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EXPLAINING CERAMIC VARIABILITY: THE CASE OF TWO TEMPERS

Abstract

The article revalues the significance of temper in Finnish prehistoric pottery through the analysis of organic and talc tempered Textile ceramics found in 1998-1999 from an Early Bronze Age dwelling-site of Muhos Hangaskangas in the lower Oulujoki river valley. After a brief survey on the main characteristics of the dwelling-site, its ceramic assemblage is introduced and mechanisms contributing to its formation are identified. Macroscopic and petrographic analysis are used to point out the similarities and the differences between the two fabrics, which in turn are utilized to draw conclusions on the choice of temper. It is put forward that the need to use particular temper arose from the working properties of clay, availability of exotic tempering materials or seasonal weather conditions rather than from potter's need to manifest ethnicity.

Keywords: pottery technology, temper interchangeability, production season, ethnicity.

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INTRODUCTION

It is generally assumed that fragile clay pots were not items of trade, neither were they transported for long distances. Therefore, they were produced at the same site they are found and their fragments indicate to which population the inhabitants belonged to (Huurre 1998:115, our translation). The preceding excerpt from the latest introduction to the Stone Age in Finland outlines quite perfectly the starting-point of this paper. While pottery has been in recent years one of the central themes in the study of Finnish prehistory (e.g. Lavento 2001; Torvinen 2000), the methodology used has been fairly tedious and studies concentrating on the pottery technology rare (e.g. Korkeakoski-Väisänen 1993; Gustavsson 1997). For most scholars the analysis of decorative schemes has offered a set of seemingly suitable tools to establish linkages between style, chronology and populations that have consecutively been transformed to signify archaeological cultures and ethnic entities (especially Carpelan 1999:249-251; cf. Lavento 1998:49-52; Taavitsainen 1999:353-354; Bowser 2000). Due to this style-oriented research tradition, interpretations concerning the manufacture, use or status of pottery in prehistory have too often been based on assumptions developed through the establishment of inadequate analogies or – even worse – "common sense" approach.

"The immobile pot syndrome" is an illustrative example of an interpretation arousing from the alliance of analogy and "common sense". By relying on "common sense" it goes without saying that clay pots are fragile and difficult to transport (Gustavsson 1997:122; cf. Arnold 1985:110-112; Reid 1990:12-14). Therefore, pottery only marginally fit into the long cherished idea of nomadism as the principal livelihood in prehistoric

Finland, the impetus for which was undoubtedly derived from an analogy established with the "native" inhabitants of Northern Finland, the Saami. Recently, the idea has been overthrown by the discovery of Neolithic villages, which often comprise several semi-subterranean house-remains and rich pottery finds (Karjalainen 1999). Consequently, if pots were immobile and they were produced during the summer months, these sites are difficult to interpret as mere winter encampments. Similarly, as long as "individuals changed places instead of vessels" (Lavento 2001:171) the discovery of two wares or fabrics at the same site bears witness to human mobility instead of vessel mobility. Hence, the spatial coexistence of two fabrics may be explained even by exogamy (e.g. Hiekkanen & Seger 1988:26; Forss & Jarva 1992:70-72).

In this article we try to approach the coexistence of fabrics from a technological point of view by paying special attention to pottery composition. It will be argued that the availability as well as the quality of raw materials influenced the choice of temper (Hulthén 1985a). Besides raw materials, the study will center on production techniques and the limiting effect of the production environment. All these themes will be reviewed through the examination of a recently excavated ceramic assemblage comprising two Early Bronze Age pottery fabrics. This will be done by complementing a macroscopic inspection with a small-scale petrographic analysis that is used, in addition to temper identifications, to estimate the amount of temper in the ceramic paste. Attention will also be paid to clay matrix, especially to natural inclusions, as their presence may indicate whether the clay used in the production of the two fabrics came from the same source. A positive answer to this query will, in turn, require an explanation for simultaneous use of several tempers. As the article focuses on the composition of pottery, meticulous descriptions

Fig. 1. The location of the Hangaskangas dwelling-site in the lower Oulujoki River valley.

of surface finishes as well as the discussion on their impact on the vessel function have deliberately been omitted from the study.

