Fennoscandia before the last glacial maximum. According to the geological record, occupation was possible during the period from the late temperate stage of the Eemian interglacial to the beginning of first Middle Weichselian glaciation. This article focuses on the question 'artefacts or geofacts?', which was subject of several critical discussions. An analysis of the complete lithic material and the comparison of natural and artificial reduction on the local raw materials are presented as well as a method to distinguish between artefacts and geofacts.

Keywords: Susiluola Cave, artefacts, geofacts

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INTRODUCTION

In 1997, the National Board of Antiquities began archaeological excavations in the Susiluola cave in cooperation with the Geological Survey of Finland and the University of Helsinki. The first fieldwork period lasted four years. In 2000, the studies were interrupted due to the danger of parts of the cave ceiling collapsing. The problem was remedied in 2002, and the excavations continued in 2003. A three-year research project (2004–2006) was financed by the Employment and Economic Development Centre of Southern Ostrobothnia and the communities of Kristiinankaupunki and Karijoki. A grant from the South Ostrobothian Fund of the Finnish Cultural Foundation supported the analysis of the lithic material.

Preliminary results of the research in 1997–2000 were published in 2002 and 2003 (Schulz 2002; Schulz et al. 2002). This article focuses on the question 'artefacts or geofacts?', including an analysis of the complete lithic material and a comparison of natural and artificial reduction on the local raw materials. A summary of the excavations 1997–2000 and 2003–2006 with a detailed presentation of the archaeology of the cave and the geological record including sediment analysis, pollen and diatom data and sediment dating will be presented in other contexts.

The question 'artefacts or geofacts?' was the focus of several critical discussions where attention was paid, for example, to the abrasion of the lithic material, its poor or moderate technical quality, and the exposure of the find horizons to glacial processes (e.g., Kinnunen 2005; Matiskainen 2005; Pettitt & Niskanen 2005; Schulz 2005; Donner 2006).

A SHORT VIEW ON THE STRATIGRAPHIC RECORD

Inside the cave, nine stratigraphic layers were revealed in an area of 52 sq. m. Five of the six lower layers that were covered by a glacial boulder belt contained archaeological finds. Outside the mouth of the cave, an area of 23 sq. m. was opened up. With the exception of the remains of a Weichselian till, the sediments outside the cave were deposited after the last glaciation. The deposits of the cave derive from littoral, proglacial and subglacial processes. Some archaeological structures and a part of the lithic material originate from activity in the cave; the greater part of the lithics and a number of possibly burnt stones have been redeposited by glacial processes. This find material probably originates either from the front part of the cave or from the terrace outside. The two layers (IV:2 and VI) that indicate long terrestrial periods that affected these sediments are of major importance for the archaeological research. The layers are regarded as being the floor of the cave for nearly 50,000 years, from the Eemian interglacial to the first main glaciation of the middle Weichselian. According to the sedimentary record, only during this period was there enough space in the cave for human activity. Only two minor sedimentation processes have been recorded from this period. One is a displacement of gravel sediment in the western part of the cave regarded as a solifluction process, that is, a ca. 15 cm thick stratum flowing from the central part of the cave in the direction of the mouth (layer IV L). The other process is a concentration of rocks dropping from the roof of the cave onto the surfaces of the above-mentioned layers.

Proglacial processes – indicated by layer V – filled up the back of the cave. In the ensuing glacial conditions and at the latest during the Ancylus littoral stage, the cave was nearly filled up to its roof (layers I–VI:1). Disturbances in or between deposits have mainly been effected by tree roots and burrowing badgers. Due to the coarse-grained character of the sediments, very fine-grained material (e.g. pollen and fine-grained particles transported by wind into the cave) had contaminated even the lower sediment layers.

THE SUSILUOLA LITHICS – ARTEFACTS OR GEOFACTS?

The sediment layers of the cave consist of gravels that contain pebbles of rock types that were used during the Stone Age as raw material. During the Quaternary glaciations, the cave lay under the Fennoscandian ice sheet and was exposed to glaciofluvial processes. After the deglaciations, the isostatic land uplift brought the cave mouth for a short while to the same altitude as the sea level. During this period water and pushing sea ice (during winter) affected the cave sediments. Under such circumstances we have to expect naturally cracked stones that show ‘artificial’ marks. The problem of ‘eoliths’ has been a subject of discussion for over a hundred years. Typical study cases have included find assemblages from gravels of river terraces and glacial sediments (e.g., Breuil 1945; Clark 1958; Mason 1965; Albrecht & Moser 1996; Baales et al. 2000). Several models have been presented which use various methods to distinguish between artefacts and geofacts (e.g., Patterson 1983; Hahn 1991; Peacock 1991; Albrecht & Moser 1996; Baales et al. 2000; Schmude 2004). These models are mostly based on assemblages of flint or flint-like rock. The rock types found in Susiluola Cave and its surroundings, however, are far less brittle than flint.

