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NEANDERTHALS IN SUSILUOLA CAVE, FINLAND, DURING THE LAST INTERGLACIAL PERIOD?

Abstract

Here, we evaluate arguments that excavations in Susiluola Cave in Finland at 62° 18′10″ N have provided evidence that Neanderthals inhabited Finland during the Last Interglacial (OIS 5 *sensu lato*) period. We argue that the lithic 'artefacts' recovered from Susiluola Cave Layer IV 2 are natural inclusions that could well have been transported into the palaeosol from elsewhere, none of them is unquestionably manmade and that the scattered burnt stones in Layer IV 2, which were claimed to indicate the presence of human campfires, could well have resulted from natural fire. Although we conclude that Susiluola excavations have not provided convincing evidence that the Neanderthals inhabited Finland during the Last Interglacial period we acknowledge that Schulz et al. (2002) have done all of us a service by publishing findings from Susiluola Cave in such a clear manner that facilitate formal exchanges of views regarding the evidence.

Keywords: Neanderthals, Susiluola Cave, Mousterian, Last Interglacial

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INTRODUCTION

Schulz et al. (2002) have published a preliminary report of their excavations in the Susiluola (Wolf) Cave, in which they suggest that artefacts recovered from a palaeosol of apparently Last Interglacial age (OIS 5 *sensu lato*) indicate the presence of humans, presumably Neanderthals (*Homo neanderthalensis* King 1864), who lit fires and knapped various stones in the cave and the cave mouth somewhere prior to ~100,000 BP. If their controversial (see Rydman 2004; Carpelan 2005; Kinnunen 2005; Matiskainen 2005; Saarnisto 2005) interpretation of the data is correct, the cave and its materials will dramatically alter our perception of the geographical range and environmental tolerances of this human taxon, which has to date been seen to have been restricted to mixed open/woodland environments of mid-latitude Europe and to have flourished in the earlier and late parts of interglacials in environments that were not as heavily wooded as those of the OIS 5 period northern Europe (van Andel and Tzedakis 1996; Huntley et al. 2003; Finlayson 2005; Hockett and Haws 2005). Such views are in accord with notions of the Neanderthals as highly predatory encounter hunters dependent in the main on herds of medium and large-sized herbivores for survival (Richards et al. 2000; Bocherens et al. 2001, 2005; Hockett and Haws 2005).

The apparent recovery of OIS 5 archaeology from the Susiluola Cave would, if genuine, suggest that Neanderthals, at least on occasion, had

a distribution far more north than the northernmost definite Last Interglacial site located at c. 58° N (Pavlov et al. 2004), were capable of exploiting coastal resources (not common until Late Upper Palaeolithic, Richards et al. 2005) and possibly even colonising islands, apparently under heavily wooded interglacial conditions (van Andel and Tzedakis 1996; Huntley et al. 2003). The Interpleniglacial (OIS 3) period human settlement of Finland would have been far less astonishing for paleoenvironmental reasons (van Andel and Tzedakis 1996; Huntley et al. 2003; Ukkonen and Mannermaa 2004) and because humans definitely inhabited the northernmost Russia at least part of OIS 3 (Pavlov et al. 2001, 2004).

Schulz et al. (2002) have done us a good service by presenting their view to date that there are indications of anthropogenic contributions to the sediments of the cave in the Upper Pleistocene. They present enough data and, especially, illustrations to facilitate independent evaluation of their argument, which is, we assume, the purpose of their publication. Recently Schulz has noted that since the original publication of 2002, no one has yet criticised formally, the conclusions of Schulz et al. (2002) that Susiluola Cave represents Neanderthal activity in the Upper Pleistocene (Schulz vs. Pellinen 2005). We realise that our subject advances by formal exchange in the literature, rather than informal critiques that do not facilitate responses.

