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Approaching Linear Pottery Economics – Distribution and Supply of Amphibolite Adzes

Abstract: The distribution and consumption of adze-blades made of amphibolite that occurred in settlements and burial sites of the Linear Pottery Culture is the main focus of this article. With this purpose in mind, two aspects were considered: the percentage of adze-blades made of amphibolite in relation to the total number of adzes-blades as well as the number of adze-blades linked to the number of households or graves. Interpolation was applied to define and highlight different areas of consumption. Additionally, a new approach for measuring the connection between settlements and burial sites is proposed. Consequently a rank correlation between the amounts of amphibolite found in both types of sites was adapted to compare the data.

Introduction

This article deals with the distribution and consumption of amphibolite adze-blades and focuses on a particular aspect of the economy of the Linear Pottery Culture (LBK), which corresponds to the period of the Early Neolithic in Central Europe (LÜNING / FRIRDICH / ZIMMERMANN 2005).

The distribution of adze-blades is analysed in order to recognize different areas of consumption. In this case study, consumption is defined by the type and the quantity of goods consumed. Two questions become significant: Firstly, does the supply cover the demand, and, if so, how much was consumed? The application of spatial statistics provides some answers to these questions, as well as a means by which particular areas of consumption can be characterised and defined. Considering the fact that adze-blades are found both in LBK settlements and burial sites, this paper is also in the position of considering a further aspect, i.e. the relationship between these different types of sites in respect to the consumption of adze-blades.

This work is part of the project “Ökonometrie des mitteleuropäischen Neolithikums” (Econometrics of the Central European Neolithic), at the Institute for Prehistoric Archaeology at the University of Cologne (Germany) (KERIG 2008 in this volume).

Database

Adze-blades are found both in LBK settlements and on burial sites. Adzes were used as tools for working

wood (WEINER / LEHMANN 1998). Since adze-blades are recovered as grave goods for some males, they might also indicate social differences in the LBK for example by display of prestige (MÜLLER / HERRERA / KNOSSALLA 1996, 96). The cross section of adze-blades is asymmetric, with the cutting edge at right angles to the shaft. They were produced from different raw materials, including amphibolite, basalt or schist. A high amount of the amphibolite used in the production of LBK adze-blades does not occur in the vicinity of many of the LBK sites. Recent studies place the source area of a high amount of the amphibolite having occurred at LBK sites at Jistebsko (Czech Republic). The precise description of this type of amphibolite is actinolite-hornblende schist (CHRISTENSEN et al. 2006, 1639; 1653; RAMMINGER in press).

The Project “Econometrics of the Central European Neolithic” has involved, among other things, the collection of representative data from archaeological contexts. This data was provided from several research programs, some dating back to the early 1970s, various master and doctoral theses, and is supplemented by the survey of modern literary sources. Only excavated sites and sites of the younger phases of the LBK, which date from about 5300 to 4900 BC, are included in this article. Up to the present a total of 41 LBK settlement and 24 burial sites from Central Europe have been recorded which contain enough reliable information on adze-blades for the application of quantitative analyses.

Regions of Consumption: Settlements

Initially, the supply of amphibolite to the LBK settlements is examined; an important indicator is the proportion of adze-blades made of this raw material in relation to the total number of adze-blades. This meant an interpolation of the percentages of amphibolite adze-blades could be undertaken. The interpolation method applied in this case and the following ones is natural neighbour (GOLDEN SOFTWARE 2002, 127–129). The resulting isolines (Fig. 1) suggest that the settlements closest to the source, the Bavarian settlements and the settlements in the southwest of Germany are capable of satisfying most of their raw material needs for adze-blades with amphibolite. On the other hand, settlements further to the north used other raw materials as supplements. The percentage of amphibolite decreases even more to the west.

In order to compare the quantities consumed in different areas, the number of adze-blades linked to LBK households needed to be analysed. Therefore, the second interpolation was applied to the index: adze-blades per household (Fig. 2).

For interpolating the index the parameter settings of the first interpolation were kept the same. It is of note that the regions characterised previously by a high percentage of amphibolite, seem now to differ greatly. The households of the Czech settlements as well as the Bavarian settlements are furnished

with a high number of adze-blades. In comparison the settlements in the southwest of Germany show a very low index. Likewise the households of the settlements further to the north and west seem to be equipped with a comparatively small number of adze-blades.

