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Nomadic Pastoralism in the Early Bronze Age of the Central Balkans Evaluation of Background Knowledge

Abstract: The aim of the paper is to examine background knowledge about the organizational properties of mobile pastoral groups in order to assess the likelihood of the existence of pastoral nomads in the Early Bronze Age in the central Balkans. The patterning found by A. L. Johnson (2002) is taken as a point of departure for the cross-cultural analysis conducted in this study. Johnson's findings are in the main corroborated. Acquired knowledge about the workings of pastoral societies suggests that highly mobile pastoral groups should not be expected in the Early Bronze Age of the central Balkans.

Keywords: mobility, pastoralism, transhumance, Early Bronze Age, central Balkans, cross-cultural analysis

Introduction

The existence of nomadic pastoralism in Neolithic and Bronze Age Europe has been a widely-debated topic (e.g. Chapman 1979; Geddes 1983; Hielte 2004; Higgs 1976; Walker 1983), with the debate often focusing on the scale and range of mobility and the degree of pastoral specialization. Generally, the post-Neolithic period in Europe is characterized by an increased emphasis on the pastoral mode of subsistence, which in turn can be considered as one aspect of the so-called Secondary Products Revolution (Sherratt 1983).

The idea that animal husbandry and animal products other than meat gained importance in the post-Neolithic period has had implications even for pottery type terminology. So we have forms which were a priori (based on formal ethnographic analogy) identified functionally as milk jugs (Ger. *Milchtopf*, fossil type of the Bodrogkeresztúr group) and milk churns (Ger. *Fischbutte*, vessel type occurring in the Baden and Baden-related groups), although it has been shown later that such interpretations are not entirely correct, at least when it comes to milk jugs (Craig et al. 2003).

Similarly, ethnographic analogy has been used to infer about organizational aspects of post-Neolithic societies. For example, M. Garašanin (1977; 1994) relied on ethnographic analogy in his attempt to explain the apparent lack of settlement sites in the Early Bronze Age (EBA) central Balkans, western Serbia in particular. He postulated a resemblance of the subsistence and settlement system to that of the ethnographically known

Balkan pastoral nomads such as Vlachs and Sarakatchani (cf. Hielte 2004 for similar ideas). I have argued elsewhere (Porčić, forthcoming) that this interpretation is very unlikely to be true for many reasons, and that besides new problem-oriented archaeological research, the problem of the EBA in the central Balkans requires some new theoretical (anthropological and middle-range research) work.

One of the basic objections to the nomadic pastoralism hypothesis in European prehistory was put forward by P. Halstead years ago. According to Halstead (1987: 80–81), in the prehistoric Mediterranean there was no propitious social environment (e.g. market economy) for the emergence of a specialized pastoral economy (such as that of e.g. Vlachs and Sarakatchani). This is a very strong theoretical argument against highly specialized pastoral adaptations in prehistoric contexts (at least in the Balkans).

When it comes to theory, the results of A. L. Johnson's (2002) research on pastoral adaptations are the most relevant source. Her inquiry into pastoral adaptations, conducted in the style of Lewis Binford's (2001) seminal work on hunters and gatherers, can be seen as a landmark in building background knowledge relevant to the study of pastoral groups. As a result of her preliminary study, she has been able to recognize three distinct pastoral adaptation modes (Johnson 2002: 166):

1) Agropastoralists — who employ mixed subsistence strategies involving animal husbandry and agriculture, have moderate mobility, and occupy habitats with a biomass greater than or equal to 1500 g/m²/yr. Dependence on acquired plant food is generally below 20%.

2) Subsistence pastoralists — who rely mainly on small stock and have mobility up to 100 km/yr. Agriculture is mostly absent and dependence on acquired plant food is between 20% and 40%. Their habitats exceed 500 g/m²/yr in biomass.

3) Economic specialists — whose subsistence depends more than 40% on plant food acquired by trade or purchase. They occupy the least productive habitats in biomass terms (less than 500 g/m²/yr) and are highly mobile.

These system states can be distinguished by reliance on acquired food, mobility and organization of labour (Johnson 2002: 161).

Although the sample size of Johnson's study is very small (14 cases), her conclusions seem very convincing and offer a range of possibilities for further research and theory building; but above all, there are for the first time frames of reference against which informed evaluation of past pastoral systems can be carried out, and one that is not based on formal analogy.

The aim of this paper is to explore the ideas proposed by Johnson and Halstead and to evaluate the hypothesis about nomadic pastoralism in the

central Balkans in terms of the background knowledge gained in an exercise of cross-cultural pattern recognition.

1. Investigating the patterns using a cross-cultural sample

Johnson bases her analysis on 14 ethnographic cases of pastoral groups. The first thing she does is to make a distinction between dependence on animal husbandry in economic terms (production for trade and exchange) and dependence on pastoralism in dietary terms (reliance on milk, meat and blood), because, as she stresses, these two dimensions are often conflated in the literature (Johnson 2002, 159). Thus, reliance on pastoralism is not to be thought of as single-dimensional (cf. Cribb 2004: 15–20; Porčić 2007). She provides figures for dietary dependence on pastoral products (ranging from 15% to 65%) for the societies in question, but no figures for the other dimension (economic dependence); rather she states that they all are “economically dependent on herding” (Johnson 2002: 160).

Johnson’s conclusions can be framed as a set of hypotheses regarding environmental, socioeconomic and demographic variables. Some of these might be:

1) Dietary dependence on pastoral products is inversely correlated with dependence on acquired plant foods. As calculated from Johnson’s data, this seems to be true (Pearson’s $r=-0.605$, $p=0.028$, $N=13$).