Here, we throw down the gauntlet in the spirit of friendship and evaluate their argument for Upper Pleistocene human presence in Finland during the Last Interglacial. On the basis of their geological, sedimentological, geochronological and (especially) artefactual arguments, we are not convinced that they have a) eliminated all possible natural process for the formation of the critical Layer IV 2 and b) demonstrated beyond reasonable doubt that human presence is implied by the data. We evaluate their specific arguments and the existing data below, and come to the working conclusion that there is as yet no convincing evidence of human activity at the cave. We therefore maintain a view based on scientific parsimony that the lithic 'artefacts' from Susiluola Cave Layer IV 2 are natural inclusions in the palaeosol which developed some time in the Upper Pleistocene during which time there was no human presence in this region. Until these ambiguities can be eliminated, we stress that Susiluola Cave should *not* be taken to provide evidence of Neanderthal presence in Finland. We would welcome the clarification of these ambiguities and the elimination of perceived problems, only from which should come the construction of a firmer base of inference for making claims of Neanderthal presence in Finland.

SUSILUOLA CAVE: THE VIEWS OF SCHULZ ET AL. (2002)

Excavations at Susiluola Cave, a large cavern several hundred square metres in size located on the northern slope of Susivuori Hill 2 km west of Karijoki in the province of south Ostrobothnia, began in 1996 and continued in 1997. Preliminary results of a multidisciplinary project were published by Schulz et al. in 2002, the thrust of which was to demonstrate the Upper Pleistocene antiquity of human presence in Finland. As we understand the situation, the combined regional geology, sedimentology, palynology, geochronology and possible archaeology from Susiluola Cave suggests human activity in the cave/just outside of the cave entrance, in the Last Interglacial *sensu lato* (OIS 5, possibly OIS 5e) during which time the site lie either at the Eemian Sea coast or even on an island in the Eemian Sea (see Kakkuri and Virkki 2004). This activity – assumed to represent the Eurasian Neanderthals, given the apparent absence of any other known human taxon in Europe at this time and on the basis of OIS 5 archaeology elsewhere in Northern Europe, takes the form at least of a) the knapping of locally available stone and potentially stone imported from non-local sources, and b) the lighting of fires.

HOW OLD IS THE LAYER IV 2 PALAEOSOL?

Although accurate and precise dating of the Susiluola Cave sediments is hampered by the lack of preserved organics, Schulz et al. (2002) present IRSL and TL measurements of samples from Layers IIa, IV and V. These are taken to suggest that the age of Layer II is younger than or equal to ~35,000 BP; that the age of Layer V is younger than or equal to ~90,000 BP; and that the age of Layer IV (broadly of OIS 5 age) appears to have been older than the underlying sediments of Layer V which is ascribed to 'very poor bleach-

ing' of the Layer IV deposits (Schulz et al. 2002: 15). It is difficult to interpret this set of dates given that, rather surprisingly, the authors present no errors. We assume that the precision of these measurements is typical of their kind, i.e. ±10 % of their mean. Thus, the 'dates' of ~128,000 BP (IRSL) and ~148,000 BP (TL) for Layer IV presumably have errors in the order of 12-14,000 years. At two sigma error, this would make the chronometric age ranges of these measurements ~158,000 – 98,000 years. While the general age range of these samples is generally in accord with the sedimentological indications that the Layer IV palaeosol obviously developed on dry land and is therefore of broadly Last Interglacial age, the chronometric data as published do not independently support this notion, especially given the poor bleaching of the Layer IV samples. Thus, while we accept on geological and sedimentological ground the broad ascription of the levels of the cave to OIS 5 we feel that the chronometry of the site could be improved in terms of precision.

PROBLEMATIC ISSUES RAISED IF THIS IS AN OIS 5 NEANDERTHAL OCCUPATION

Taking the arguments of Schulz et al. (2002) at face value, i.e. the presence of Neanderthals in Finland at around 62° N under full interglacial conditions, a number of problematic issues are raised, which in a number of ways either contradict our understanding of Neanderthal activities to date or at least require explanation. These are:

1. The presence of Neanderthals this far north in the Pleistocene. This is not so much of a problem *per se* (see Pavlov et al. 2004), although the absence of convincing traces of Neanderthal presence elsewhere at the same latitude is problematic.

2. The presence of Neanderthals in a coastal habitat or even on an island. Given that hardly any of the Neanderthal sites were coastal sites and water seems to have presented something of an obstacle to Neanderthal colonisations elsewhere (e.g. Africa from the nearest European point, i.e. the southern tip of Spain/Gibraltar and the United Kingdom unless it was joined to the continental mainland), we wonder how this site, which was possibly an island was colonised by regional Neanderthal groups for which we have no other evidence, and how this coastal or island community could have supported large-bodied human predators which we assume Neanderthals were.