An analysis of the local rock types was carried out in order to recognize traces of cracking by natural forces.[1] It is based on striking experiments and identification of fracture processes indicated by find context. The following processes were recognized: cracking by frost, cracking by mechanical pressure, cracking by surge during a littoral stage and retouch by cryoturbation. A possible, but not verified, process is the falling of a boulder from the rock face. In addition, abrasion by current (littoral stage and glacial processes) was frequently observed (Schulz et al. 2002: 20–1). Cracking by frost was observed on hundreds of sandstone pieces and some quartzites. The typical find situation was in the uppermost layer near the mouth of the cave; in many cases the pieces were still accumulated together. Frost cracking caused an irregular coarse fracture surface, on sandstone sometimes following its natural stratification. Mechanical pressure could be verified on pieces that were jammed between bigger boulders. Several sandstone and quartzite pieces were found. The fracture surface was coarse and irregular and sometimes damaged.

The majority of fractured rocks with marks of kinetic impact of natural origin (see definitions below) derive from littoral deposits. Dozens of cores and some flakes (sandstone, quartzite and pebble quartz) with striking marks – point of impact, conical fractures, fissures, and sometimes flat bulbs – were found in the Ancylus-littoral deposits outside the cave. Additionally, several ‘flaked’ pieces came from find level III b and a few pieces from find level II b. These geofacts from the find levels could derive from the Eemian littoral stage. Two ‘cores’ with multiple negatives were found in the esker a few hundred meters east of the cave. In both environments, kinetic processes occurred that produced flaked items, but the

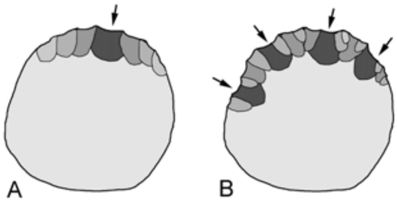

Fig. 1. Model of natural (a) and artificial (b) reduction of a pebble. The arrows mark the primary negatives.

same conditions destroyed these products rather rapidly by abrasion. Therefore, geofact assemblages usually consist of a clear majority of 'cores' and 'core tools' (e.g., Clark 1958; Mason 1965; Baales et al. 2004).

Some pieces with a concave, irregular retouched edge are possibly the product of cryoturbation. Such an edge can be produced in frozen soil, when the expanding lower soil layer presses a pebble against a sharp edged stone.

In the previous publications the lithic material of the Susiluola cave was discussed mainly from an archaeological point of view; data of non-archaeological fractured material was not yet presented. This drew justified criticism on this point (e.g., Pettitt & Niskanen 2005). The find levels of the cave undoubtedly contain geofacts; therefore, a discussion of the material requires the presentation of the complete material.

ANALYSIS OF THE ROCK TYPE ASSEMBLAGES

Of the rock types that could be used as lithic raw material (sandstone, siltstone, quartzite, quartz and volcanic rock, jasper and similar) all fractured rocks and rocks with negatives were collected during the excavation, altogether over 4000 pieces. More than a quarter of the rocks in the sediment removed from the cave were collected for petrographic analysis carried out by the Geological Survey of Finland. Rocks in the size range of 20–150 mm were collected from one quarter of each excavation square, boulders from a larger area. Altogether, 15,035 rocks were analysed. For the estimation of the amount of cracked pebbles per rock type, the cores recorded as artefacts or geofacts were added to the rock type count results. The material was grouped in the following way:

ANALYSIS OF THE RAW MATERIAL GROUPS

Sandstone

Sandstone appears with a frequency of nearly 3 % in the cave sediments. About 2.4 % of the sandstone pebbles were cracked.[2] The core/flake index within the groups 'geofacts' and 'artefacts' is typical for each group. Counting both groups together, the index of 46.7–53.3 % still remains untypical for assemblages produced by natural forces.

Red Siltstone

The results of the rock species count remain somewhat uncertain because of the difficulty in distinguishing between red siltstone and very fine-grained sandstone under field conditions. An examination of the five uncertain rocks from the years 2005 and 2006 (7800 rocks of 15,035 had then been analysed) gave a negative result; all

Table 1. Scheme applied to the classification of lithics from Susiluola.