2) Mobility of a group is positively correlated with dependence on acquired plant foods. Johnson measures mobility in two ways — as the number of moves per year and as the distance moved per year. Positive non-linear correlation with the distance moved measured by Spearman’s rho is indicated from Johnson’s data (Spearman’s $\rho=0.754$, $p=0.084$, $N=6$), but fails to reach the significance level of 0.05, probably because of the small sample size.

The question is: Can these results be replicated on a larger sample?

1.1. Defining the variables

The only cross-cultural databases available to me have been the *Ethnographic Atlas* (EA) (Murdock 1967) and the *Standard Cross-Cultural Sample* (SCCS) (Murdock and White 1969), published in electronic format by the *World Cultures* journal. Unfortunately, hypotheses that may be derived from Johnson’s study cannot be rigorously tested because of incomparability between her variables and those from the EA and SCCS. For example, both

the EA and SCCS¹ contain the variables termed *Dependence on Animal Husbandry* and *Settlement Patterns*, but it is unclear how they correspond to Johnson's variables.

Although an exact correspondence cannot be established, the effort will be made to find at least a hint to what these variables measure (more or less) in terms of Johnson's variables. Fortunately some but unfortunately not all of Johnson's cases are recorded as cases in the EA and SCCS (Table 1).

I ran cross-tabulations of the variables measuring dependence on pastoralism and mobility from Johnson and the EA. In addition, I cross-tabulated Johnson's variable measuring the percentage of acquired food and SCCS v1, *Intercommunity Trade as Food Source*. The results are shown in Tables 2–5.

It is evident that the variables are not measuring the same thing, except perhaps the pair of variables in Table 5, but the SCCS variable (v1) has a lower measurement resolution since it is given on an ordinal scale. There might be, judging from Table 2, a vague correspondence between the number of moves per year and settlement patterns, but the cases are too few to permit any confident claims.

The *Dependence on Animal Husbandry* variable does not correspond to the one termed *Percentage Subsistence from Pastoral*. It is possible that the EA and SCCS variables referring to the importance of animal husbandry for subsistence are in fact measuring the economic activities pursued, which, as already noted by Johnson (2002: 159), is often the case. If this is true in this instance, we would expect to find a negative correlation between the EA/SCCS variables measuring dependence on animal husbandry and Johnson's variable measuring dietary dependence on pastoral products. No such correlation could be detected, but then, it would be difficult to detect even if it existed given the small sample size (N=7). It should be mentioned in this context that the aforementioned significant correlation between *Percentage Subsistence from Pastoral* and *Dependence on Acquired Plant Foods* from Johnson's data diminishes and becomes statistically insignificant if the correlation coefficient is computed using the only seven cases that can be matched in the EA. The question of what the EA and SCCS variables are measuring in comparison with Johnson's data will be put aside for the moment.

The analysis has proceeded using only SCCS data. First the number of SCCS cases has been reduced by excluding all those categorized as hunters, fishers or gatherers on variable 820 (*Principal Subsistence Category*). Then a missing value analysis has been carried out (MVA module in SPSS) in

¹ Most variables included in the EA are also included in the SCCS and measure the same thing. The opposite is not the case.

order to determine whether the cases on variable 728 (*Importance of Animal Husbandry in Subsistence*) are missing at random. As it has been determined that they are really missing at random, missing values have been replaced using the multiple regression procedure (Tabachnick and Fidell 2007) with recoded v5 *Animal Husbandry–Contribution to Food Supply* (7 categories being collapsed into 5 categories to obtain an ordinal scale),² and v206 *Dependence on Animal Husbandry* as independent variables (adjusted $R^2=0.730$, $p<0.001$).

Furthermore, all the cases with values less than 4 on v5 (meaning that less than 10% of food supply is contributed by animal husbandry) have been excluded from the analysis, as well as the cases on v6 (*Mean Size of Local Communities*) exceeding the value of 6 (meaning that the mean value of local communities is over 5,000 people with towns and possibly cities present). So, 49 cases have remained for further analysis.

Principal component analysis has been carried out separately on two sets of variables. One set is related to the pastoralism dimension: the recoded v5 (*Importance of Animal Husbandry in Food Supply*); v728 (*Importance of Animal Husbandry in Subsistence*); v206 (*Dependence on Animal Husbandry*); and v812 (*Importance of Domestic Animals*). The first component has been extracted using this variable set and interpreted as the dimension of pastoralism (eigenvalue 3.522, 88.039% variance explained, variable loadings: v5 – 0.928; v815 – 0.954; v206 – 0.919; v728 – (-0.952)). The other set of variables has been used to construct a mobility scale. Three variables have been used: v61 (*Fixity of Settlement*); v150 (*Fixity of Residence*); and the recoded (in order to achieve ordination) v234 (*Settlement Patterns*).³ The first principal component has been extracted and equated with the dimension of mobility⁴ (eigenvalue 2.854, 95.132% of variance explained, variable loadings v234 – 0.951; v61 – 0.988; v150 – 0.986). What exactly this component measures in terms of Johnson's variables is unclear, but an educated guess

² The original coding for this variable was: 1) none; 2) present, not food source; 3) less than 10% food supply; 4) <50%, chiefly meat; 5) <50%, chiefly dairy; 6) <50%, chiefly honey; 7) >50%. Categories 4, 5 and 6 have been collapsed into one.

³ The original coding for this variable was: 1) nomadic or fully migratory; 2) seminomadic; 3) semisedentary; 4) compact but impermanent settlements; 5) neighbourhoods of dispersed family homesteads; 6) separated hamlets, forming a single community; 7) compact and relatively permanent settlements; 8) complex settlements. Categories 5, 6 and 7 have been collapsed into one category.