3. The presence of Neanderthals in a full interglacial environment. Although on a continental scale Neanderthals could and did extract useful resources from wooded landscapes, broader contexts of these finds indicate that their main resource-extraction areas were relatively open grasslands on which they could exploit large herds of gregarious herbivores (Hockett and Haws 2005). The restricted territory available especially if an island site, and dense interglacial woodland vegetation as suggested by the palynology, raises issues as to how Neanderthals could cope with such environments, as has been debated before (e.g. Gamble 1992, 1999; Roebroeks et al. 1992). At Susiluola, we are presented with data that we find problematic, namely: an apparently Neanderthal (i.e. Mousterian) technical adaptation to small pebbles of raw material which a) we are not convinced is of anthropogenic manufacture, b) seems to have required the transportation of a material (Red Siltstone) of poor knapping quality, c) seems to reflect a poor technical adaptation to the nature of the available raw material, d) lacks convincing examples of Mousterian analogues from broadly contemporary working of similar raw materials by Neanderthals elsewhere, and e) results in flakes of such a small dimension that we wonder about their efficiency in the very broad and thick-fingered hands of the muscular Neanderthals (Trinkaus 1983). We are obviously not ruling out an anthropogenic interpretation of the artefacts on such grounds, but to interpret them in this way requires that they be addressed. But are they truly anthropogenic?

ARE THE LITHIC ARTEFACTS HUMANLY MADE, OR NATURAL?

Several points are forwarded by the authors to substantiate their views that a number of the lithic artefacts recovered from Layer IV 2 are humanly made:

1. The artefacts were recovered apparently *in situ* from the Layer IV 2 palaeosol.

2. The raw material composition of lithic pieces from this layer is thought to be different from that of the littorally-deposited and moved artefacts from the overlying Layer III and underlying Layer V, implying different depositional processes for Layer IV 2.

3. Some of the raw materials on which possible artefacts were made *possibly* derive from a non-local source.

4. Apparent traces of fire-modified natural rocks in Layer IV 2 are seen to suggest the lighting of hearths by humans.

5. A number of lithic artefacts from Layer IV 2 are seen to possess clear signs of human workmanship, in the form of varying but systematic flaking of small pebbles by methods known to Neanderthals in OIS 5, the age at which it is thought that Layer IV 2 was deposited.

Here, we address the arguments of Schulz et al. (2002) in these issues and raise several problems that we feel require resolution.

WERE THE ARTEFACTS IN SITU IN LAYER IV 2?

As the authors are well aware, Susiluola Cave is located in a region that was covered by numerous Pleistocene glaciations, has been affected by innumerable periglacial processes, and in which decent dry land cover has only been present since the early Holocene. We might therefore be entitled to be rigorous in any evaluation of claims for human presence in the Pleistocene, particularly for taxa (i.e. the Neanderthals) for whom such distributions is not apparent elsewhere. This need not, of course, demonstrate that Neanderthals were not present here – absence of evidence of course need not provide evidence of absence – but it certainly strengthens the need to eliminate all possible natural factors in the formation of sites of this nature before coming to strong conclusions that human presence is necessarily indicated.

Almost all of the sedimentary infill of Susiluola Cave was deposited by the Eemian sea (Layers I, IV, V and VI) or, potentially, by glaciers (II and III). The critical Layer IV is largely a gravel and sand (i.e. littoral) deposit, in which developed a palaeosol that formed the interglacial floor of the cave. In general then, and by the authors' own admission, layer IV, and layers I, V and VI '…are clearly littoral deposits' (Schulz et al. 2002: 13). The palaeosol which contained lithics interpreted by Schulz et al. therefore developed in a gravel and sand matrix. The authors summarise the condition of Layer IV lithics in their Table 5 (Schulz et al. 2002: 29), and from this data it can be seen that with the exception of fine-grained quartzite, between 81 and 96 % of the artefacts show signs of abrasion and edge rolling. In fact, 33–44 % of materials show signs of strong rolling and destruction of surface features. Although the authors present no comparative data on clearly natural lithics from Layer IV or neighbouring Layers III and V (which we strongly suggest they do) it is quite clear that the majority of lithic items from the Layer IV 2 palaeosol are highly weathered. We find this to be inconsistent with the notion that they were deposited *in situ* atop/among a soil at the mouth of or within a cave, there to remain for ~100,000 years. If we assume that the apparent traces of burning on natural pebbles in this layer represent hearth (which we discount – see below) the lack of preserved hearths *in situ* is also a problem. It seems a clear working hypothesis to us that the lithic pieces in Layer IV 2 have been transported into the palaeosol from elsewhere. We acknowledge the authors' observation that refitting – which would allow a greater confidence in the integrity of the deposit – has not yet been possible due to the surface damage, but this damage apparently does not prevent them from making clear identifications of dorsal removal scars and inferring technological procedures from these. If this is possible we assume refitting should be too. In addition, the vertical integrity of the 'artefacts' should be revealing: how tightly, for example, do they cluster within the palaeosol? We would expect a thin vertical distribution and perhaps clear isolation of this stratum from the overlying and underlying gravels of Layer IV if they do indeed reflect human use of the cave during a relatively discreet period of time.