THE MUHOS HANGASKANGAS SITE

The material used in this study comes from an Early Bronze Age dwelling-site located on the southeastern-most tip of the Hangaskangas sand esker formation, some 20 kilometers SE of the city of Oulu (Fig. 1). The esker belongs to the Sotkamo-Rokua esker chain and forms a dominant element in the topography of the lower Oulujoki river valley (Alestalo 1986:155-157; Helle & Ylinen 1965:104-109). The dwelling-site was first discovered in 1926, when a stone adze -attributed to the Kiukainen culture of the Late Neolithic period - was found by the constructors of the Oulu-Kajaani railroad. In spite of this promising find, the site was first inspected by an archaeologist only in 1954 during a field survey conducted by the National Board of Antiquities in the surroundings of the vast construction site of Montta hydro-electrical power plant.

Thanks to the co-operation of the Museum of Northern Ostrobothnia and the Department of History at Oulu University archaeological excavations took finally place at the site in 1968. The result of a nine–day campaign was a rich collection of artifacts including four fragmentary straight-based arrowheads and several fragments of a clay crucible, one preserving a stain of melted copper or bronze. In addition, many examples of three differently tempered pottery fabrics (asbestos, talc and organic matter) were found. In spite of these important results, neither a report nor an article was ever published on the 1968 campaign.

After three decades of inactivity, archaeological excavations at Hangaskangas were continued in 1998, when the site was chosen as the focus of Archaeological Test Excavation group formed under the supervision of the Department of Art Studies and Anthropology, University of Oulu. Although the excavations were continued in the following year, their total extent was limited to just 29 square-meters. The finds made during these recent campaigns do not differ significantly from the material recovered in the 1968 excavations: another piece of a clay crucible, more straight-based arrowheads and other quartz implements, and a miniature elk-head carved from a piece of talc or soapstone. The ceramic assemblage of the 1998-1999 excavations, which constitutes the reference material of this study, will be introduced next.

ANNIHILATED ASSEMBLAGE

The quantity of different pottery types found in 1998-1999 is indicated in Table 1. In contrast to the 1968 excavations at Muhos Hangaskangas, the recent find material contains hardly any examples of asbestos tempered pottery. The relative absence of this pottery, which has been classified within the so-called Lovozero-group (see Lavento 2001:30) on stylistic grounds, promulgated its exclusion from the study. Contrary, the remaining two groups of pottery with either organic or talc temper are both well attested among the finds (Fig. 2). Despite of the difference in temper, both wares have been attributed to the group of Textile ceramics (Lavento 2001:220). This pottery is thought to have been introduced to Finland through the Karelian isthmus and East Karelia during the Early Bronze Age, in other words, sometime in the second millennium BC (Carpelan 1999:268-269; Lavento 2001:88-107). It is also known that both organic and talc tempers are fairly common in Textile ceramics found within the Oulujoki water system (Lavento 2001:47, fig. 4.3).

Table 1. Quantification of the Muhos Hangaskangas 1998-1999 pottery assemblage

Temper/fabric	Asbestos	Organic	Talc
Total number of the fragments	3 pcs	431 pcs	1265 pcs
Total weight of the fragments	2.40 g	212.95 g	512.12 g

Together the two fabrics include nearly 1700 potsherds (Table 1), but as indicated by the 0.5 gram average fragment weight, the assemblage consists mainly of bits and pieces that have no potential to contribute for further analysis. In fact, the best preserved fragment in the whole assemblage measures 39 x 27 x 6 mm and weighs no more than 6.7 g. The assemblage includes only four rim sherds, all of which belong to the group of organic-tempered pottery. Still, none of these rim fragments preserves enough circumference or height for the reconstruction of vessel diameter or