⁴ The scores for this component were multiplied by -1, because the original variables were coded in such a way that higher values meant lower mobility. By multiplying the component scores by -1 the signs of the scores are changed, so that higher scores on the thus transformed Mobility Component correspond to higher mobility, which is more intuitive.

can be made that mobility as measured in the SCCS is more related to the number of moves per year than to the distance moved per year.

I have mentioned that there might be an indirect way to infer what the component of pastoralism measures. The idea is to see whether there is a positive correlation with the variables measuring the importance of trade in the SCCS. Two such variables are present. One is the already mentioned v_1 (ordinal), and the other is v_{819} (*Importance of Trade*) (approximating the interval scale). Kruskal-Wallis test shows that there is no significant difference between the categories of v_1 on the dimension of pastoralism (Chi-Square 4.919, $df=3$, $p=0.178$), but if the categories of v_1 are collapsed into two supercategories $\leq 10\%$ and $10-50\%$ of intercommunity trade importance, Mann-Whitney test shows a statistically significant difference on the dimension of pastoralism, with the latter supercategory showing higher scores on the component of pastoralism (Mann-Whitney $U=71$, exact $p=0.048$). Correlation between the component of pastoralism and v_{819} is weak, but statistically significant ($r=0.352$, $p=0.033$). All this suggests that the thus defined dimension of pastoralism is weakly correlated but cannot be fully equated with the variable measuring the degree of economic specialization. This means that the original SCCS animal husbandry-related variables and the derived first component probably measure a little bit of both variables (the one relating to dietary reliance on pastoralism and the other relating to economic specialization) with a stronger emphasis on the economic aspect of animal husbandry.

1.2. *Evaluating the patterns*

Apparently, it is not possible to test Johnson's hypotheses rigorously, but it would be useful to examine the data with these hypotheses in mind and see what inferences could be drawn.

First the relationship between mobility and pastoralism will be evaluated (Fig. 1). The overall picture resembles the relationship between mobility and pastoralism as envisioned by Cribb (2004: 15-20) and further elaborated by Porčić (2007), in terms of the overall positive relationship between the two dimensions. This pattern, however, is a very broad one, and the goal set here is to investigate the more detailed and informative patterning discovered by Johnson. Labelled cases in Figure 1 are those which are present both in the SCCS and in Johnson. All cases have been marked with v_1 (*Intercommunity Trade as Food Source*) in order to explore Johnson's findings concerning dependence on acquired food. Both Teda and Tuareg (Ahhagar) are characterized as economic specialists by Johnson (2002: 158), while Chukchi (Chukchee in the SCCS) are classified as subsistence pasto-

ralists. Teda and Tuareg score highly on both the pastoralism and mobility components.

High mobility for the system state of economic pastoralists is predicted by Johnson's model and high scores on the pastoralism component can be brought into correspondence with her findings if the pastoralism component is interpreted in terms of economic specialization.

But the validity of such an interpretation could be called into question, because the Chukchi have a higher score (than Teda and Tuareg) on the pastoralism component, which is consistent with the higher score of Chukchi on the variable measuring the contribution of pastoral products in Johnson (2002: 157). The contradiction is obvious.

Yet, it seems that there are three clusters of cases: 1) groups with high mobility and high scores on the pastoralism dimension, characterized by a predomination of the highest and second highest score on *v1*;⁵ 2) groups with low mobility and low scores on the pastoralism component; 3) not so well defined cluster of cases with higher mobility than cluster 2, and lower scores on the pastoralism component.

Can these clusters be equated with Johnson's system states? Not quite. Teda and Tuareg (designated as economic specialists) are in the same cluster as Chukchi (designated as subsistence pastoralists). It could be argued that this cluster consists of two subclusters which are impossible to detect with so coarse measuring tools as the mobility and pastoralism components used here. Moreover, where are agropastoralists then? If we equate groups from cluster 3 with agropastoralists, a discrepancy arises because these groups have much lower mobility scores than Chukchi, and, according to Johnson (2002: 166), this should not be the case since the mobility of agropastoral groups should substantially exceed that of subsistence pastoralists both in the number of residential moves per year and in the distance moved per year (Johnson 2002: 164, Fig. 5).

The third option would be to equate cluster 1 with subsistence pastoralists, and cluster 3 with agropastoralists, but in that case subsistence pastoralists would practically be sedentary communities (note that all cases from cluster 3 have the same lowest score on the mobility component, meaning that these are sedentary communities), and Chukchi would be too far to belong to that cluster.

Marking the cases in terms of their primary (*v1716*) and secondary sources of subsistence (*v1717*) somewhat clarifies the matter (Fig. 2). It is

⁵ The precision of *v1* is quite dubious, given that Ahaggar Tuareg score 52% on Johnson's variable measuring the proportion of subsistence mix acquired through trade or purchase, while this group was categorized as depending less than 50% on trade as food source. It seems best, then, to consider *v1* mainly in relative terms.

evident that trade is the secondary source of subsistence for nearly all communities in cluster 1. This supports the idea that this cluster mainly represents specialized pastoral communities. The primary source of subsistence for the cases in cluster 1 is mainly animal husbandry, while the primary source for those in cluster 3 is extensive or intensive agriculture. If the cases are marked as v246 (*Subsistence economy*) instead of v1716, it is clear that cluster 3 could not possibly represent subsistence pastoralists since their primary subsistence activity is agriculture, which cannot be true in terms of Johnson's model⁶ (Fig. 3).

Could it be then that the cases from cluster 3 are in fact agropastoralists? Or is it possible that this frame of reference gives clue to a kind of patterning different from the one found by Johnson? From cross-tabulating the categorical variable describing the system state with v30 (*Settlement patterns*) from the small sample of matching cases in the EA, a suggestive patterning emerges. Agropastoral cases seem to show lower mobility than subsistence groups. If agropastoralists scored lower on the mobility component as measured by the EA and SCCS variables, then it would make sense to equate cluster 3 with this system state. Since too much speculation and ambiguity has been involved in the previous discussion, the best thing to do would be to change the frame of reference.

