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NON-FLINT PSEUDO-LITHICS: SOME CONSIDERATIONS

It is well-known that pseudo-artefacts can most deceptively resemble artefacts retouched by man; frequently difficult problems arise regarding interpretation, especially in the case of isolated finds. It is even true to say that pseudo-artefacts and artefacts cannot always be distinguished with absolute certainty; in such cases any uncertainty felt by the author should be mentioned (Stapert 1976a: 62).

INTRODUCTION

Pseudo-lithics, that is, naturally formed geofacts and humanly produced specimens that by accident resemble prehistoric lithic artefacts have been a central topic of discussion in Paleolithic archaeology since the early eolith controversy in Europe (e.g., Warren 1905; Oakley 1972; Roebroeks & Stapert 1986; Hemingway et al. 1989; Chalachula & Leslie 2001; Driver 2001; on the eolith controversy see e.g., Johnson 1978: 338–46; De Bont 2003).

Until recently, however, archaeological research in Finland has been practically devoid of discussions on how to differentiate prehistoric lithic artefacts from pseudo-lithics. There are several reasons for this, probably the most important being the common assumption that glacial processes must have destroyed all possible evidence of human occupation in Finland prior to the Holocene. Discussions on eoliths, pebble tools, and Paleolithic archaeology in general, have therefore drawn little attention from Finnish researchers in the past.

Another important reason is the fact that lithic technology in Finland, where natural deposits of flint-like material are almost non-existent, was during the Mesolithic and Neolithic largely based on quartz, different kinds of relatively coarse grained rocks, slates, simple flaking technologies and grinding. With the exception of ground stone tool typology these were hardly subjects of interest for the early culture historical archaeology. In more recent times the development of lithic research in Finland has been hampered by a bias in international literature towards fine grained homogenous flint-like rocks and minerals and elaborate technologies facilitated by such raw materials.

Lithic analysis, not to mention fracture mechanics, was for long not taught in archaeology departments in Finland and the study of lithic artefacts relied therefore mainly on typology and petrology. Consequently in archaeological surveys, although fractured quartz was from early on considered a marker of Stone Age activity (Appelgren-Kivalo 1908: 39–40), Stone Age sites were and still are often verified by other criteria – such as finds of pottery, burnt bone or formal stone tools. However, interest in lithic technology has rapidly increased during the last few decades. Especially the knowledge that, contrary to previous beliefs, quartz also fractures mostly following certain rules (Callahan et al. 1992) has led to a better understanding of fracture mechanics and lithic technology among Finnish archaeologists.

During the last five years the ways of distinguishing prehistoric lithic artefacts from pseudo-artefacts have become a subject of serious discussion also in Finland. Fittingly it is the publication of suggested Paleolithic artefacts from excavations in Susiluola Cave (Schulz et al. 2002) that have launched this discussion (see below). Apart from the finds from Susiluola Cave also concerns related to the correct identification of Stone Age sites in surveys (Halinen 2001), especially prior to demands for rescue excavations, have also brought out a need to study possible sources of pseudo-lithics.

A wealth of international literature has been published on processes that produce or may produce different sorts of pseudo-lithics, on criteria for distinguishing pseudo-lithics from artefacts, and on test-cases where these criteria have been applied (e.g., Warren 1914; Barnes 1939; Stapert 1976b; Duvall & Venner 1979; Patterson 1980;