Artefacts		Geofacts	
Marks of kinetic impact:		Marks of kinetic impact:	
Core tools:	- specific sequence of primary negatives	--	
Cores:	- platform,	'Cores':	- pieces without platform,
	- > 3 negatives		- < 3 negatives,
	- clear reduction strategy		- no recognizable reduction strategy
			- irregular negatives, angle(s) > 90°
Flakes:	- platform rest and striking marks	'Flakes':	- platform missing
	- modified flakes		- angle > 90°
Marks of impact missing:		Marks of impact missing:	
Chips, others:	- convex/concave fracture surface	'Flakes':	- flake-like pieces possibly produced by
	- regular surface texture		mechanical pressure or frost cracking*

*) pieces < 10 mm were not analysed as the determinability of fracture processes of small pieces is too uncertain.

Table 2. Basic types of sandstone grouped by maximum length.

	Geofacts		Artefacts		Chips &
mm	'Cores'	'Flakes'	Cores	Flakes	others
≤ 10	--	--	--	--	224
11–20	--	13	--	20	68
21–30	13	2	--	4	7
31–40	12	3	3	2	3
41–50	5	2	2	1	2
51–60	2	1	--	1	--
61–70	3	--	--	1	--
71–80	2	--	--	1	--
81–90	--	--	--	--	--
131–140	1	--	--	--	--
Total	38	21	5	31	304
%	64 %	36 %	14 %	86 %	--

Table 3. Basic types of red siltstone grouped by maximum length .

	Geofacts		Artefacts		Chips &
mm	'Cores'	'Flakes'	Cores	Flakes	others
≤ 10	--	--	--	5	91
11–20	--	1	1	36	27
21–30	1	2	1	9	3
31–40	--	--	--	7	--
41–50	--	--	--	4	1
51–60	--	--	--	1	1
61–70	--	--	--	--	1
Total	1	3	1	62	124
%	25 %	75 %	3 %	97 %	--

rocks were very fine-grained sandstone. This means that the possible amount of red siltstone pebbles in the cave sediment would be extremely low.

The core/flake index of ca. 4.5–95.5 % and the missing or possibly extremely low amount of uncracked pebbles are a rather certain indication of artificial reduction.

Quartzite

Quartzite pebbles are rare in the cave sediments (0.26 %). The proportion of cracked pebbles, on the other hand, is rather high, ca. 13.5 %. Because quartzite is tougher than sandstone, especially fine-grained sandstone, the higher amount of cracked quartzite pebbles cannot be explained by a difference in fracturing quality. If the cracking depended only on fracturing quality, there should be less fractured pieces. One possible explanation of the situation could be that the group 'geofacts' includes artificially reduced pieces; flaked quartzite often does not bear clear striking marks. The core-flake index of 41–59 % is suggestive of artificial reduction.

Quartz

Quartz pebbles or blocks appear with a frequency of below 0.4 % in the cave sediments. Calculating the amount of cracked pieces is actually not possible, because vein quartz is often already in a 'cracked' form in gravels. The commonly occurring fissures and cleavages in a vein quartz block cause new cracking again and again. These products usually do not fit into the categories 'core' or 'flake'. For this reason, a core-flake index would not be useful for the analysis of the assemblage. The technical quality of vein quartz also affects the interpretation of archaeological material. If a quartz block is split by the 'anvil technique', which produces a large number of irregular pieces

Table 4. Basic types of quartzite grouped by maximum length .

	Geofacts		Artefacts		Chips &
mm	'Cores'	'Flakes'	Cores	Flakes	others
≤ 10	--	--	--	3	112
11–20	1	1		6	38
21–30	2	7	2	9	6
31–40	3	1		4	4
41–50	9	2	1	--	1
51–60	1	1	--	1	--
61–70	1	--	2	--	--
71–80	1	--	--	--	--
81–90	--	--	--	1	--
91–100	--	--	--	--	--
101–110	1	--	1	--	--
Total	19	12	6	24	161
%	61 %	39 %	20 %	80 %	--

Table 5. Basic types of quartz grouped by maximum length.

	Geofacts		Artefacts		Chips &
mm	'Cores'	'Flakes'	Cores	Flakes	others
≤ 10	--	--	--	--	60
11–20	1	11	--	17	46
21–30	4	8	1	5	8
31–40	2	4	1	6	2
41–50	--	3	1	--	--
51–60	--	2	2	--	--
Total	7	28	5	28	116
%	20 %	28 %	15 %	85 %	--

with irregular sharp edges in a short time, the majority of the products do not show any marks of artificial striking. Due to the technical character of this raw material, conclusions on the geofact or artefact character of the assemblage cannot be made.

The other rock types are represented by only a few pieces that do not allow statistical analysis. Jasper is represented by 12 pieces; no pebbles were recorded from the cave sediments. The assemblage consists of 5 flakes (3 modified), 5 chips, one 'geofact', and one piece without fractured surfaces. Volcanic rock pebbles occur with the frequency of 1.6 % (239 pieces) in the cave sediments. This rock type is thus six times more frequent than quartzite, but astonishingly, only one flake and 8 chips of volcanic rock were found. This raw material was in common use almost from the beginning of the early Mesolithic settlement in Finland, mainly for the fabrication of ground stone implements. Because volcanic rock is clearly softer than quartzite, it may be possible that fractured surfaces have been rounded by mechanical and chemical abrasion.