Regions of Consumption: Burial Sites

The next step is to apply the same analyses to the burial sites. Once more “natural neighbour” was applied as the method of interpolation. The isolines in Fig. 3 denote the different percentages of amphibolite adze-blades in relation to the total number of adzes.

As observed previously, in regard to the interpolation of the settlements, the burial sites close to the source area and the sites in south-western Germany are well provided. Considering the fact that the Bavarian burial sites are much closer to Jistebsko than the sites in south-western Germany, it is curious that in Bavaria there is a higher amount of materials other than amphibolite. The burial sites to the north-west have a low percentage of amphibolite or, like the burial sites in the southwest, no amphibolite at all. Considering the first interpolation (Fig. 1) the results produced by the interpolations of the percentage of amphibolite in settlements and burial sites show similarities, with the exception of the sites in Bavaria.

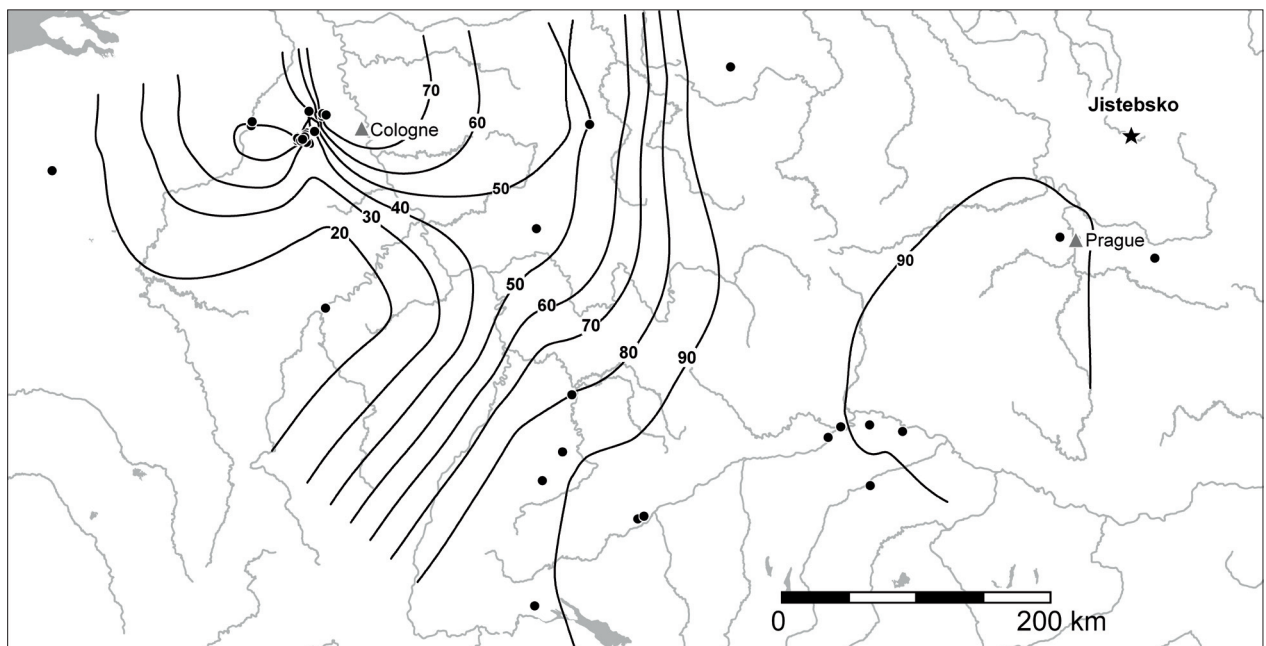


Fig. 1. The interpolation of the percentage of amphibolite adze-blades found in LBK settlements.