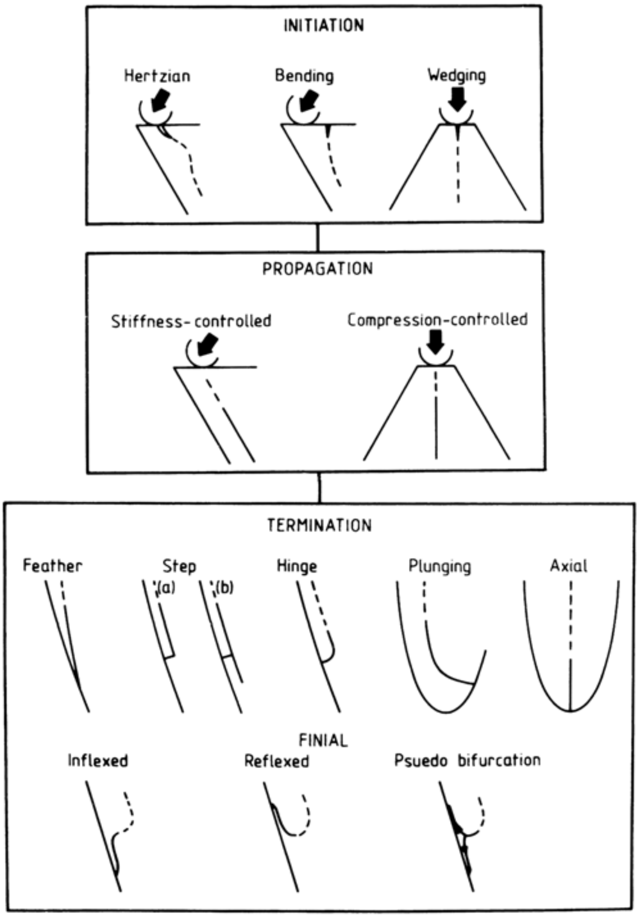

Fig. 1. The phases of flake formation according to Cotterell & Kamminga (1987: Fig 4).

1983; Miller 1982; Luedtke 1986; Peacock 1991; Chlachula 1996: 301–5; Gillespie et al. 2004). From a Finnish perspective the problem with most of this literature, however, is again a focus on fine-grained homogenous rocks and minerals and platform flaking methods. For example Patterson (1983: 305) considers bipolar flaking, which is very common in Finnish quartz assemblages, not worth discussing. There is therefore a definite need for a more localized perspective on possible sources of pseudo-artefacts in present-day Finland.

FRACTURE MECHANICS AND PSEUDO-ARTEFACTS

Different stones fracture somewhat differently under pressure and impact depending, among other things, on homogeneity and grain size. In principle, however, the mechanics of fracture in brittle solids (Cotterell & Kamminga 1987; Callahan et al. 1992; Pelcin 1997a; 1997b) apply for most types of rock and minerals found in Finland. Therefore rock type should never be used as the sole criterion in separating flaked artefacts from naturally fractured stones.

For instance, although natural cleavage plains tend to affect fracture propagation in some types of rock, such as slates, they were nevertheless flaked as well as cleaved in prehistoric times. In fact, natural cleavage plains and frost fractured pieces often offer a natural platform that facilitates fracture initiation (for humans and nature alike) in the same way as one flake scar facilitates the initiation of the next (Luedtke 1986: 56). In some types of stone, however, the basic characteristics of fracture initiation, propagation and termination (Fig. 1) are diffuse and sometimes even impossible to detect.

Central for the discussion concerning pseudo-

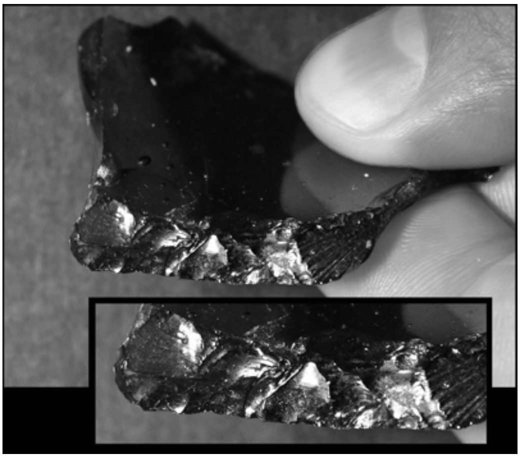

Fig. 2. Plough damage resembling continuous retouch on a piece of bottle glass.

lithics is the fact that the fracture types used for making stone tools can all be, under favourable conditions, produced also by natural processes. The three basic flake initiations (herzian, bending, and wedging) can all be produced by both pressure and percussion and with both soft and hard indentors (Cotterell & Kamminga 1987: 685–91; Pelcin 1997a; 1997b). Consequently, none of these fracture types directly indicates human involvement.