Since layers in the cave are clearly mixed (Saarnisto 2005), we suggest, as a hypothesis that requires elimination, that the lithic objects in the

Layer IV 2 palaeosol, derive from the gravels of Layer IV, and were transported into the Palaeosol either during deposition (i.e. from above) or postdepositionally. We feel that an adequate demonstration that the damage levels on these artefacts was considerably less than that from surrounding gravels, and the demonstration of clear spatial (horizontal and vertical) integrity of these artefacts is necessary as a minimum to clarify the issue of whether they are *in situ* or not. As it stands, we are unconvinced.

ARE THE LITHIC RAW MATERIALS FROM THE LAYER IV 2 PALAEOSOL CLEARLY DIFFERENT TO THOSE FROM THE LAYER IV GRAVELS?

The possible humanly-produced artefacts from Layer IV 2 are described as having been made on small pebbles of red siltstone ('<10 centimetres, possibly mainly oval, with flat sides', Schulz et al. 2002: 25) in addition to other materials presumably from the same sources and of the same form as naturally occurring gravel inclusions from Layer IV and other layers in the cave. The authors note the problems in trying to isolate lithic artefacts that have been introduced by humans from those deposited naturally in sedimentary contexts wherein the majority of layers are formed from pebbles of the same materials that the apparent artefacts are supposedly made from (Schulz et al. 2002: 21), and that in such natural deposits '…naturally cracked rocks that appear to show evidence of deliberate reduction are known from many contexts' (Schulz et al. 2002: 21-2). They can, for example, be found in most solifluxion/gelifluction deposits as well as fluviatile and littoral gravels such as those that comprise the sedimentary matrix of Susiluola Cave. It was such artefacts that led Reid Moir to his long-discredited suggestion that 'Eoliths' from river terraces in the United Kingdom represented human activity in the Pliocene (Reid Moir 1927). To eliminate the possibility that the Layer IV 2 artefacts were created by a potential number of glaciofluvial processes – which for us seem most likely given the context of the finds – the authors compare raw materials of gravels from Layers II to VII. We note their sampling strategy ('bigger pebbles 5–15 centimetres were collected from about 50 % of the excavated area', Schulz et al. 2002: 23). Given the diminutive size of the potential artefacts and the authors' belief that Neanderthals were working pebbles smaller than 10 cm in maximum dimensions, we wonder whether this sampling strategy is particularly well suited to addressing this question. We agree with the authors' contention that 'if natural processes had formed all or a major part of the lithic material classified as artefacts, the frequencies should be at least similar' (Schulz et al. 2002: 23) but we question the validity of their conclusion that the raw material composition of Layer IV 2 differs significantly from Layer IV and other layers in general and that this difference reflects human action. Of course we might expect the formation of Layer IV 2 to differ from the gravel contexts as it is a palaeosol. The authors present a breakdown of raw material types across the layers in their Figures 10–12. Rather than seeing clear differences between Layer IV (which they appear to treat as a homogeneous unit as opposed to isolating the artefacts from the palaeosol) and the other (littoral) layers, we see general similarities across the layers, with the few differences observable parsimoniously explained due to the varying glaciofluvial processes that affected the area across large amounts of Pleistocene time. Layer IV contained frequencies of artefacts intermediate between Layers V and VI (which are both natural in origin) for which therefore we would invoke no special argument. Oddly, Schulz et al.'s Figure 11 shows only quartzite used 'as raw material' in layer IV while in the text they discuss a wider range, and show more variable materials in the natural deposits of other layers. We are confused about their arguments here, and in no way do we feel that their treatment of raw materials need invoke human presence. The frequencies of naturally cracked stones in Layer IV is both greater than some of the littoral gravel deposits in the cave (e.g. Layers V, VI, VII) or lower (Layers III and II). In fact, a glance at their Figure 12 demonstrates a clear pattern of *increasing* frequencies of naturally cracked stones in the cave's sediments over time, which we suggest is parsimoniously interpreted solely in terms of natural processes (e.g. cumulative postdepositional shattering).