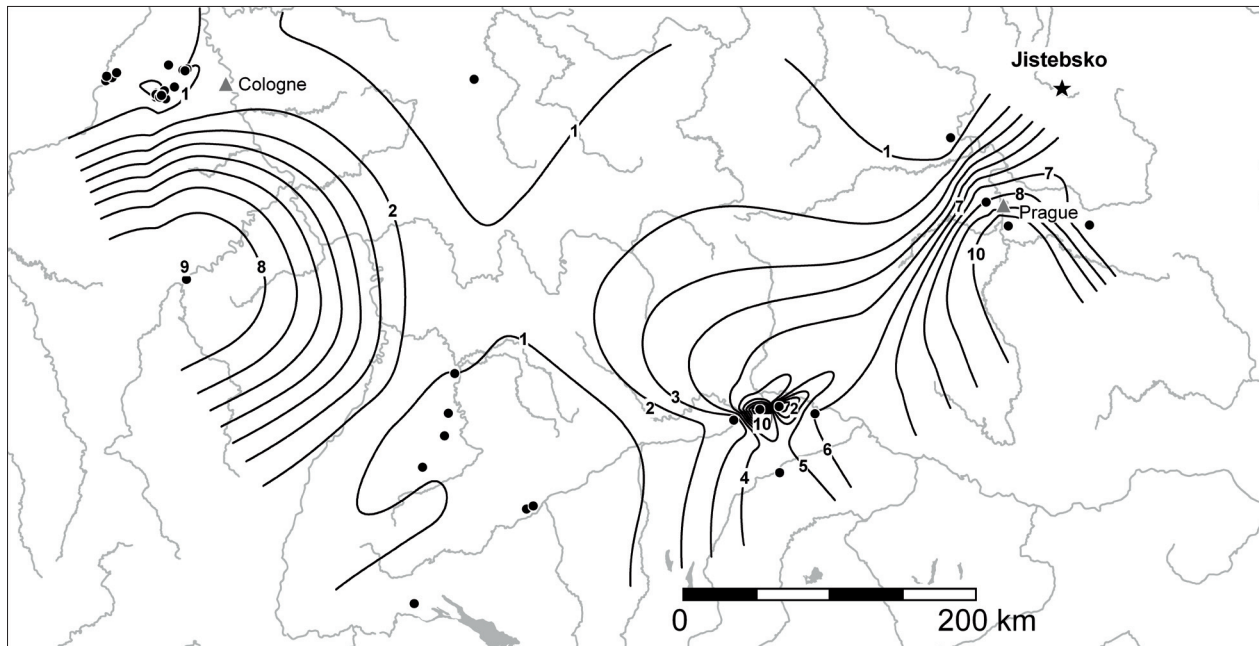


Fig. 2. The interpolation of the index adze-blades per household found in LBK settlements.

The next interpolation of the index, adze-blades per grave, was undertaken using the same settings as before (Fig. 4).

The burial sites to the southeast display an extremely high number of adze-blades per grave. The Bavarian index is slightly lower. The sites in southwestern Germany and even more distinctly the sites of central Germany do have a rather low index. Before, these were characterised through high percentages of amphibolite. The index of the burial sites to the northwest is even a little bit higher. Some of the necropolises to the southwest have a rather high index, which tends to decrease further to the southwest.

The Rank Correlation

In order to measure the relation between settlements and burial sites with respect to the consumption of amphibolite adze-blades, a correlation of ranks was calculated.

The first step was to select areas for the correlation. Only regions which were represented through both settlements and burial sites were chosen. Geographical vicinity of the sites in one area and other factors were considered. For example, in Bavaria two areas were defined according to the variability reflected at the burial sites (Fig. 3). Also the results

of the previous interpolations suggested regions of consumption, which were also taken into account.

By applying Spearman's correlation coefficient a linear relationship between variables is not required and it is possible to calculate the correlation between variables at ordinal scale level (FLETCHER / LOCK 1991, 110–112; IHM / LÜNING / ZIMMERMANN 1978, 263). Thus an internal ranking of settlements and burial sites was constructed. The amphibolite adze-blades of the settlements of one region were summed up and their percentage was calculated and assigned as the value for the region. The bar chart (Fig. 5) displays the regions and their percentages of amphibolite.

The samples were arranged into a sorted sequence according to the percentage of amphibolite. Since some regions are described by quite similar percentages, it was decided to apply the same rank to them. The new rank for a group of samples is the average rank of the places the samples occupy in the sorted sequence. For example, the first rank was assigned to the three regions with the lowest percentage of amphibolite. Since these regions occupied the places 1 to 3 in the sequence, they were ranked as 2, the average of their former places.

A second sorted sequence (Fig. 6) of the regions was constructed by taking into account the percentage of amphibolite adze-blades recovered on the burial sites. Again the percentages of adze-blades made of amphibolite were converted into ranks.