Even such things as facetted platform remnants (Peacock 1991: 352), acute platform angles (Luedtke 1986: 58) and continuous retouch (Barnes 1939: Figs. 1–3; Peacock 1991: 355) may be produced by nature or unintentionally by modern human activity (Fig. 2). The difference between humanly and naturally produced assemblages is therefore never clear-cut. Humans have a *tendency* to favour certain fracture types, produce fractures in series and control the fractures in order to get pre-determined results whereas natural fracturing tends to be more random.

However, archaeologists collect artefacts and pseudo-artefacts using the same criteria and therefore the pseudo-lithic assemblages are more similar to assemblages of actual artefacts than just random samples of naturally fractured stone. This problematic phenomenon was coined *form selection* by Duvall & Venner (1979: 455) but already

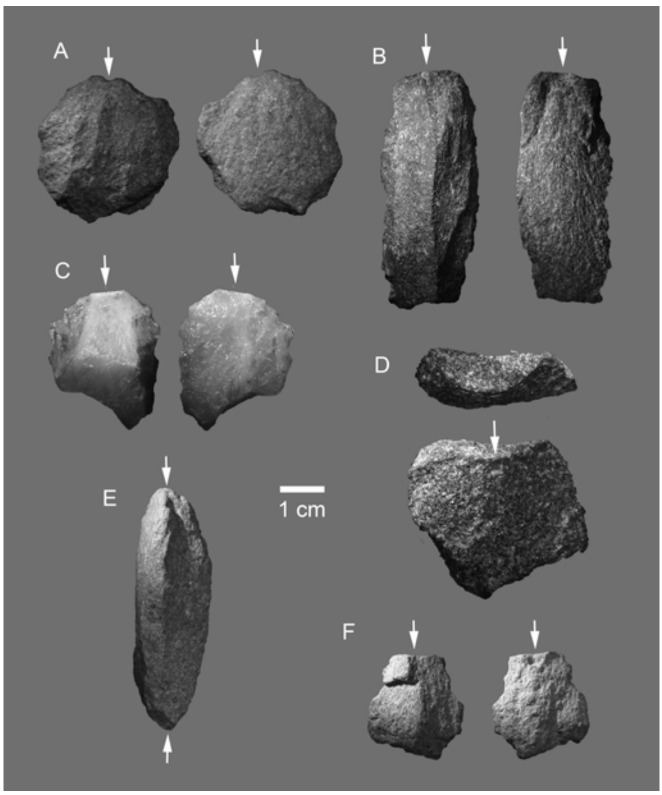

Fig. 3. Examples of pseudo-artefacts produced by gravel crushing: (a) dorsal and ventral view of a flake of unidentified reddish rock with heavy edge modification, (b) dorsal and ventral view of a blade of grey unidentified rock, (c) dorsal and ventral view of a quartz flake produced by gravel crushing, (d) proximal and ventral view of a flake of grey unidentified rock with clear herzian initiation and platform remnant, (e) bipolar core of reddish unidentified rock, (f) dorsal and ventral view of a flake of red unidentified rock with a step termination scar from a previous flake detachment on the dorsal surface. All examples are collected from parking-lots and roads recently covered with crushed gravel. A snapped distal end seems to be common in gravel crusher flakes.