We are unconvinced that there are any gross differences in the composition of Layer IV and any other layers. The differences that have been observed, we argue, can be explained by natural

factors. Schulz et al. need to eliminate these and demonstrate strongly why they feel the minor differences observed need reflect human activity. We also feel they need to demonstrate that their samples have not been subject to collection bias.

ARE ANY OF THE LITHICS FROM NON-LOCAL SOURCES?

The presence of artefact materials from clearly non-local sources would clearly improve arguments for their anthropogenic introduction to the cave, although given the complexity of Pleistocene glacial and periglacial activity in Finland one can never rule out natural processes in the movement of relatively small amounts of materials.

Of the six main lithic raw materials represented in Susiluola Cave (especially Layer IV) four are local in source. Two – the fine-grained quartzite and the red siltstone – are seen by Schulz et al. as possibly non-local (Schulz et al. 2002: 19). The source of the fine-grained quartzite is *unknown*, and given this and poorly understood glaciofluviatile processes, one presumably cannot rule out a local origin. The red siltstone, although the source of which is seen to be unknown, is noted to occur as boulders and pebbles in glacial sediments in SW Finland, and as lenses in the Jotnian sandstone formation (Schulz et al. 2002: 19). As this formation is local, e.g. at the bottom of the Gulf of Bothnia and to the south of Karijoki, we may therefore assume that the red siltstone was easily eroded from primary and secondary deposits in the region of Susiluola Cave. At present, there is no reason to assume that any of the materials are non-local. We suggest that a working hypothesis is that all materials represented in the cave derived from local primary and secondary sources and were deposited naturally.

DO THE SCATTERED BURNT STONES REFLECT HUMAN USE OF FIRE?

As Schulz et al. clearly note, 'Layers IV-VII contain no structures in clear context that would indicate the presence of hearths in the cave' (Schulz et al. 2002: 18). This being said, they interpret '…scattered burnt stones in Layer IV 2' as traces of fire. Despite the fact that '…these stones were clearly in a secondary position' (Schulz et al. 2002: 18) magnetic susceptibility measurements showed a number of strong anomalies in the finest sediments near the stones which were taken to 'indicate camp fires during the occupations of Layers IV and V' (Schulz et al. 2002: 18). There are at least two problems here. First, and assuming one has confidence in the magnetic susceptibility technique, the presence of burnt stones and heat-shattered rocks may indicate fire, but it does not discriminate between humanly made and natural fire, a problem that has long been appreciated by palaeoanthropologists. Secondly, as the authors' are clearly aware, the 'burnt' stones are clearly not in primary position. How confident therefore can they be that smaller artefacts of apparently worked stone *are* in primary context? A parsimonious interpretation would see all components of Layer IV 2 as deriving from similar processes, i.e. all in secondary position. We suggest as a working hypothesis that, if convincing, these traces of fire reflect redeposited traces of natural fires – common elsewhere in the Last Interglacial. The authors need to eliminate this possibility before making confident identifications of human campfires in the cave, that have to all intents and purposes disappeared whilst leaving intact magnetic susceptibility traces. We thus agree with Matiskainen (2005) that there is no convincing evidence of Palaeolithic hearths in this cave.

ARE ANY OF THE LITHICS FROM LAYER IV 2 THE PRODUCT OF HUMAN (NEANDERTHAL) ACTIVITY?