ANALYSIS OF THE FLAKED STONES CLASSIFIED AS ARTEFACTS

Several stones fractured by natural forces have been recorded from the Susiluola cave sediments. This fact renders it necessary to investigate every single piece (or group of items with identical features) that exhibits an artificial character from an archaeological point of view, as to whether they could be geofacts.

A comprehensive analysis of the Susiluola lithic material was carried out in 2005–2007, and the results will be published in multimedia format in 2008. The material is to be presented as high-resolution digital scans with surfaces features and interpretations of the features plotted on separate layers. In this presentation, however, the analysis

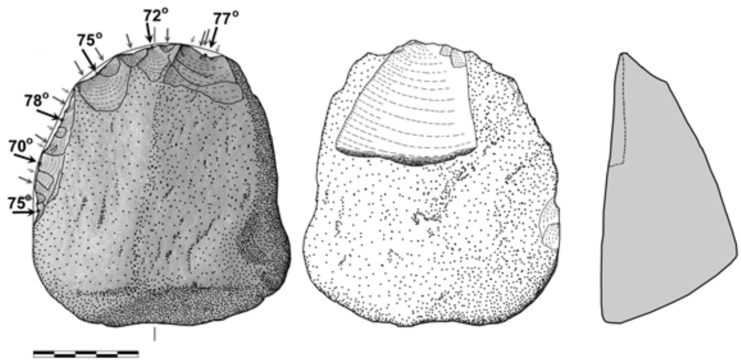

Fig. 2. Chopper from horizon III b, sandstone; NM 30301: 1.

will only be represented by a few case studies.

Artefacts and geofacts can look very similar. Distinguishing between artefacts and geofacts needs the study of particular features. The identification of artefacts is based on the following observations (modified after Schmude 2004):

- The preference of distinct rock species
- Clear marks of kinetic impact (the identification must be verified by experimental striking)
- The blow angles (platform/negative) are between 45–90°.
- The essential fracture surfaces are of the same age
- Sequence of the primary negatives (regular distance and direction)
- System of blow axes (similar blow angles, directed to the centre of the object)
- Regular modified edge (with possible integration of the natural edges)
- Recognition of a multistage process chain.

Chopper reduction is presented in Figure 1 as theoretic example of application.

'Choppers' produced by natural forces are quite commonly found in gravel deposits. They are typically characterised by bifacial removals with strongly varying reduction angles (e.g., Hahn 1991; Schmude 2004). If the pebble is set fast in the ground, negatives may occur only on one surface. The formation of a sequence of negatives is commonly explained in the following way: after a kinetic impact has produced a fracture on a pebble, the sharp edges bordering the negative are easily starting points for new removals. Thus, series of negatives can develop in one or both directions from the primary negative.

Artificial reduction differs from the previous process: the intended edge is first coarsely shaped by serial blows, the final form (e.g., regular convex or denticulate edge) is shaped by a consequent series of blows. Artificial reduction is characterised by the preparation of an edge or a surface previous to the final shaping or reduction process.

EXAMPLES FROM SUSILUOLA CAVE:

Example 1

Sandstone chopper (Fig. 2). On the convex surface, six primary negatives can be discerned lying at regular distances from each other; the striking points are located 1–2.5 mm inside the original edge and the angles are between 70° and 78°. On the same part of the edge are 16 secondary negatives forming a slightly toothed border. On the flat surface, there is a big negative with a step fracture and four smaller negatives. The piece shows all the criteria of the artefact-type chopper. It fits well into the hand, the measurements are 109 x 96 x 56 mm and the weight is 613 g. The type is represented by two finds.

However, could natural forces have produced the features? The negatives show clear marks of the type that kinetic impact produces on sandstone. In the case of Susiluola, two processes could be responsible, a boulder falling from the