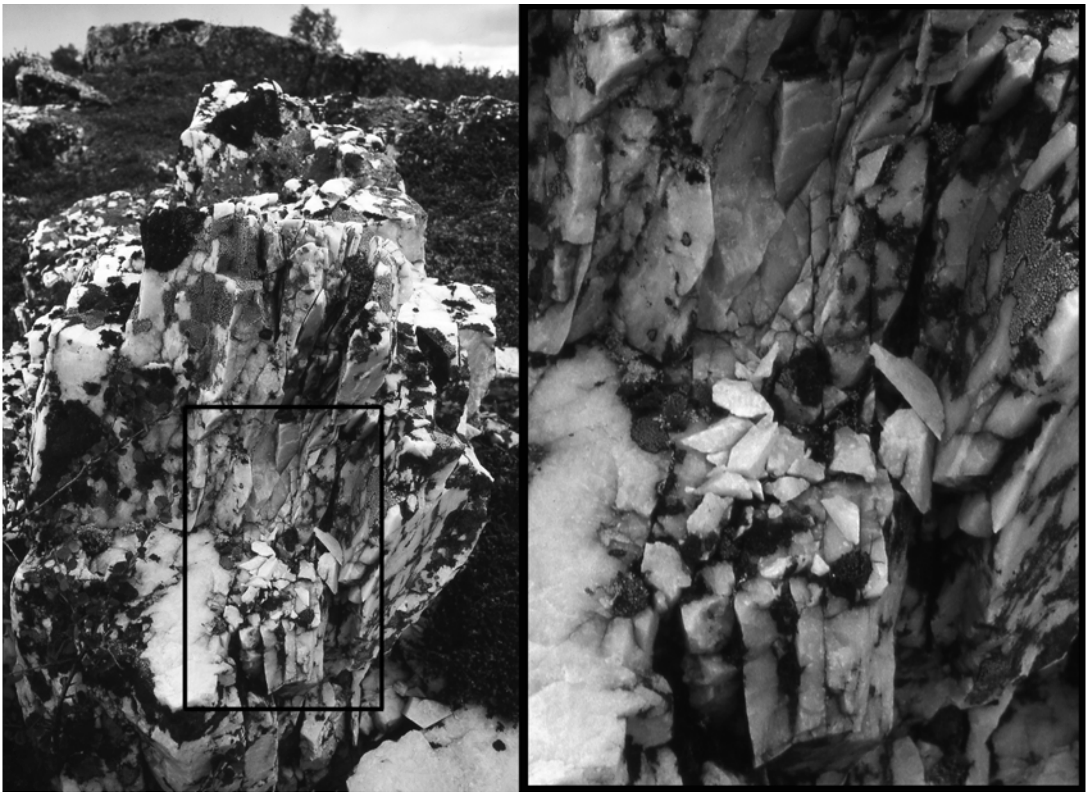

Fig. 4. Left: a heavily frost-fractured quartz boulder in Utsjoki. Right: an enlargement of the area inside the rectangle.

Warren (1914: 434) noted its existence: 'It is so easy to argue in a circle to show that our series of flints indicates intelligence, and not to see that the intelligence has been put into them by ourselves, in our own selection out of the infinite variety of Nature.'

SOME SOURCES FOR PSEUDO-ARTEFACTS IN FINLAND

The most common situation where the question of possible pseudo-artefacts arises in Finnish archaeology is when a possible site with only fractured rock is found. It is widely known that fractured quartz, the most common find category especially on Mesolithic sites, may in some cases be a by-product of industrial activities such as gravel-crushing (Fig. 3) or glass manufacturing (see Matiskainen et al. 1991: 70). Quartz, as well as other rocks and minerals, can also be flaked by natural processes such as frost (Fig. 4), glacial transport, wave action, cryoturbation, and pressure of overriding ice (see e.g., Barnes 1939; Boulton et al. 1974; Stapert 1976b: 28–9; Kleman 1988: Fig. 9; Gillespie et al. 2006: 616), heavy machinery (Fig. 5) and in rare cases even by hoofed animals such as reindeer and cattle (Miller 1982).

Despite the usual heavy rounding of stones in the glacial tills in Finland, fractured rock can be found also in contexts where Holocene human involvement is very unlikely. Stones with a striking resemblance with humanly flaked cores, flakes, and implements can be found for example in moraine deposits (Fig. 6) and on the present sea shore (Fig. 7). Fractured stones found in contexts where Holocene human involvement is ruled out can be explained in two possible ways: either they are stones fractured by glacial or later natural processes or they are artefacts that have survived the glacial processes commonly thought to have destroyed all evidence of Pleistocene human occupation in Finland.