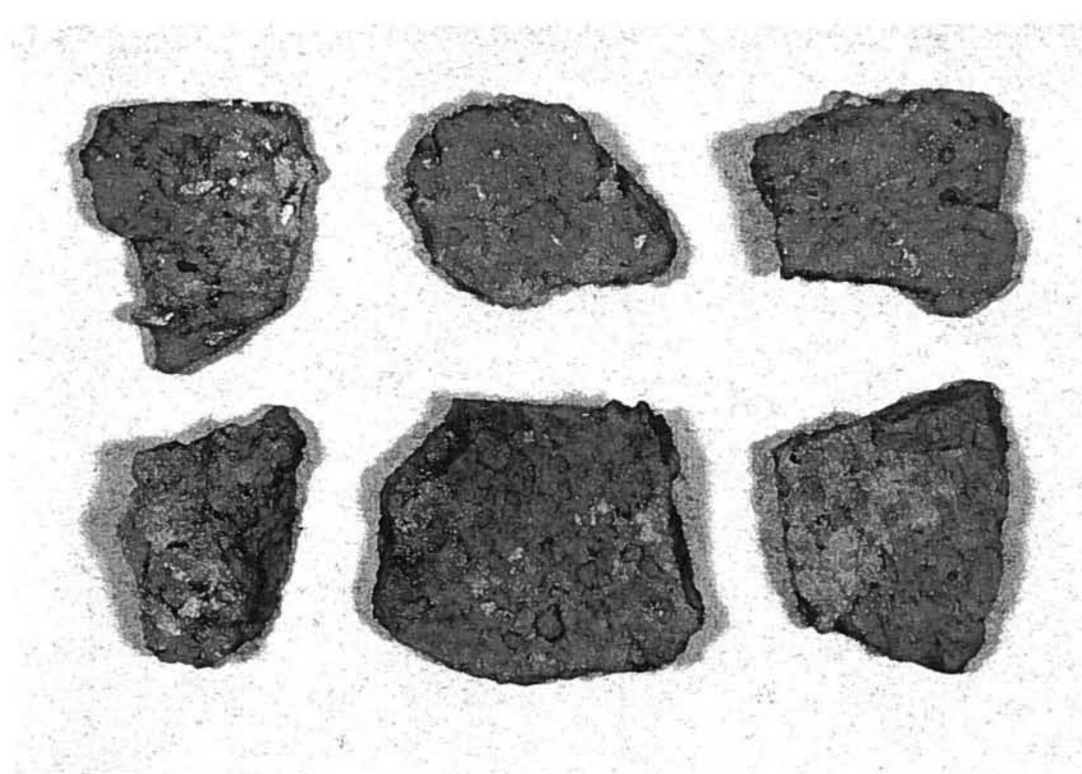

Fig. 2. A selection of talc (NM 32048:90, upper row) and organic (NM 30888:60) tempered pottery from the Hangaskangas excavations. Scale 4:3.

rim profile. The data concerning surfacing techniques as well as decorative schemes is equally scanty.

The highly fragmented nature of the assemblage impedes us from making precise observations on the distribution of surface finishes over different parts of the vessel besides basic exterior/interior categorization. The exterior surface in both fabrics often shows traces of a two-staged smoothing process, in which the rough smoothing was accomplished with a bunch of grass (Jaanusson 1981:42-44). The resulting wide striations were then wiped away from the vessel surface, confirming that the process itself was destined to improve the use-related properties of pottery (Ikäheimo 1998:50, cf. Arponen 1994:11). The exterior surface may show more occasionally a net-pattern resulting from the use of cloth in the forming process or sharp striations that tend to form a rhomboid pattern in talc-tempered pottery. The interior surface is customarily smoothed in both fabrics. Proper decoration, besides some tiny rounded pits and barely visible comb stamps on talc-tempered pottery, is absent from both wares. It must be stressed, however, that the ostensible nature of the study assemblage is rather a blessing than a curse, as it forces us to focus on the study of fabrics.

The first observation to be made is the ascendancy of talc-tempered pottery in the assemblage, which at first may seem to reflect one preference of the inhabitants that once populated the Muhos Hangaskangas dwelling site. In reality the explanation is probably of more humdrum character. Even a superficial examination of the assemblage shows that this pottery is customarily in better preserved than the one with organic temper. The most likely reason is that these fabrics resist post-depositional processes differently. The highly porous fabric resulting from the use of organic temper easily absorbs water, which crumbles the pottery through the annual freeze-thaw cycle (Reid 1984:67-69; Skibo *et al.* 1989:137-