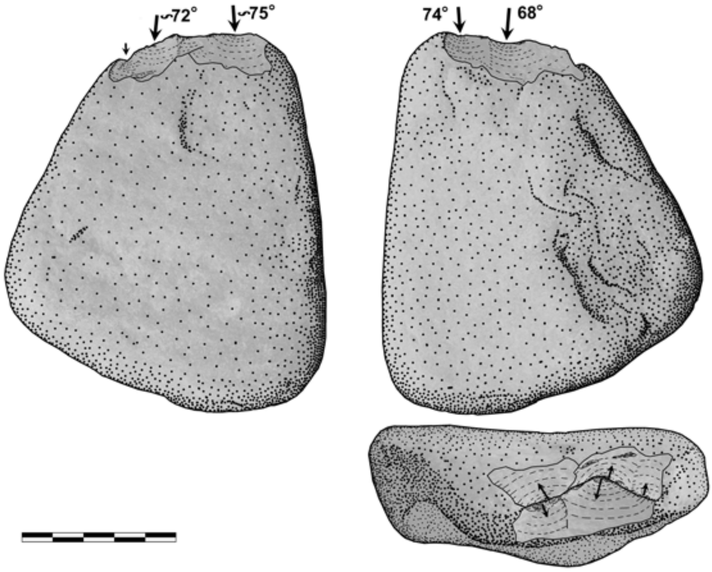

Fig 3. 'Chopping tool' from horizon II b, sandstone; NM 36380: 6.

rock face or kinetic events in a surge during the littoral stage. Purely the production of the primary negatives requires six impacts of similar strength, which strike the piece at regular intervals and nearly identical angles and on the same surface.[3] To our knowledge, there are no records of natural processes that could produce such regular features. The probability that the features were produced purely by accident can be regarded as extremely low.

Example 2

Coarse implement of sandstone (Fig. 3). Five 'blows' formed a bifacial, somewhat irregular sharp edge. The piece fits well in the hand (measurements 119 x 100 x 42 mm, weight 560 g). The stone could have functioned as a crude tool.

Naturally flaked pieces with similar negatives are commonly recorded from gravel deposits. Because of its flat shape, the pebble could have been jammed into the sediment; this would explain the negatives on only one end. In this case, we are dealing with an item that could just as well be an artefact or a geofact.

Example 3

Scraper of fine-grained quartzite (Fig 4). This is a thick flake with two retouched edges, a convex edge on the dorsal surface and a 'transverse' edge on the platform (from dorsal). The retouch of the

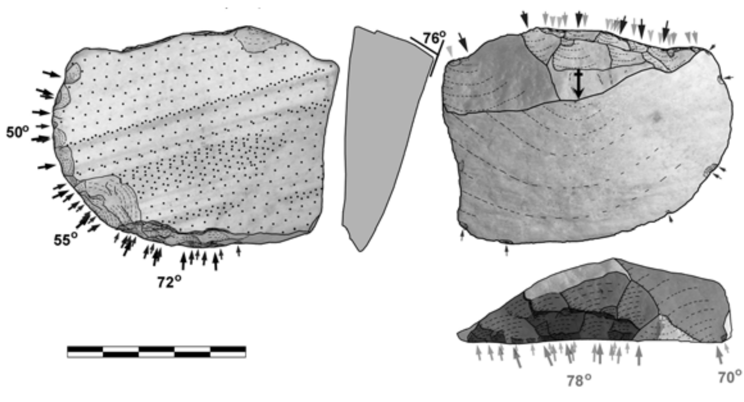

Fig 4. Scraper from horizon III b, fine-grained quartzite; MN 33810: 16.

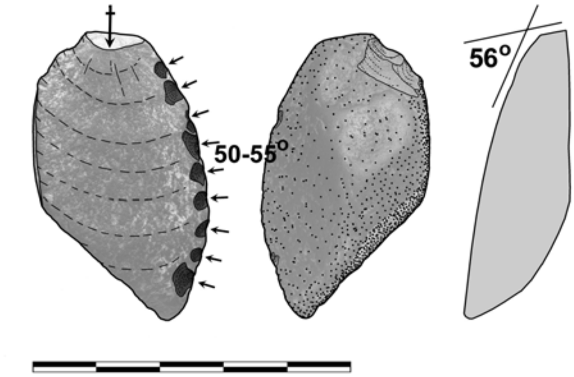

Fig 5. Retouched flake from the sediments removed in 1996, red siltstone; NM 30301: 10.

transverse edge is stepped. The edge is formed by six blows (primary negatives) and sharpened/reshaped by 16 blows. The convex edge bears 11 primary negatives and 22 secondary negatives. A sequence of four reduction processes is recorded: production of the platform, flaking, shaping the edges by blows and sharpening by retouch. The item represents a typical Middle Palaeolithic scraper type (e.g., Dibble 1995).

Natural forces could produce flaked pieces; flakes with platforms are also (seldom) recorded. The modified edges of the piece would require regular series of impacts, and after this mechanical pressure to form the edges. Cryoturbation produces concave edges; to our knowledge, there are no recorded natural processes that produce regular convex edges. Stepped retouch is also a feature that is regarded as artificial (e.g., Hahn 1991).