A systematic study of this kind of fractured

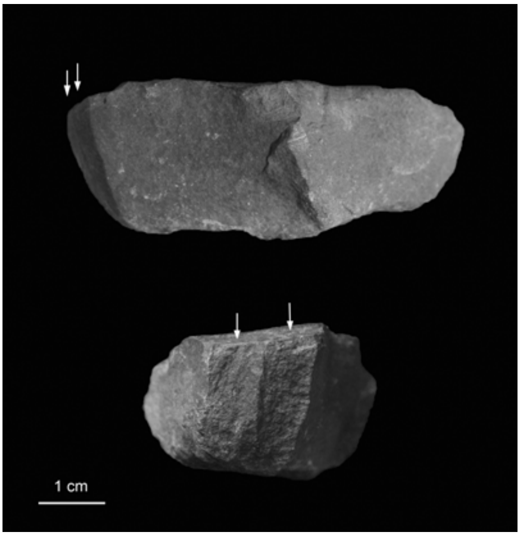

Fig. 5. Side and frontal view of a sandstone 'handle core' from Karijoki with two adjacent flake scars flaked by a car tire. The detached flakes were found in situ.

stones and especially their mode of origin would therefore be beneficial for Finnish archaeology either as potential evidence for Paleolithic occupation in Fennoscandia or as naturally fractured reference material for the finds of the only suggested Paleolithic site in Finland, the Susiluola Cave.

SUSILUOLA CAVE – A SPECIAL CASE?

The interpretation of Susiluola Cave as showing evidence of Pleistocene occupation (Schulz et al. 2002; Schulz 2005a; 2005b) has been questioned by several authors (e.g., Kinnunen 2005; Matiskainen 2005; Pettitt & Niskanen 2005; Donner 2006). The fact that archaeologists and geologists involved in the discussion are not always speaking about the same things (Schulz 2005a: 44) or familiar with each others methods has been a major hindrance in the discussion. A case in point is archaeological lithic illustration which does not aim at realistic drawings (contra Donner 2006: 7) but is a tool for illustrating the (sometimes eroded) fracture features in a given find (e.g., Addington 1986).

However, since the problematic nature of the fractures in the illustrated finds from Susiluola cave has been already pointed out earlier (Pettitt & Niskanen 2005: 84–6) it is not the intention here to discuss the finds one by one or comment on the earlier discussion. Some notes on the possibilities of finding conclusive evidence on whether the finds are artefacts or pseudo-artefacts are instead made.

The published finds from the cave consist of at least six rock types (Schulz et al. 2002: 18–20) of which Jotnian and red sandstone and red siltstone are all sedimentary rocks that differ mainly in grain size and possibly all derive from the same Jotnian sandstone formation. From a lithic technological point of view all of these rocks, constituting two thirds of the finds from layers IV and V reported in Schulz et al. (2002: Table 6), could be classified also as different grades of the same material.

As has been demonstrated by Hertell (2006) the 'better' grades of this material fracture easily into flakes and cores in which the signs of fracture are easily read. In this light the results by Kaitanen & Ström (1978) discussed by Kinnunen (2005) regarding the shapes of glacially transported sandstone cobbles are interesting. The natural cleavage plains present in sandstone seem to produce cobbles in which natural platforms with varying platform angles are common. Natural platforms facilitate fracture initiation and make flaking by both nature and humans easy since the cobbles do not need to be opened and a platform created. Together with the good flaking properties of the material this of course means that also the probability of pseudo-artefacts is much higher in environments, such as the surroundings of Susiluola Cave, where sandstone cobbles of different grain sizes are present than in environments where only round cobbles and possibly also rocks with less ideal flaking qualities are found. However, a higher probability of pseudo-artefacts does not mean that also man-made artefacts could not be present – it is known, for instance, that rocks deriving from the Jotnian sandstone formation were used at sites close to Susiluola Cave during the Holocene (e.g., Hertell & Manninen 2005: Tabell I).