A somewhat clearer picture emerges when the SCCS cases are plotted against v819 (*Importance of Trade* expressed as percentage) and the mobility component marked with v246 (*Subsistence Economy*) (Fig. 4). Three clusters and one group are now discernible. The group of cases with the lowest scores on the mobility component (sedentary agricultural societies) will be omitted from further discussion. The cluster membership of Kurd, Toda, Papago and Basseri is uncertain in this property space.

Cluster 1 consists of cases with high mobility and high scores on v819, cluster 2 consists of cases with high mobility and low scores on v819 (mostly with score of 5), and finally, cluster 3 consists of cases with mobility score ranging from 0 to 1, and v819 score ranging from 0 to 5. If it were not for the discrepancy (in terms of Johnson's model) in ordination of system states on the mobility component, I would be very tempted to equate cluster 1 with economic specialists, cluster 2 with subsistence specialists, and cluster 3 with agropastoralists.

Further support for equating cluster 1 with agriculturalists comes from the examination of population densities. It is obvious from Johnson's data that agropastoralists have the highest population densities (Table

⁶ It is interesting to note that Teda are coded as practising intensive agriculture on v246 (Fig. 3), but this group is designated as economic specialists by Johnson and scores highly on pastoralism and mobility. The only explanation I can think of is a coding error.

7). Density-related information (as measured by the ordinal *v1130* from SCCS) is summarized in terms of medians for separate clusters in Table 8. It is clear that cluster 3 cases have the highest population density, but now there is another ambiguity regarding the first two clusters, because cluster 2 (which I have tentatively identified as subsistence pastoralists) has got a smaller median value than cluster 1 (tentatively equated with economic specialists), which should not be the case judging from Johnson's data, where the mean and the median of subsistence pastoralists are greater by order of magnitude than the same statistics for specialists. But the maximum values of *v1130* for different clusters are consistent with the ordination of system states by density medians as shown in Table 8.

At least two explanations are possible for the observed patterns. Either the variables in the SCCS are very low in resolution (and incomparable with Johnson's variables), or some of Johnson's generalizations, particularly the one concerning the mobility of agropastoralists, are incorrect since they are based on only two cases of agropastoral groups.

Whatever of the two is the case, it is a fact that the groups associated with the highest mobility score highly on the pastoralism dimension and have the highest dependence on trade (measured by *v1* and *v819*), creating a cluster which, in general, can be equated with specialized pastoralists (allowing for possible exceptions, such as that of Maasai,⁷ because of the ambiguity of the SCCS variables).

The hypothesis about the relationship between mobility and importance of trade (*v819*) can be formally tested by calculating the correlation coefficient (assuming that this variable correlates with the variable measuring the importance of acquired food in Johnson's study, which seems to be a reasonable assumption given the scores of Teda, Tuareg and Chukchi on *v819*). Correlation coefficients range from 0.422 ($p=0.003$, $N=49$) to 0.496 ($p=0.016$, $N=23$) for Pearson's r , and from 0.405 ($p=0.004$, $N=49$) to 0.497 ($p=0.016$, $N=23$) for Spearman's ρ , depending on whether all cases or only those belonging into the defined clusters are included into the calculation.

It can be concluded that even though the data resolution in the SCCS and EA is not high enough to test Johnson's model rigorously, there are indications that the organizational properties discovered by Johnson are genuine. The most important result regarding the problem discussed in this paper is that it is possible to delineate two clusters (1 and 2) of highly mobile pastoral groups so that their properties could be further examined.

⁷It may be concluded from Marshall (1990) that Maasai are actually subsistence pastoralists rather than economic specialists.

2. *Social and natural environment of specialized pastoral groups*

2.1. *Social environment*

A logical consequence of Johnson's definition of specialized pastoral groups is that such groups are heavily dependent on trade for their subsistence, and that they need to have someone to trade with and something to trade for. In addition, their high mobility necessitates a social environment suitable for making long journeys unhindered by various social and political obstacles.

The previous section has demonstrated that most cases from the specialized pastoralists' cluster had trade as a secondary subsistence activity. Halstead's (1987) argument has been that the existence of markets and marketplaces was an essential prerequisite for specialized pastoralism. It should be mentioned that the models put forward to explain the beginnings of specialized pastoralism in the Near East insist that this kind of adaptation developed as a consequence of changes in social and economic environments — e.g. the development of the first states, irrigation systems, population pressure, rise of cities and marketplaces (cf. Lees and Bates 1974; Levy 1983; Rosen 1988).

But it seems that this argument applies only to the Near-Eastern and circum-Mediterranean forms of pastoralism, because it is often claimed that nomadic pastoralism in East Africa developed in a different way and for different reasons (cf. Marshall 1990; Spooner 1971). It has been argued that the development of specialized pastoralism in Africa precluded that of agriculture (Marshall 1990; Marshall and Hildebrand 2002). The difference between modern African and Near-Eastern pastoralism, as suggested by Spooner (1971: 202), is that the former is directly dependent on pastoral products as a regular supply of food, while the latter "lay greater emphasis on the production of a marketable surplus of pastoral products, which they then trade for the greater part of their non-pastoral needs". In Johnson's terms the former are mainly subsistence pastoralists while the latter are economic specialists.

The issue of cattle-breeding societies in Africa is not without its problems though. There are opposite claims that pastoral groups were actually very much involved in the market economy (Turner 1993: 407). Turner's criticism may be valid for modern or historical cases. When it comes to prehistory, however, Marshall's (1990) explanation for adopting the pastoral way of life seems more likely since in prehistoric East Africa there was no market economy on a scale comparable to the colonial and postcolonial periods.