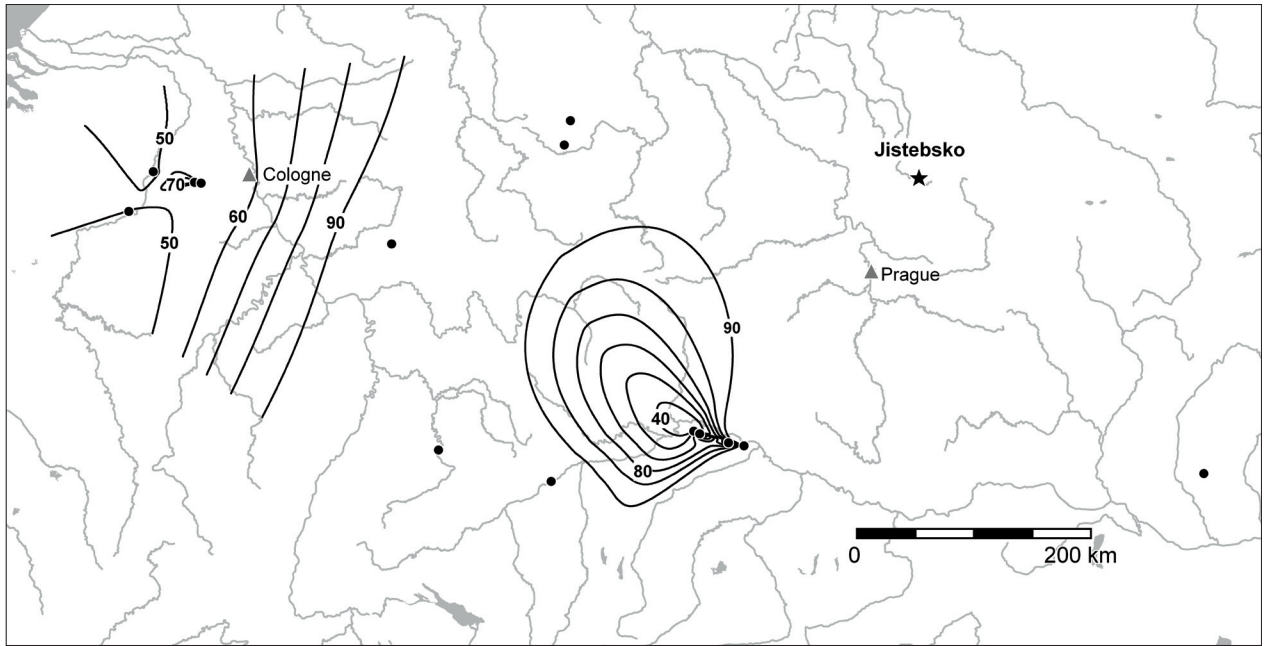


Fig. 3. The interpolation of the percentage of amphibolite adze-blades found on LBK burial sites.

The advantage of Spearman's rank correlation coefficient is that two rankings are compared, that were constructed independently from each other. Spearman's correlation coefficient is based on the differences between the ranks. The result of the calculation was a coefficient of 0.524. This correlation however is not significant (IHM / LÜNING / ZIMMER-

MANN 1978, 612 Tab. A-18). In order to understand this result, the absolute values of the differences between the ranks were also interpolated (Fig. 7).

Two areas are characterised by a very high difference between ranks. Conversely, other regions show only slight differences. It is noteworthy that the difference is not due to the distance from Jistebko – the