With this in mind it becomes clear that the criteria used to separate pseudo-artefacts from artefacts in the original publication of the finds (Schulz et al. 2002: 21–3; Schulz 2005a: 45) are not adequate since they were only aimed at separating finds with signs of flaking by pressure or percussion from the rest of the material. New research would therefore be needed to compare

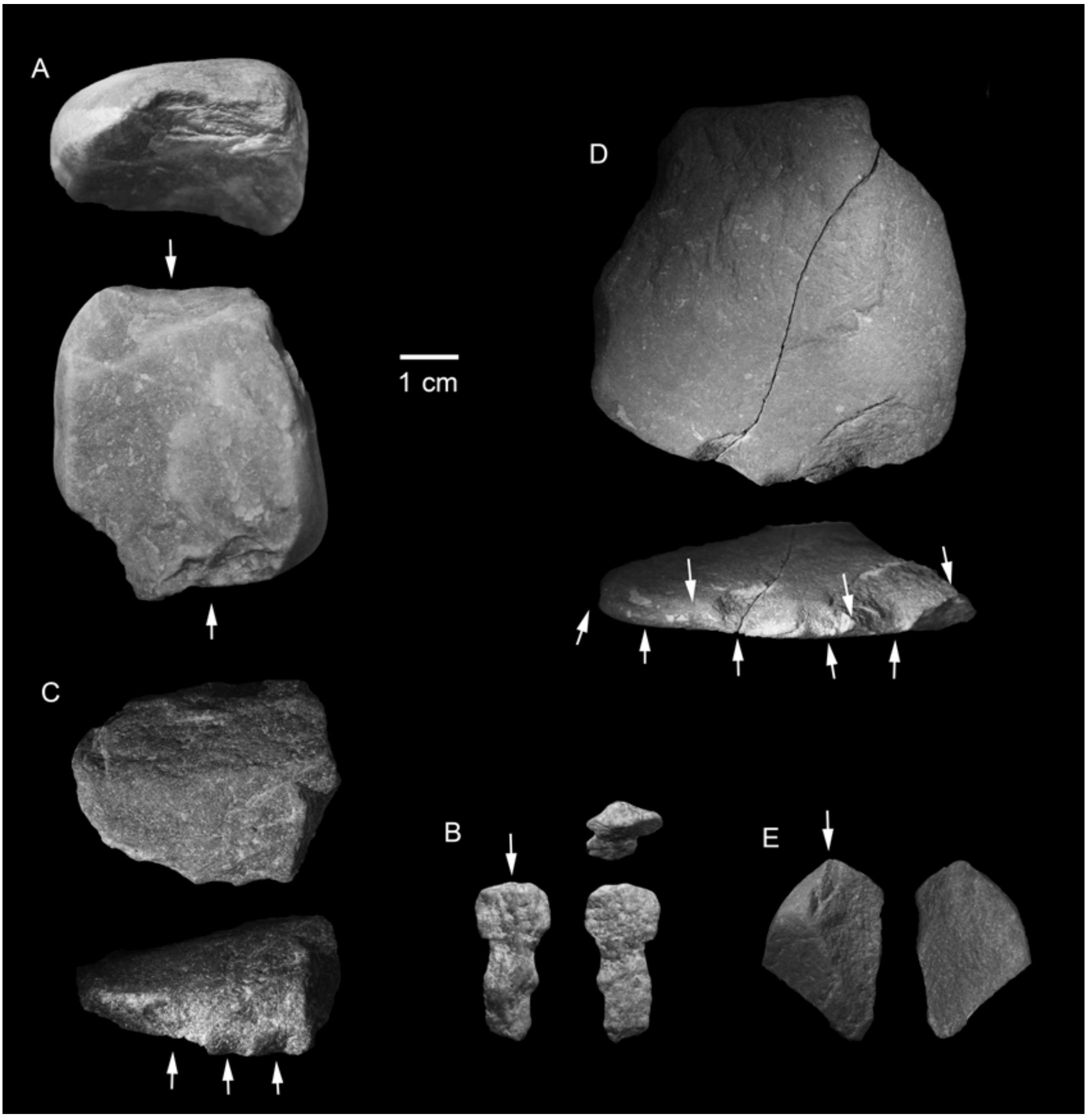

Fig. 6. Examples of fractured stones found in tills: (a) Proximal and ventral view of a bipolarly fractured quartz cobble from Utsjoki, (b) Dorsal, ventral and proximal view of a blade-like flake of yellowish unidentified rock from Honkajoki, (c) Dorsal and edge view of a 'denticulate' or 'notched piece' of red quartzite, (d) Dorsal and edge view of a chopper-like pseudo-artefact of red sandstone fractured in two conjoining pieces, (e) Dorsal and ventral view of a flake of red sandstone. Examples (c), (d) and (e) derive from the gravel pit east of Susivuori Hill in Karijoki. Note the rounded edges and surfaces.

whether the *form selected* fractured stones from inside the cave are significantly different from a large enough form selected sample collected from the gravels nearby.