If we are to trust Marshall's conclusions, nomadic pastoralism can develop even without all these preconditions occurring in the Near-Eastern model. Khazanov (1994: 71) states that close dependence on market trading

is a characteristic of modern nomads, but not necessarily of all of them. But he also notes that:

Nomadism is practically inseparable not only from supplementary forms of economic activity, but also from such social and political activity which numbers amongst its aims the overcoming of economic one-sidedness. Of course, in the different variants of nomadism and even in different nomadic societies, specialization has manifested itself in different ways and with different degrees of intensity. (Khazanov 1994: 70)

As for the different ways of integrating with the social environment, the aspects of the social environment that can act as constraints are worth mentioning. The presence or absence of a market economy is not the only constraining factor. Political environment is very important for the movement of people. It has been recognized that long-range movements of pastoral peoples in the Balkans coincided with the existence of great empires. For instance, the range and intensity of pastoral movements in the Balkans was much greater at the time of Ottoman rule (Antonijević 1982: 41). But Cribb (2004: 60) reports that the intensity of pastoral migrations in Iran was much higher in periods when there was a collapse of central authority. The contrast is more apparent than real, because in the former case, the disintegration of such a large political entity as the Ottoman empire resulted in the formation in the Balkans of several small nation-states whose defined borders became an obstacle to long-range migrations (Antonijević 1982: 42), while in the latter, the disintegration of central authority led to a certain form of anarchy with no established borders to act as obstacles to nomadic movements. The main point is that nomadic pastoral adaptation is very much dependent on the social environment.

2.2. *Natural environment*

The natural environment is an important factor constraining and partly determining the nature of pastoral adaptation. As shown by Johnson (2002), the three system states of pastoral adaptation are largely dependent on the biomass of the environment. In turn, the amount of biomass is determined primarily by solar radiation and water availability (for a detailed account, see Binford 2001: 55–113).

A very robust illustration of the claim about the marginality of niches exploited by highly mobile pastoralists emerges in Fig. 5 and Table 9.

It is evident that most of the highly mobile societies come from extremely dry and/or extremely hot/cold conditions. Mobility is a way of coping with an unpredictable environment with its marked intra-annual and inter-annual variation. The impact of an unpredictable environment on

mobility can be detected by means of the multiple regression model where MTEMP variable, which measures the temperature constancy intra-annually (after Binford 2001: 68, Eq. 4.03), and the natural logarithm of the coefficient of variation in mean annual rainfall (as a measure of inter-annual unpredictability of rainfall, v_{1914} in the SCCS), are independent variables, and mobility is a dependent variable. The multiple correlation coefficient is significant (as are both predictors), but the effect size is quite low ($R=0.429$, adjusted $R^2=0.148$, $p=0.01$, $\text{Beta}(\text{MTEMP})=-0.275$, $p=0.048$, $\text{Beta}(\ln(v_{1914}))=0.297$, $p=0.034$), meaning that mobility is inversely correlated with the evenness of temperature during the year and positively correlated with the inter-annual variation in rainfall. Unfortunately, as the data on intra-annual rainfall variation are not available in the SCCS, this analysis is not complete, but the results are nevertheless in accord with Spooner's (1971: 205) statement that the habitat of nomads is marginal in terms of intra-annual and inter-annual climatic variation.

As more precise data regarding the rainfall have not been available to the author, caution should be taken not to overinterpret these results. For the sake of discussion, I shall proceed with the analysis nonetheless.

If 49 SCCS cases are organized by regional groups and the same regression model is applied, the only region for which the model is statistically significant is Sub-Saharan Africa (Table 10). What is interesting is that MTEMP is statistically significant as a predictor, whereas v_{1914} is not.

In the case of East Eurasia the situation is completely opposite. Although the model does not reach the level of significance of 0.05, it is very close to it (0.061). What is even more interesting is that v_{1914} is closer to being statistically significant and is more important as a predictor (as measured by beta value) than MTEMP, meaning that inter-annual variability in rainfall is a more important determinant of mobility than intra-annual variability in temperature.

As I have already noted, one should not put too much faith in these results, since the validity and meaning of the mobility dimension is very vague, its resolution coarse, and the relevant climatic variables used are too few (especially in comparison with Binford 2001). But it does seem that ecological variables explain variability in mobility in Sub-Saharan Africa more than in any other region. It should be kept in mind that the origin of mobile pastoralism in Africa is correlated to the emergence of bimodal rainfall pattern (Marshall 1990), that is to ecological variables.

What can be affirmed as a result of this very low-grained analysis is that most mobile pastoral adaptations arise in climatic circumstances which are not temperate. Mobility is negatively correlated with mean annual rainfall (Pearson's $r=-0.476$, $p=0.001$), which is roughly in agreement with Johnson's conclusion about the role of biomass in determining the system state.

It is important to note that in general the extreme climate (dry) is usually accompanied by greater mobility.

It may be argued that circum-Mediterranean and Near-Eastern pastoral economic specialization was an adaptation to the social rather than the natural environment. In contrast, it seems that in East Africa pastoral specialization was mainly a response to ecological conditions (Marshall 1990). Obviously this is a gross oversimplification, but it emphasizes the supposed distinction between economic and subsistence specialists. This is not to say that pastoralists in the Near East (and Europe in particular) do not migrate in accordance with seasonal changes (because they obviously do), or that East-African pastoralists do not exchange their products; this should only point out that different causes might have been conducive to the origin of the phenomenon.

3. Looking back at the EBA of the central Balkans

The main purpose of the exploration presented above has been to identify some of the major properties and determinants of mobile pastoral societies. It is time now to make an attempt to view the problem of the EBA in the central Balkans in the context of previous discussion.