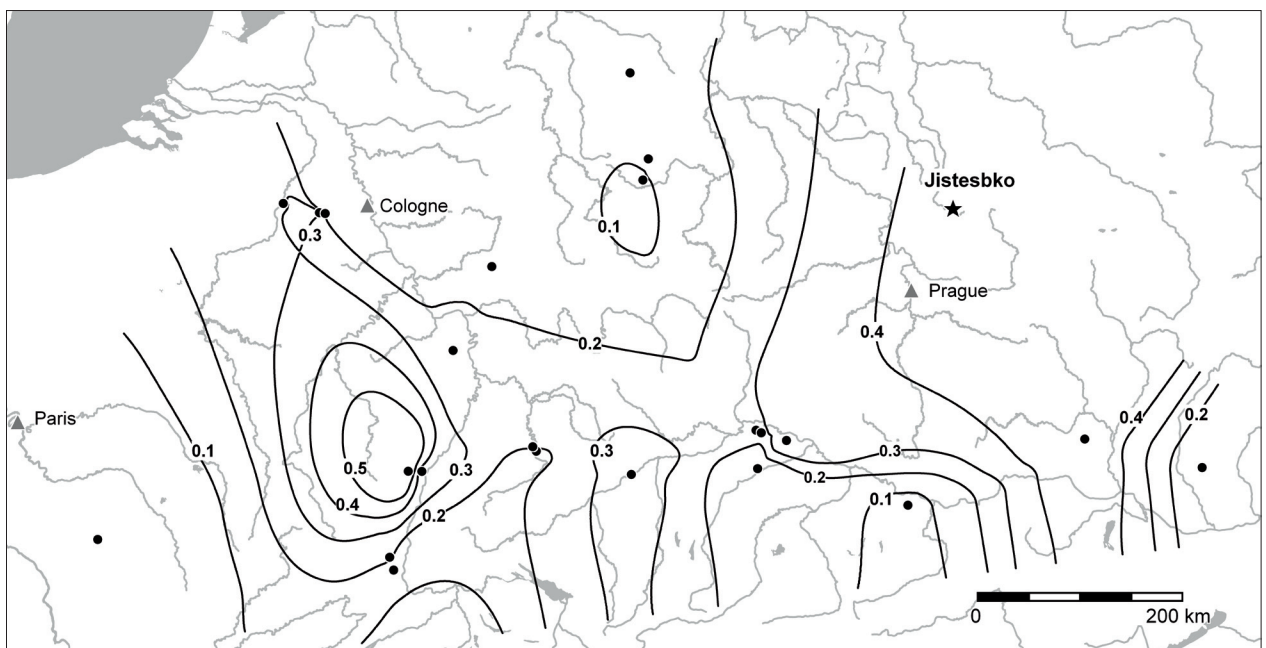


Fig. 4. The interpolation of the index adze-blades per grave found on LBK burial sites.

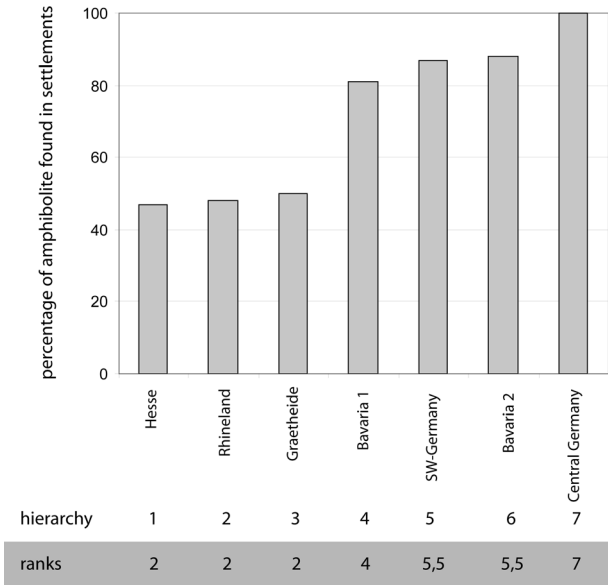


Fig. 5. The ranking of the settlements.

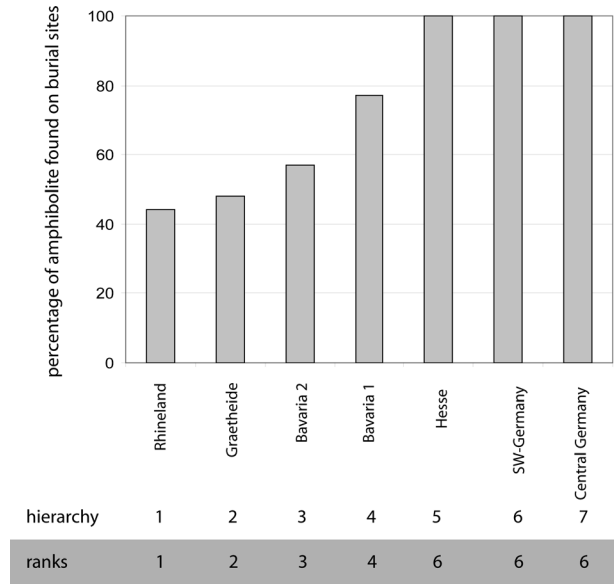


Fig. 6. The ranking of the burial sites.

source of the amphibolite. It is also interesting that in Bavaria the difference seems to be rather variable, which probably results from the differences between the Bavarian burial sites, some of which showed a very high percentage of material other than amphibolite. The high difference in Hesse is problematic since this region is only represented through one settlement and one burial site.