We appreciate that, with lithic technology, there comes a point at which naturally fractured lithic materials, particularly pebbles in glaciofluval contexts, are impossible to distinguish from those that are the products of human activity. Of interest here, however, is the fact that the currently earliest known African Oldowan assemblages (>2Myr BP) such as Lokalalei 2C and Kada Gona are readily distinguishable on a number of technical grounds from the shattered lithics produced and excavated at chimpanzee nut-cracking sites (Semaw et al. 1997; Roche et al. 1999; Mercader et al. 2002). Many Middle Palaeolithic technologies – for Neanderthals these would include discodial/centripetal core reduction, single and recurrent flake and laminar Levallois reductions,

biface production, and 'Quina' and related 'salami slice' technologies akin to discoidal methods – leave clearly identifiable traces in the form of flake/blade platform, platform modification, and dorsal scar number, size and orientation. With medium and fine-grained raw materials even simpler technologies such as random multi-platform flaking can leave obvious traces of striking platforms and bulbs of percussion, e.g. as at the 0.5 Myr old Lower Palaeolithic site of High Lodge in the United Kingdom (Ashton et al. 1992). Retouch, where present, we take to be fairly regular, i.e. continuous and producing a regularly shaped edge, and at the same time without gross irregularities in the size and shape of removal scars or battering which may be ascribed to natural processes. Most naturally fractured products bear traces of a) being removed from a 'core'; b) dorsal scars indicative of 'previous removals' and c) some 'edge retouch'. Simply documenting the gross presence of these is not convincing *per se*. In the absence of obvious traces of working, and in this case the absence (we feel) of characteristic Neanderthal techniques (see below), we agree with many other researchers (e.g., Rydman 2004; Kinnunen 2005; Matiskainen 2005) that Schulz et al. have not convincingly eliminated natural causes for the modified artefacts they illustrate in Plates 1-3.

Here, we work through the lithic 'artefacts' illustrated by Schulz et al. and use our own criteria to evaluate the reliability of these pieces as unambiguous indicators of human lithic technology. Although Schultz et al. (2002) note *in erratum* that the captions to the plates have been confused, we follow the plate and item numbering as they appear, as the authors' description of the pieces does not concern us. We note pieces by plate, followed by item, thus 1.1 refers to Plate 1, Item 1.

I.1-2: this coarse pebble bears the very rough outline of up to six removals across one face. As the fracture mechanics of this material is hardly known, we suggest that several of these could have been removed in one kinetic event, as often happens on brittle, coarse-grained materials. Thus, one or two 'bumps' could account for this piece. The resulting 'edge' is irregular and given the size of the piece (7 cm in maximum dimension) we question it efficacy as a tool, especially a 'chopper' as Schulz et al. identify it. The same argument can be advanced for 1.2, which bears a very low number of highly irregular and non-invasive removals including an obvious natural fracture across a second face.

I.3-4: these are described as 'sidescrapers' although the retouch is abrupt, irregular (on 1.3) and highly irregular (1.4) and the edge shape of 1.4 is also irregular. The maximum dimension of these pieces is 5 cm and the illustrations reveal signs of battering. We believe these are natural artefacts and would anyway question the efficacy of these pieces in the hands of a muscular Neanderthal that has very broad hands and thick fingers (Trinkaus 1983).

II.1-3, II.5, II.9-11: these are all <3 cm in maximum dimension, bear signs of battering and 1-3 removals. They are totally undiagnostic and cannot be demonstrated to be of non-natural origin.

II.4: up to four removals are shown from apparently four distinct directions. From the morphology of this piece it is difficult to see how this would be a sensible reduction strategy, or indeed possible: one removal – hardly invasive at all – seems to come from a 'platform' of >90 degrees, a technical impossibility.

II.6-7: the very small size of these pieces (<5 cm maximum dimensions), their 'globular' shape and the random scars of small dimensions suggest these are natural. If they are flakes as the authors suggest, they would be functionally useless.

III.1: this is the only piece with fairly regular retouch and a regular convex edge. Given the nature of the pebble fragment it is on the regular edge is probably natural, and in any case the very short, non-invasive retouch could not have modified the edge very much beyond its natural shape. The status of the piece as a product of human hands stands or falls on this retouch. We feel that this is obviously not enough.

III.3, III.5-6: these pieces are clearly natural. Only III.3 may be said to have clear removals, but a large 'Clactonian notch' with clear 'nibbling' removals inside it is far more likely to be naturally produced. One of us (PP) excavated an example of such from a British Lower Palaeolithic context, which had been produced by pressured contact with a natural pebble in a low energy setting.