The first question is: if the EBA populations of the central Balkans were mobile pastoralists, is it possible to infer what was their system state in Johnson's terms?

One possible approach to this question is quite straightforward and relies on Johnson's projection (Johnson 2002: 168; Fig. 7) of the expected system state for a certain region using the model she formulates as a baseline. It is evident from her projection that if entire Europe was populated by pastoralists, the expected system state for all these groups would be agropastoral. Johnson (2002: 169) directly addresses this issue and comments that the results of this projection do not support the ideas of Marija Gimbutas (e.g. 1965: 21) regarding widespread nomadic incursions into Europe. It is interesting to note that Johnson's projections predict agropastoral adaptation even in the Russian steppes.

To answer only the first question using Johnson's method is not enough for two reasons. First, we do not know whether the adaptations and their organizational properties as inferred by Johnson are entirely correct (since her results are preliminary and based on a small sample), and second, the projection tells us only what is to be expected under certain conditions, it is meant only as a frame of reference, not as a final statement about what really happened.

The most problematic part of Johnson's model, in my view, concerns the mobility of agropastoralists. It can be deduced from her conclusions

that the distance moved by agropastoralists usually exceeds 100km/yr.⁸ The results of my analysis show that the general mobility (as measured by the ill-defined mobility component) of agropastoralists (that is the groups of which I think are compatible with that system state — cluster 3) should be lower than the mobility of subsistence pastoralists. Although I tend to trust Johnson's results much more than my own because of the quality of her data, it is possible that the small sample size (only 6 cases coded for the distance moved per year) influenced her results, because variation in pastoral mobility can be very high, even among the nomads of the same "type" populating similar habitats (cf. Khazanov 1994, 52).

The results of my analysis imply that high mobility is associated with the marginal environment and unpredictability of rainfall. The climate of the central Balkans is temperate, so the reasons for the existence of high mobility are questionable. Moreover, Arnold and Greenfield (2006: 9) contrast the Mediterranean with the continental parts of the western and central Balkans in terms of possible causes of transhumance. Their point is that while ecological reasons for seasonality are more or less clear along the Adriatic coast because of the Mediterranean climate with its sharp contrasts in rainfall during the year and high summer aridity (see also Gušić 1976; Ršumović 1976), they are not so unambiguous for the temperate climate hinterland. This implies that subsistence and economic pastoralism should not be expected to arise in this area for ecological reasons alone. If I understand correctly the meaning of Johnson's agropastoralist system state as characterized by a mix of agriculture and pastoralism — diversified economy, then this is precisely what one would expect to arise in the central Balkans.

But what about Vlachs and Sarakatchani, the ethnographically known pastoral nomads, the group which Garašanin used as a source for formal analogy with the EBA groups of western Serbia? They are certainly not agropastoralists because they practise no agriculture whatsoever (Antonijević 1982). Even though I have no quantitative data for their dependence on food acquired by trade, I am inclined to classify them as economic specialists because of their very important role in the trade and commerce in the Balkans (Trojanović 1909). Their way of life could be viewed as an adaptation to the social environment (although their migrations are necessarily finely tuned with seasonal changes in temperature and rainfall); they were dependent on markets and sedentary populations. It would be very difficult to argue that markets and a comparable social environment existed in the EBA of the central Balkans. That is why it is more probable that small-scale

⁸ Since they should be more mobile than subsistence pastoralists who, according to Johnson (2002: 166), generally do not move more than 100km/yr.

vertical transhumance and a mixed economy were the subsistence basis for the period and region in question.

Why are there no EBA settlement sites then? Garašanin's explanation for the lack of settlements is that since the EBA people were highly mobile their dwellings were made of light and perishable materials and thus difficult, if not impossible, to detect archaeologically. The relationships between the durability, mobility and permanence of settlement have been theoretically elaborated (McGuire and Schiffer 1983) and empirically tested (Binford 1990; Diehl 1992), and in that sense Garašanin's statement is likely to be true. But is it likely that there was an economic (or subsistence) specialization in the EBA of the central Balkans that would imply high mobility? The answer is probably negative, because there were neither ecological nor social reasons for such specialization to arise (cf. Bankoff and Greenfield 1984).

It may be interesting to compare the archaeological signatures of the Final Neolithic sites in the Nabta region, Western Desert, Egypt (Johnson 2002), and the EBA in central Serbia. In both cases there are no houses detected, only burial tumuli; in both cases small cattle gains importance.

Johnson (2002: 173) states that her model predicts economic specialization for that particular area, but she also adds that none of the modern groups living nearby could be used as direct analogs for the Final Neolithic groups. The role of the tumuli in Nabta is discussed in connection with the leaders' increasing prerogatives. One of the things that Johnson has empirically found is that the leaders of the economic specialist groups have the highest prerogatives because of their role in the trade with the external (to the community in question) world. Johnson hypothesizes that the building of the tumuli and megaliths is connected with the increasing role of leadership. The pottery of the Final Neolithic from the Nabta region is similar to the contemporaneous pottery from the Nile valley. Johnson does not offer any definitive interpretation, but is it possible that what we have here is some kind of specialized pastoral economy with elements of trade? I am not an expert on the prehistory of Africa, so I really do not know the answer to that particular question, but what interests me is whether this situation is comparable to the Early Bronze Age in Serbia.

Let us compare. First of all, it cannot be claimed a priori that the EBA tumuli in the Balkans were elite burials. Perhaps they were, but it is something to be tested (or at least evaluated), not assumed in advance. There is evidence for long-distance trade: a very small amount of amber (33 amber necklace parts) (Palavestra 1993: 139–140). But I do not believe it enough to be able to infer that these groups were involved in large-scale trading, or that they were specialized traders. Objects from distant sources are known even in the preceding Neolithic period (e.g. obsidian and *Spondylus* arte-

facts), and nomad-mediated trade is not the only way for foreign materials and objects to arrive in certain context.