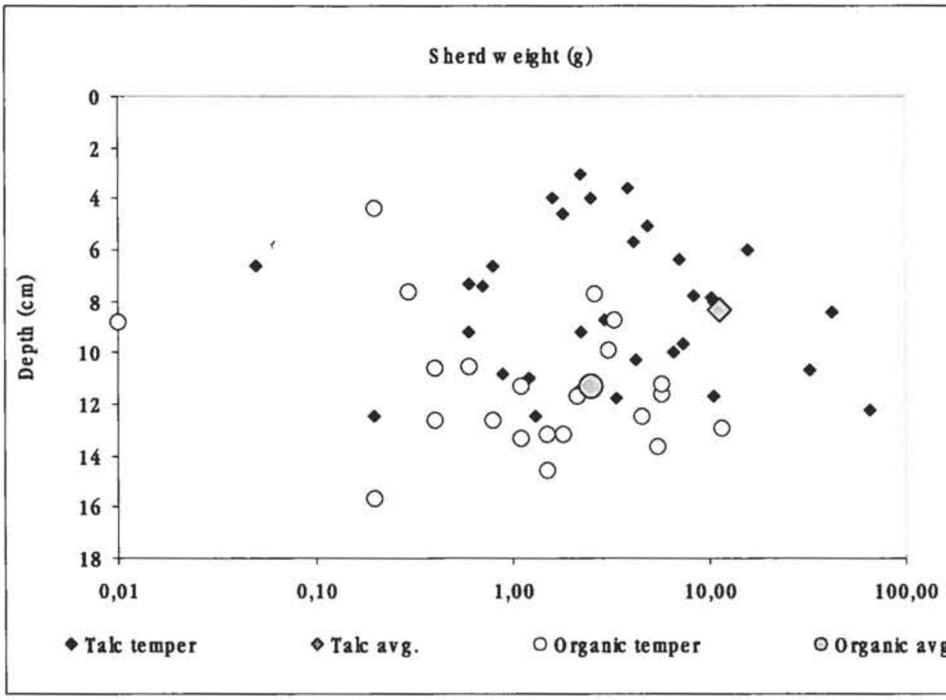

Fig. 3. The vertical distribution of pottery finds at Muhos Hangaskangas by weight

139; cf. Korkeakoski-Väisänen 1993:19). The difference also has a skewing effect on the vertical distribution of fabrics. At Muhos Hangaskangas, organic-tempered pottery was regularly found underneath talc-tempered pottery (Fig. 3), because the freeze-thaw effect caused by the frost gradually weakens with depth. Had this difference in physical properties not been recognized, we could erroneously postulate on the basis of stratigraphy that the use of organic-tempered pottery preceded the use of talc-tempered pottery at the site.

Another factor, besides fabric porosity, skewing the effect of post-depositional processes between the two fabrics is the apparent difference in the firing temperature. As its significance will be discussed in following chapters, we would like to point out here the effect the firing temperature has on the appearance of the assemblage. The surface and core of talc-tempered pottery are mainly light yellowish brown (10YR 6/4), but quite often show reddish brown (5YR 5.5/5) tints indicating firing in relatively high temperature. In organic-tempered ware, the predominant vessel surface and core color is also light yellowish brown (10YR 6/4) with very pale brown (10YR 7/4) as the most frequent variant. Together with a dark grey (10YR 4/1) vessel core, which is often visible in thicker sherds, the combination points towards lower firing temperature and shorter firing time than in talc-tempered pottery.

TWO FABRICS, ONE TECHNOLOGY

Instead of offering a separate description of both fabrics, we prefer to discuss their similarities and differences together on the basis of both macroscopic inspection and petrographic analysis. Macroscopic inspection was accomplished both with the naked eye and a hand-lens (magnification 10x), while six specimens - three of both fabrics (organic temper: NM 30888:60, NM 32048:569, 1488; talc temper: NM 32048:81, 90, 96) – were prepared for petrographic analysis at

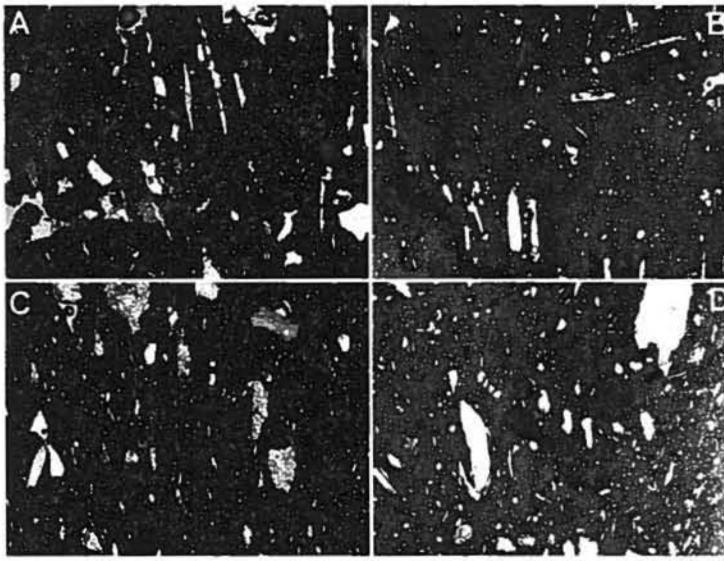

Fig. 4. Photomicrographs: A-B) organic temper (A. NM 32048:1488, crossed nicols. B. NM 30888:60). C-D) talc temper (C. NM 32048:96, crossed nicols. D. NM 32048:81). Magnification 20x.