To this point the approach of applying a rank correlation did not prove to be as effective as hoped. This might be due to the database, which is still in the process of being extended. Also chronological trends, which might influence the picture, must be considered in the future. However the application of a rank correlation coefficient is still held to be appropriate for the problem.

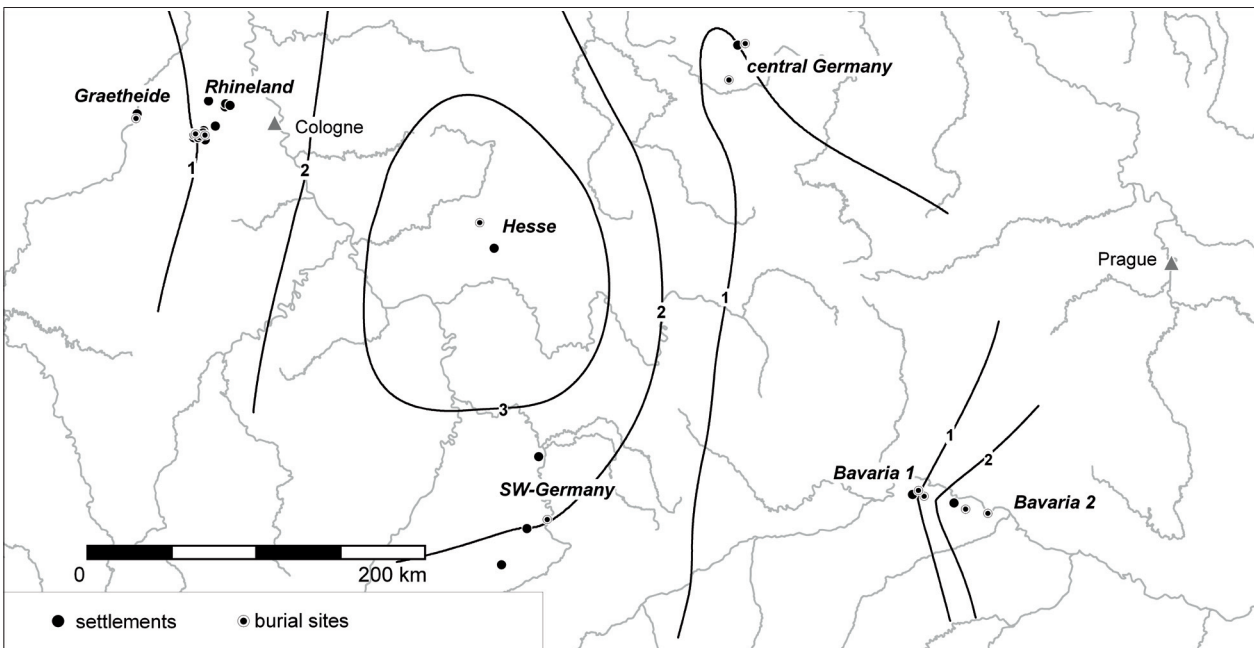


Fig. 7. The Interpolation of the differences between ranks of settlements and burial sites.

Conclusions

Observed over a wide geographical range there are different regions characterised by different modes of consumption in the LBK.

The portion of amphibolite that covers the demand of lithic raw materials for adze-blades in settlements and on burial sites differs during the LBK. The percentage of amphibolite decreases with the distance from the source at Jistebsko, but also seems to depend on other factors, probably economic or social characteristics of one region. Furthermore, there is also a difference in the number of adze-blades that is needed to furnish one household or to equip single persons.

As an approach for measuring the relation between consumption in settlement and burial sites the rank correlation coefficient was applied. Based on the interpolation of the difference between the ranks of both types of sites it can be assumed that in some regions the consumption of adze-blades in settlements is better reflected at the burial sites than in other regions. A possible interpretation leads to the suggestion that in some regions part of the population that is represented on the burial sites has a better or worse access to amphibolite than others. The results however must still be examined more closely and discussed more thoroughly. Since this work is still in progress more data shall be collected and analysed in the future. After extending the database it is planned to apply the rank correlation to the indices of the adze-blades per household and the adze-blades per grave.

However, the method introduced is appropriate in tackling the problem of measuring the relationship between different types of sites.

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