Finally, the ecological and climatic properties of the two regions are completely different, one being in an African desert and the other in the temperate region of Southeast Europe. The ecological determinants of mobility have already been elaborated, so there is no need to dwell on them any further.

The main point is that the use of formal analogy would not take us far, because if you only look hard enough similarities are easy to find almost everywhere, both in archaeology and ethnography (e.g. Hielte 2004).

There is a possibility, though small, that what we are dealing with in the EBA of the central Balkans is a completely unique form of pastoral adaptation, but this would be an *ad hoc* hypothesis because, from all that we have learned in the course of background knowledge exploration, this should not be so. There is a potentially much more down-to-earth and simpler explanation for the lack of settlement sites in the region — the lack of appropriate survey design. Central Balkan EBA communities were probably more mobile than Neolithic groups, but far less mobile than modern specialized pastoralists. Their settlement pattern probably even has a modern analog in the Balkan semisedentary transhumant groups with permanent settlements in lowland and pastoral outposts in highland areas. These communities practise agriculture and not all of their members are mobile.

Conclusion

The construction of frames of reference, as envisioned by Lewis Binford in 2001, is one of the most important tasks for archaeologists interested in theory building. Organizing prior knowledge about the organizational properties of different systems is a difficult but rewarding enterprise. I have tried in this paper to look at one particular problem with the background knowledge in mind. Organizing background knowledge and constructing frames of reference in an analytical way is still in a preliminary phase when pastoral groups are in question, but even these preliminary studies yield quite interesting results.

I believe that I have been able to provide a rough confirmation of Johnson's preliminary results for the relationship between major variables of pastoral systems, the only discrepancy relating to the mobility of agropastoralists and subsistence pastoralists. The communities tentatively identified as subsistence and economic specialists in my analysis tend to be highly mobile. High mobility in turn is related to the extreme climatic conditions with high seasonal variability. There are no cases coming from a temperate climate that score highly on mobility. The causal mechanism behind the fact

that most mobile communities come from less productive environments in terms of biomass is clear. Put simply, once the local resources are depleted, the group has to target another area for resources.

After evaluating these patterns and establishing the frames of reference, I have looked at the problem of pastoralism in the EBA central Balkans. My conclusion, in the light of our current background knowledge about pastoral adaptations, is that Garašanin's hypothesis is not probable. The conclusion should not be viewed as the final word on the problem, because the archaeological evidence must be evaluated too. To use a Bayesian metaphor, this kind of consideration is similar to determining the prior probability of a hypothesis. This is best expressed by Johnson:

The point is not to assign meaning to our current understanding of the archaeological record but to work between the archaeological record and the ethnographic frame of reference to identify what we still need to learn. (Johnson 2002: 174)

In the case of the EBA of the central Balkans there is still much to be learned, especially about the archaeological record. Our prior knowledge tells us that we should not expect to find nomads in the Balkans in the Early Bronze Age. The current state of archaeological investigation in western Serbia is far from being such that we can say safely and with enough certainty that the theory is wrong simply because we have not found any settlement sites. What seems to be needed first therefore is problem-oriented fieldwork, survey in particular. Before being able to proceed to discuss the organizational properties of the system under study, we need to determine if there is a case to answer at all — whether there really are no settlement sites or whether we just failed to detect them due the lack of properly designed survey.

Table 1 Cases shared by Johnson (2002), EA and SCCS

Groups present both in Johnson (2002) and in EA	Groups present both in Johnson (2002) and in SCCS
Chukchi	Chukchi
Teda	Teda
Tuareg-Ahaggar	Tuareg-Ahaggar
Nuer	
Jie	
Turkana	
Kababish	
Mutair	

Table 2 Variable *Settlement Patterns* (v30) from EA and variable *NOMOV* from Johnson (2002)

		Settlement Patterns			Total
		Nomadic or fully migratory	Seminomadic	Semisedentary	
NOMOV (Number of moves)	6.00	0	1	0	1
	6.50	0	1	0	1
	7.00	0	1	1	2
	20.00	1	0	0	1
Total		1	3	1	5

Table 3 *Settlement Patterns* (v30) from EA and variable *DISTMOV* from Johnson (2002)

		Settlement Patterns			Total
		Nomadic or fully migratory	Seminomadic	Semisedentary	
DISTMOV (Distance moved (km))	93.00	0	1	0	1
	241.00	0	0	1	1
	354.30	1	0	0	1
	483.00	0	1	0	1
Total		1	2	1	4

Table 4 Variable *Animal Husbandry* (v4) from EA and variable *Percentage Subsistence from Pastoral* from Johnson (2002)

		Animal Husbandry				Total
		26-35% Dependence	46-55% Dependence	76-85% Dependence	86-100% Dependence	
Percentage Subsistence from Pastoral	15.00	0	0	1	0	1
	20.00	1	1	0	0	2
	30.00	0	1	0	0	1
	45.00	0	0	0	1	1
	62.00	1	1	0	0	2
Total		2	3	1	1	7

Table 5 Variable *Intercommunity Trade as Food Source* (v1) from SCCS and variable *Percentage Subsistence from Acquired Food* from Johnson (2002)

		Intercommunity Trade as Food Source		Total
		<10% of food	<50% of food/less local source	
Acquired food	1.00	1	0	1
	45.00	0	1	1
	52.00	0	1	1
Total		1	2	3

Table 6 System state and mobility of the eight matching cases from Johnson (2002) and EA

		Settlement Patterns			Total
		Nomadic or fully migratory	Seminomadic	Semisubsetary	Nomadic or fully migratory
System state	Agropastoral	0	1	1	2
	Pastoral subsistence	1	1	0	2
	Specialized pastoral	2	2	0	4
Total		3	4	1	8