Example 4

Retouched flake of red siltstone (Fig. 5). This is a thick flake with a natural dorsal surface bearing a few small negatives at its proximal end. There are recognizable clear striking marks on the ventral surface, a flat bulb, fissures, and ripples. A simple retouch on the ventral surface follows a naturally convex border. Pressure retouch with a pointed implement evidently produced it; each of the fractures begins from one clear initial point that is situated inside the edge. The retouch sharpens the edge by decreasing its natural angle. On the basis of the feature of the sharp edge and the shape of the piece (nearly triangular section with a natural back) it could have been used, for example, as a knife.

Naturally flaked pieces with platforms are seldom recorded (e.g., Clark 1958; Mason 1965), but nevertheless observed. The regular retouch, however, precludes natural genesis. Under littoral conditions, pressure or kinetic impact can produce fractures starting from a sharp edge, but this cannot be explained how this process could produce small initial points located inside the edge (cf. Donner 2006).

Example 5

Denticulates (Fig. 6) are made mainly of red siltstone; two pieces were made of quartz. The selected basic forms were quite varied: flakes with a thickness of 1–1.5 cm, waste, and even one small flat pebble. The worked edge covers 30–50 % of the circumference and the retouch angles vary

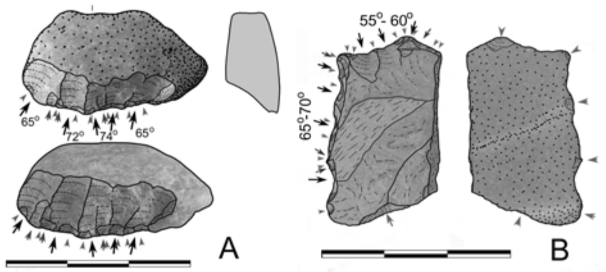

Fig 6. Denticulates: (a) quartz , horizon II b, KM 33810: 27, (b) red siltstone, from the sediments removed in 1996, NM 32133: 14.

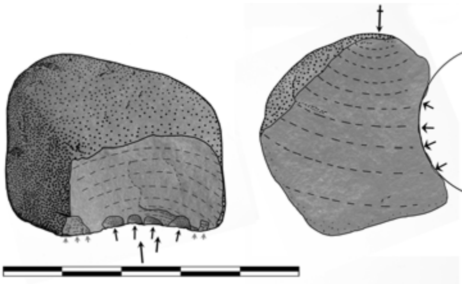

Fig 7. Notched piece, fine-grained sandstone, horizon II a; NM 30301: 28.

between 55–75°. The size of the denticulates varies between 20 mm and 40 mm. The pieces show a coarse forming of the edge by primary negatives and production of the teeth by a secondary series of retouches. This fact points clearly to artificial reduction. Also the small size of the pieces rejects natural origin, the production of the teeth requires series accurate pressure points, and the piece must be kept tightly on a base.

Example 6

Notched piece of fine-grained sandstone. The notch is on a ca. 2 cm thick small flake (Fig. 7); the regular concave edge fits a circle of 27 mm diameter. The item would theoretically function well as tool for smoothing wooden shafts. Notched pieces however are a problematic morphological group from the point of view of the artefact-geofact discussion. Cryoturbation could produce a concave sharp edge with even a complex 'retouch'. Although this piece shows additionally striking marks, in this case we must consider its possible geofact character.

Example 7

Quartz core. The core shows three reduction surfaces with three to eight negatives. The reduction concept is visible. A series of at least seven blows started from a natural platform (Fig 8, left). After this, the core was rotated. All striking points of the next sequence (Fig. 8, middle, arrows from lower left) are located on the negatives of the previous surface. The third series of blows starts from the same natural platform; all negatives stop at a cleft. Following the reduction, the latter striking edge was crushed by many blows, which could have been caused by using the core as hammer stone.

Natural flaking can be rejected on the basis of the complex reduction sequence: a series of impacts from a similar angle, then rotation of the piece and another series of impacts *et cetera*. The secondary modification appears only on one edge; also this feature points to an artificial character.

Example 8

Bipolar quartz core. A number of similar cores have been found, which represent alternate flaking on one axis. These cores display 40–60 % of cortical surface and have one side (sometimes flat, often prismatic) with alternating negatives (Schulz et al. 2002: Plate III: 4, 7, 10). These cores are problematic; geofacts[4] with few negatives resembling this core type were observed. The more negatives there are on only one surface, the smaller the probability that the object is a geofact, but is not possible to draw a sharp line. The here presented core, reduced however by bipolar technique (Fig. 9), displays a distinct artificial character. It bears a series of negatives starting from the proximal end and an extensive splintering on the distal end with some reflection negatives. Such