III.4: this bears five very small abrupt notch-like removals, producing an irregular edge. It cannot be described as a sidescraper but fulfils

the criteria of a denticulate. The size of this piece (4 cm maximum dimensions) is worrying and again we wonder the efficacy of this piece in the hands of a Neanderthal. While we feel that we cannot rule out the possibility that this piece was humanly made, given that such 'denticulates' can be, and have been produced by natural factors (such as sedimentary pressure as in the example above, and cryoclastic 'rain' of small stone pebbles from eroding cave ceilings) and given the status of the other artefacts from Susiluola Cave, we feel that a parsimonious interpretation of this piece is as a natural artefact.

III.7-16: are all extremely small, and bear no convincing traces of dorsal scars. For this reason, they are all undiagnostic, and we note a clear similarity between these and naturally flaked pieces. Familiarity of one of us (PP) with knapping waste from a number of Middle Palaeolithic assemblages, whereupon even small debitage possess clear striking platforms and dorsal scars, lead us to believe beyond reasonable doubt that these are natural.

To our mind, there is *not one single item* among the illustrated lithics that bears unambiguous signs of human authorship. In fact, most of the pieces can be rejected straightaway, and no piece bears *multiple* indications of human manufacture. Of the 31 pieces illustrated, which we assume that Schulz et al. feel are the clearest indicators of human manufacture from all artefacts from this layer, we feel that there are only two that we cannot reject outright. As these are problematic in their own right, our working conclusion is that the artefacts illustrated are not unambiguous indicators of human presence. As a working hypothesis, we feel that these are typical smashed products of low energy redeposition of littoral gravels within the cave: hardly a Neanderthal campsite.

Until Schulz et al. can eliminate the possibility that these artefacts are natural – or produce (only) one unambiguous example of a deliberately knapped artefact, we feel that it is premature to comment in detail upon their reconstruction of several *chaînes opératoire* which they think Neanderthals were employing at the site. At a glance, the methods they show seem misleading. Although in the text (as quoted above) they refer to the nature of the raw materials as small, flat and straight-sided pebbles, their reconstruction drawings show far more rounded pebbles than reality apparently demonstrates. We would question their reconstruction, and in any case we would suggest that the methods of pebble reduction they show are not particularly efficient ways of working the material at hand. Why not discoidal methods such as those employed in the Pontinian of Italy (Kuhn 1995), for which the raw material at hand was very similar to the pebbles of Susiluola Cave? We are also unconvinced that that the lithic *chaîne opératoire* reconstructed by Schulz et al. would produce the debitage illustrated in their plates I, II and III.

CONCLUSIONS

The Susiluola Cave project is an excellent example of how only excavation can address outstanding issues such as the antiquity of human colonisation in any given region, and the adaptive flexibility and constraints of human populations. Were the Susiluola cave not excavated, or were it not published in as clear a manner as Schulz et al. have undertaken, these issues would remain open questions for Finland, and for the Neanderthals. Now, Schulz et al. have done us a service to bring a newly excavated data to light and thus bring these questions into sharp focus. We would dearly like to see their arguments strengthened and what we regard as weaknesses and confusing data eliminated. We do, however, feel that the evidence for human presence at Susiluola Cave in the Pleistocene is at present unconvincing, and we feel that considerably more effort needs to be directed at eliminating with confidence natural processes, i.e. waves smashing pebbles on the beach, in the creation of the critical lithic artefacts. In the meantime, we suggest that the data is interpreted with considerable caution (to avoid a case similar to the early 20th century eolith debate in Britain noted above: see Gamble 1999 and references therein), but we hope that the excavators will sharpen their evidence and look forward to a more convincing argument for Neanderthal presence in Finland. To conclude, we suggest that strong questions remain in the following areas:

1. Do the deposits of Layer IV 2 convincingly belong to OIS 5?

2. Was this presumed interglacial site, which may even have been located on a small Eemian Sea island capable of supporting wildlife, let alone Neanderthal predators?

3. How did Neanderthals colonise this region?

4. Why is there a lack of contemporary Neanderthal settlement in neighbouring regions and at the same latitude, or even anywhere north of 58° N?

5. Can one eliminate entirely natural causes for any of the artefacts from the cave?

6. Can one show *one* artefact of unambiguously human manufacture?

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