the thin section laboratory of the Department of Geology, Oulu University. Two polished thin sections, three conventional thin sections and a polished specimen immersed in epoxy resin were prepared. The petrological study of the thin sections was done with a Leica polarizing microscope outfitted with different magnifications and optical settings. Photomicrographs (Fig. 4) were taken with a camera mounted on a Zeiss polarizing microscope. The following descriptions and commentary make use of special vocabulary that can be found in most introductions to archaeological ceramics (Rice 1987:309-370; Orton *et al.* 1993:67-75, 231-242).

Both fabrics are soft and have a smooth feel, as both the irregular break and fracture surface are customarily highly worn. Traces of laminated structure can occasionally be seen in the section. Both fabrics show a predominantly light yellowish brown (10YR 6/4) clay matrix with exceptions indicated in the previous chapter. In order to gain additional information on the source of clay, the samples selected for thin sectioning were also examined for their diatom content. Specimens for diatom analysis were prepared using the standard procedure described *inter alia* by Battarbee (1986). Unfortunately, no diatoms were observed in the microscopic examination. Therefore, inferences regarding the hypothesized common origin of the clay in these two fabrics must be based on their natural non-plastic content.

The only common feature in the natural non-plastic content is the sparse occurrence of deep red, rounded particles that fall into the 0,05-0,72 mm size range. In addition to color, their structure with blurred outer edge and a core resembling the clay matrix identifies them as ferruginous clasts of clay. The composition of these clasts has previously been studied in the Late Neolithic Pöljä-ware with a scanning electron microscope (SEM), which indicated aluminum (36 %), calcium (35 %) and iron (26 %) oxides as their main components (Ikäheimo 1998:51-53). Although their precise nature is still somewhat uncertain, the composition of these particles clearly does not match with grog (crushed potsherds), as which they have occasionally been identified.

The examination of natural non-plastics also brought up a feature distinguishing the two fabrics from one another, as the inspection of thin sections revealed the presence of minute quartz (0,02-0,7 mm). In talc-tempered ware, this type of quartz is present with less than 1 % fraction in two specimens (:81, :90) while in the remaining case it reaches 5 % (:96). In organic tempered pottery quartz is present in somewhat higher quantities ranging from 5-10 % (:60) up to 30 % (:1488). In the last-mentioned specimen the bimodal grain size distribution implies that the larger fraction of quartz was deliberately added to the paste. This interpretation is further confirmed by the presence of other components introduced within the sand temper, such as few grains of K-feldspar, plagioclase and muscovite.

Even on macroscopic level, the two fabrics are easily distinguished from one another due to their temper. The common feature for both fabrics is the sparse occurrence of pores with rounded cross- and elongated longitudinal section. The average pore diameter of 0,25 millimeters together with imprints on the vessel surface identify the parent material as hair, which is known to have been used as a temper from the late Stone Age onwards (Hulthén 1985b:255-256). However, hair temper is usually present in such a low quantity that it has hardly affected the use-related properties of the vessel. For this reason, another kind of explanation – functional or even symbolic (Hulthén 1985a:335-336) – must be sought for.

The fabric of organic-tempered ware displays frequent, medium-sized irregular or elongated macro-pores resulting from the use of organic tempering materials, either carbonized in firing or dissolved during the long period of exposition to acidic mineral soil. An impression left by oval, very large – the length frequently exceeds 2 mm, while the width varies between 1,0-1,5 mm – platey-like leaf of a twig, seed or other similar matter, is present with frequent concentrations. This inclusion occupies 10-15 % of total volume in fabric. The inorganic temper of the other ware was identified as talc (0,04-1,4 mm), present with 15-30 % share of the total surface volume. As indicated by dimensions of 18 x 8 mm, the biggest temper particles in this fabric are considerably large.

In all, the closer examination of the pottery assemblage from the 1998-1999 campaigns at Muhos Hangaskangas does not exclude the possibility that both fabrics may represent local production (cf. Gustavsson 1997:109-110). Both the materials and the methods used in the production of the two fabrics are fairly consistent in many respects. The variability detected in the assemblage, on the other hand, may arise from the combination of natural causes and human selectivity. By assuming this position, we are obliged to explain the occurrence of these pottery fabrics at the same dwelling site. This will bring forward the issues of temper availability, characteristics of the clay and ceramic ecology.