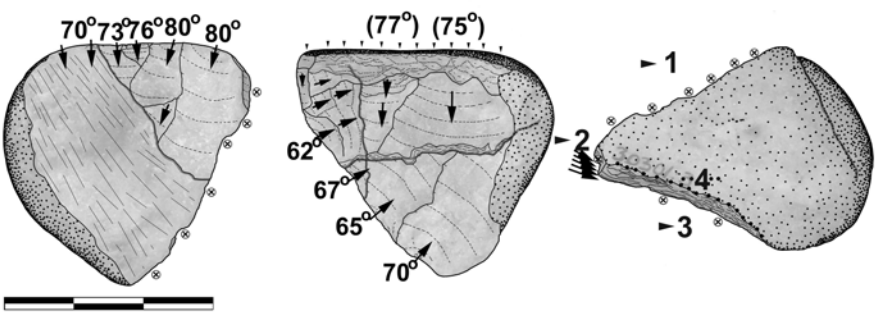

Fig 8. Core from horizon II a, pebble quartz, NM 30301: 3.

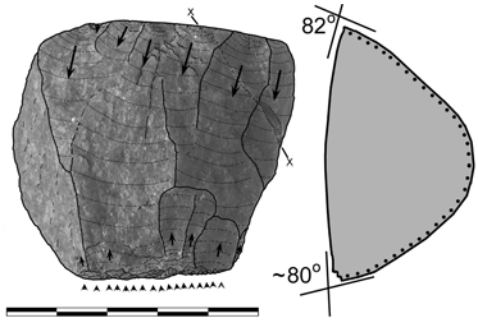

Fig. 9. Core, quartz, horizon III b.

structures occur only if the core is kept tightly on the anvil stone.

Example 9

Flakes with parallel negatives. Several flakes of fine-grained sandstone bear marks of reduction by parallel flaking in two directions (Fig 10). These flakes cannot be associated with a definite reduction concept, but they show that planned reduction is possible on this raw material (cf. Hertell 2006). A number of smaller flakes (Fig. 11) have parallel sides and parallel dorsal negatives from the same direction, partly lateral cortex remains and partly lateral negatives with transverse flaking direction. Their butts are negative or (seldom) dihedral; faceted butts are absent. These flakes could derive from a specific reduction technique that starts with parallel flaking from one platform, rotating the core and using the negative surface as a new platform (without preparation), removing the second series of flakes, rotating the core again, and continuing the reduction in the same way. Some cores indicating this technique had been found (Fig. 8, quartz core; cores of red siltstone; Schulz et al. 2002: 25; Plate III, 1, 2).

Fine-grained sandstone as well as siltstone has a laminated structure that does not support the genesis of natural regular convex/concave fracture surfaces caused by low-kinetic processes, thus these fractures were caused by kinetic impact. The flakes presented below show a clear reduction sequence, production of a platform, partly edge trimming and series of parallel flaking. There is no record of natural processes that could produce all these features together (a ‘platform’ might originate accidentally, but the following processes need a fixing of the core in an accurate position and series of blows with similar strength and angles onto points laying in a defined distance from the edge). Flakes with series of parallel negatives are commonly regarded as artificial products.

The examples above represent different morphological groups. In seven cases, there are recognizable clear archaeological reduction strategies and on the other hand, no plausible explanations for a genesis by natural processes. Two cases represent a grey zone where an artificial as well as a natural origin is possible. In the strict sense, all flakes without series of dorsal negatives should be considered possible geofacts. However, as discussed above, littoral processes that produce flaked pieces also destroy their products by abrasion; therefore typical geofact assemblages contain a majority of cores. The core-flake index of the rock type assemblages and the higher amount of smaller flakes point to artificial reduction.

EPILOGUE

The critical discussion about the Susiluola cave lithic material is characterized by four contra-arguments:

- The stones presented as artefacts could not have functioned as tools, because the edges are rounded.
- Due to the abrasion, possible artefacts cannot be recognized.
- Naturally fractured lithics are impossible to distinguish from those that are the products of human activities.
- Similar stones were found from elsewhere outside the cave.

The edge of a just flaked stone is always sharp or splintered, never regularly rounded. Abrasion is caused by secondary processes (e.g., current, sediment movement or possibly chemical processes).

Mechanical abrasion affects first on edges and convex surfaces. Negatives can even be verified on pieces with strongly rounded edges still being useful for the analysis of reduction sequences.