This kind of comparison is never unproblematic, however, since the reference material should preferably be from an analogous sedimentary environment (Chlachula & Leslie 2001: 876). In the case of Susiluola Cave the effects of glacial and littoral processes known to have affected the sediments in the cave, such as wave action and ice push of sediments and big boulders (Schulz et al. 2002: 11–3, 18), remain unknown and therefore an analogous context is hard to find. If similar frequencies of similarly fractured rocks as the suggested artefacts from the cave were present

Fig. 7. A large boulder with a bifacially flaked edge on the sea shore in Hailuoto. Photo courtesy of Esa Hertell.

also in gravels outside the cave it would, nevertheless, indicate that finds from the cave are not unique in the area and a much larger picture requiring explanation would emerge.

At the moment, like on any archaeological site, there are at least three possible scenarios for the origin of the Susiluola Cave finds of which none can be totally ruled out: 1. They are all artefacts, 2. They are all geofacts, 3. They are partly artefacts and partly geofacts. It is important to keep in mind that in considering all of these scenarios the formation of the flake blanks and the formation of the edge modifications should be treated separately. For instance, of the seventeen finds interpreted as tools in Schulz et al. (2002: Table 8) eight are denticulates and notched tools on flakes. These types are known to be common in post-depositionally altered flake assemblages as a result of geological and human disturbance (Dibble et al. 2006: 4, 11).

All this said, it must be concluded on the basis of several similar cases in the history of archaeology that it is very likely that conclusive evidence of the origin of the Susiluola Cave finds will never be reached. However, results that would make one of the above mentioned scenarios more *likely* than the other could possibly be reached with more research on the context of the finds and the sediments around the Susivuori Hill.

FINAL REMARKS

Knowledge of the fundamentals of flaking is becoming more and more common among Finnish researchers and consequently an interest in fractured rock found in contexts where no other signs of possible prehistoric human activity are present is also growing.

A rule of thumb for situations where the (prehistoric) artefactual nature of fractured rock is doubted is, besides looking for the basic signs of fracture by pressure or percussion which should not be present in frost fractured material, to study carefully the context where the finds are made and try to locate the possible sources of pseudo-artefacts. Since the facture types are the same for prehistoric and modern artefacts as well as geofacts it is often impossible to draw definite conclusions from just a small sample of fractured rock. Then again, in the case of, for example, quarry sites and small task-specific sites fractured rock is often the sole find category.

As has been noted before, however, when discussing controversial finds it is not enough to just mention different geomorphic processes that can produce geofacts (Patterson 1983: 298; Gillespie et al. 2004: 616). This applies also to man-made pseudo-artefacts and it would therefore be important in the future to study the effects that different processes have on local rocks and minerals in Finland.

The best option would be if this kind of research could be conducted as a collaborative project between archaeologists and geologists. Besides combining expertise from both fields it would also help in developing a better understanding among researchers of methods and terminology used in both disciplines. For instance names used for rock types by archaeologists and geologists are not always the same although both have good reasons for their use.

Research on processes that produce pseudo-lithics in Finland is needed especially since the local rocks and therefore also the raw materials used at Stone Age sites as well as the geological history of the country differ from many other areas. Different raw materials produce different raw material economies and artefact types (Rolland & Dibble 1990) as well as different kinds of pseudo-artefacts when compared with other raw materials.

Stone Age archaeology in Finland would benefit greatly from this kind of research since the fracture qualities of many of the rocks that are known to have been used are poorly known. Also the discussion around the finds from Susiluola Cave has been occasionally infested with the use of *argument from authority* because of a lack of scientific data on which arguments could be based on. Further research on the topic of pseudo-lithics and natural fracture would eventually produce such data and hopefully bring the discussion closer to an agreement.

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