A QUESTION OF TIMING?

As convincingly demonstrated by Arnold (1985:49-57), the availability of a temper customarily dictates its application into pottery production. At Muhos Hangaskangas this was certainly the case with talc, whose closest natural sources are talc schists found over a hundred kilometers east of the site, in the province of Kainuu. Talc-tempered pottery is obviously more common in this region (Lavento 2001:49-50). Still, the easy transportation of this commodity down the Oulujoki water system more likely took place as lumps of raw material than as finished vessels. While organic tempering materials were readily available at Muhos Hangaskangas, our incompetence to identify the principal organic temper impedes us from making more precise statements concerning its availability. On the basis of elongated, oval shaped pores in organic-tempered ware, the inclusions were more likely seeds than, for example, chopped plant fibers.

One potential explanation for the contemporaneous existence of two pottery fabrics is their use for different purposes. The piece of a clay crucible (NM 32048:61) found at Muhos Hangaskangas in 1999 demonstrates through its dense quartz-sand temper, of which we have no examples amongst "ordinary" pottery, that local potters were aware of the effect different tempering materials had on vessel performance. The wider application of quartz to pottery production was certainly not a question of availability, as even today quartz-rich sand is everywhere at the site once located on an esker close to shoreline. In the present case, the use of organic or talc temper results in a fabric with fairly similar properties, especially when it comes to vessel strength or thermal conductivity. This brings forth the issue of interchangeable tempers (Ikäheimo 1997:44-45; 1998:55), which might have played a significant role in prehistoric pottery production. When, for one reason or another, talc was not available during the active pottery production season it was replaced with a substance known to result a similar outcome. Hence, the coexistence of two or more pottery fabrics may possibly reflect gluts and shortages in the availability of raw materials rather than bear witness to the merging of diverse ethnic groups.

Even more strict interpretation may be reached by underscoring the increased presence of minute quartz in organic-tempered ware. Although the component is invisible to the naked eye, its influence on the behavior of clay may have been felt by the potter, who knew by previous experience to enhance the clay paste with organic temper. Thus, instead of vessel function, availability of raw materials or the ethnicity of the potter, the choice between different tempering materials would have been influenced by the characteristics of clay. This interpretation is, on principle, the opposite of the idea that the co-occurrence of an organic component with other temper indicates that organic temper was not sufficient by itself prevent the vessel from breaking before firing (Lavento 2001:51). Still, the quality of clay usually sets limits to applicable tempering materials, while the opposite is imaginable only with highly specific tempers, like asbestos (Lavento 1992:34).

The final question to be posed is why two compositionally different fractions of the same clay deposit would have been used together with two diverse tempers to make pottery with identical use-related properties? Perhaps organic-tempered pottery with its minute quartz component represented a means to extend the active production season towards early May and late August. The natural non-plastic content opened up the clay paste to ensure even drying, which would have otherwise been overly complicated due to low mean temperature and increased humidity. This would also explain in part the positive correlation between fabric and firing temperature, as the production of somewhat higher quality pottery with an exotic and perhaps more expensive tempering material could be timed to June and July, the most secure months of the production season.

On a broader scale, certain aspects related to temper usage and firing were certainly dictated by the climate, and not only through annual cycle. Interestingly, the group of Textile ceramics found in Northern Finland has been described as soft and poorly fired (Lavento 2001:51-52). While softness is, perhaps erroneously, attributed to the use of soft tempering materials, and poor firing is interpreted to result from organic temper, the aforementioned properties may as well reflect the regulating effect of climate on production (cf. Arnold 1985:71-72). Therefore, the question of whether the use of peculiar tempers (e.g. asbestos) in Finnish prehistory correlates with certain mean temperature or precipitation curves would be worth examining. This does not exclude the possibility that each population followed a local tradition (Lavento 2001, *passim*), only that the driving force behind tradition may have been something else than the need to manifest ethnicity.

CONCLUDING REMARKS

The examination of a highly fragmented pottery assemblage from the Early Bronze Age dwelling-site of Muhos Hangaskangas has shown that the study of prehistoric ceramics in Finland has perhaps overly relied on stylistic analysis supplemented by assumptions concerning ethnicity. The examination of two differently tempered fabrics with similar use-related properties indicated that attention should be increasingly paid to various aspects of pottery technology. The choice of temper was shown to depend equally on the availability of raw materials (both clay and non-plastics), vessel function and even on the particular time in the production season rather than solely on the desire to manifest ethnicity through material culture.

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