Artificial reduction is characterised by the preparation of an edge or a surface previous to the final shaping or reduction process. Natural reduc-

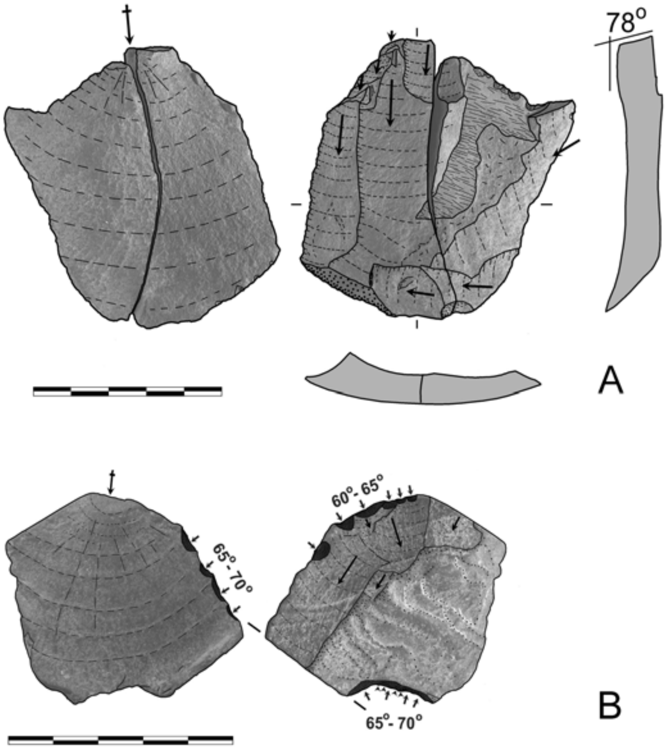

Fig 10. Flakes, fine-grained sandstone: (a) two flakes refitted (possible siret-fracture) horizon III a, NM 35643: 8, NM 35643: 11, (b) retouched flake, horizon II b, NM 36380: 7.

tion starts usually from one primary negative, producing specific negative sequences. The study of pebbles from river terraces (Schmude 2004) showed, that it is possible to recognize a pattern of pebble damages, which can be described and used to distinguish between natural and artificial products (Schmude 2004, chapters 3.5.–3.7.). The identification of artefacts is based additionally on specific observations, such as the recognition of a multistage process chain. Distinguishing between natural flaked pieces and artefacts is commonly possible, but not in all cases.

Artefacts and geofacts can look rather similar, often presented examples are ‘chopper’- and ‘*pic*’-like pieces (e.g., Albrecht & Moser 1996; Schmude 2004). Similarity by itself cannot be used as a ‘pro’- or ‘contra’-argument – an accurate analysis of distinct features (as described above) is necessary.

The problem cannot be solved solely from either an archaeological or a geological viewpoint. Distinguishing between artefacts and geofacts requires cognisance of the fracture qualities of the local rock species, including data on surface textures caused by different affecting forces, as well as substantial knowledge of artificial reduction processes and experimental flaking of local raw materials. Any interpretations that are not based on the above-mentioned data remain speculative. In strict sense, not only artificial but also natural processes must be verified or excluded before a classification can be made. (For instance, the argument that ‘these pieces are clearly natural’,

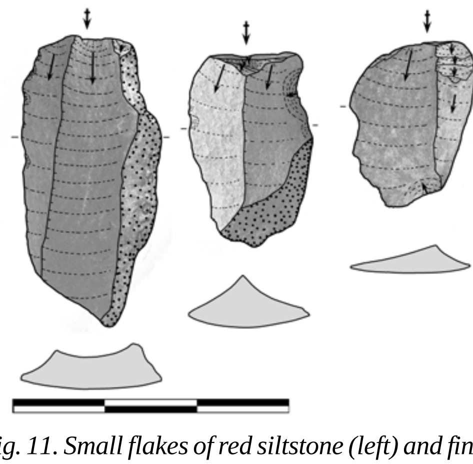

Fig. 11. Small flakes of red siltstone (left) and fine-grained sandstone, horizons II b and III b, NM 31023: 1, NM 30301: 46, NM 30301: 20.

presented in several contexts, remains dubious without any reference to the physical fracture qualities of the used raw material.) Geofacts are not uncommon in archaeological sites. From open-air sites we have to expect pieces cracked by frost and cryoturbation. The possible existence of geofacts does not mark a find assemblage as a whole questionable. In the case of Susiluola, the analysis of the complete lithic material (frequency of raw material varieties, frequency of cracked pieces, core-flake index, reduction strategies, sequences of primary negatives, etc.) unambiguously indicates artificial reduction.

NOTES

[1] More detailed work on this matter will be presented later.

[2] According to the following estimation: Petrographic analysis 439 x 4 + 38 ‘cores’ + 5 cores / SUM.

[3] It had been argued (Pettitt & Niskanen 2005) that a single blow could produce several negatives on brittle material. Sandstone, however, is very tough, and this piece exhibits six separate points of impact.

[4] Pieces with angles over 90° between cortical and fracture surface