Table 7 Differences in population densities between different system states calculated from Johnson's data (2002)

		Density (p/100sq km)	
		Median	Mean
System state	Agropastoralists	257.00	296.36
	Subsistence Specialists	100.00	115.86
	Economic specialists	9.98	35.31

Table 8 Median and maximum population densities (v1130) across clusters, calculated from SCCS data. Coding for v1130: 3=1-4.9 persons/sq mile; 4=5-24.9 persons/sq mile; 5=25-99.9 persons/sq mile

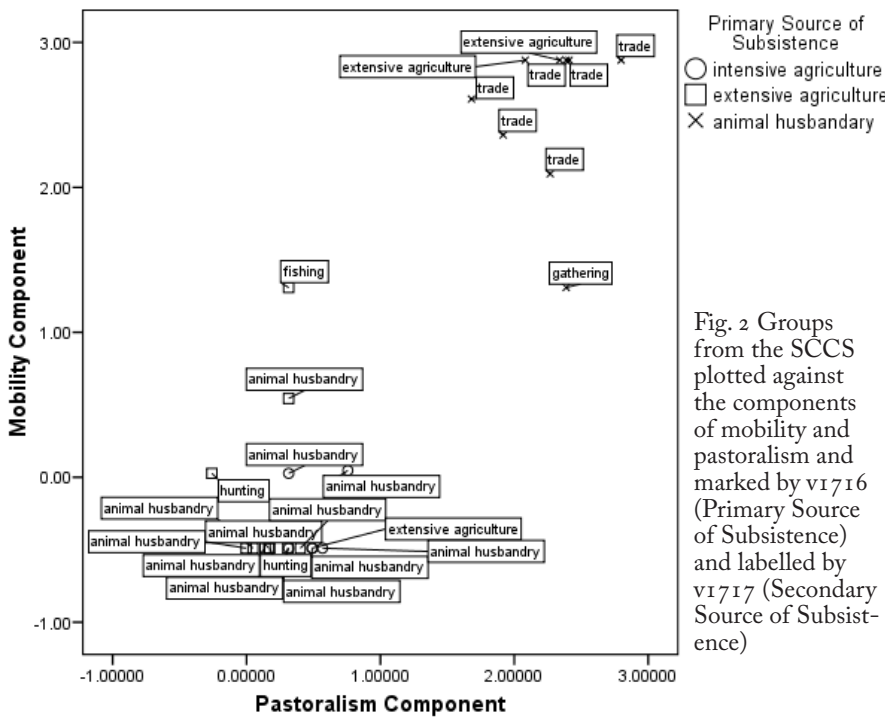
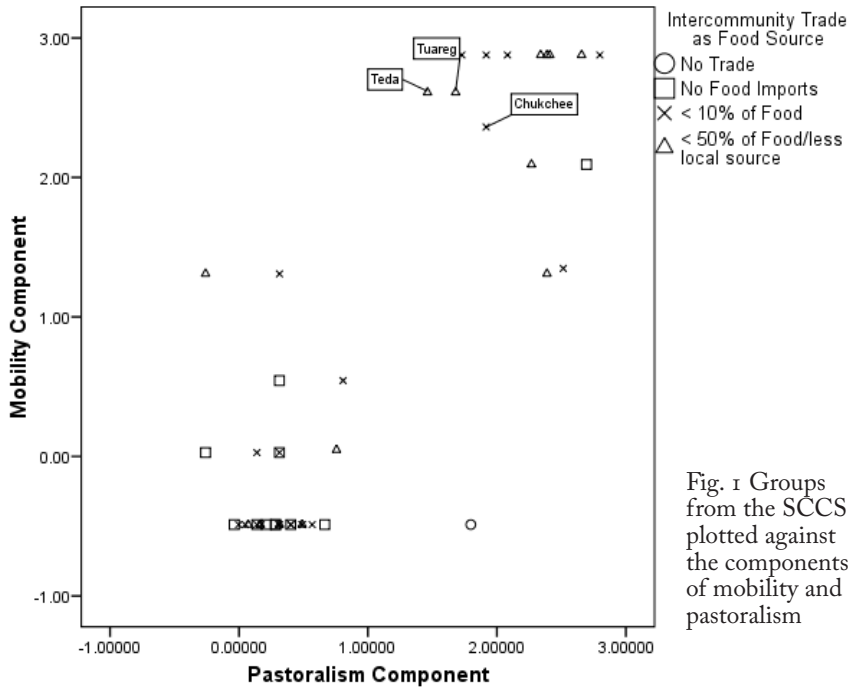
		Population Density	
		Median	Maximum
Cluster	1	3	3
	2	2.5	4
	3	4	5

Table 9 Cluster membership and niche rainfall (v855) from SCCS

		Niche Rainfall (Approximate)						Total	
		Tropical rainforest	Very wet	Wet	Mod-erately wet	Dry	Very dry	Des-ert	Tropical rainfor-est
Cluster	1	0	0	0	0	3	0	3	6
	2	0	0	0	1	2	2	1	6
	3	1	5	1	0	1	0	0	8
Total		1	5	1	1	6	2	4	20

Table 10 Results of multiple regression analysis for different regions of the world with the Mobility Component as a dependent variable, and temperature evenness (MTEMP) and natural logarithm of coefficient of variation in mean annual rainfall (v1914) as independent variables

REGION	Adjusted R ²	MTEMP Beta coefficient	ln(v1914) Beta coefficient	N
Africa (without Sahara and Madagascar)	R ² =0.796 p=0.008	-0.95 P=0.003	0.27 p=0.185	8
Circum-Mediterranean (North Africa, Europe, Turkey, Caucasus, Semitic Near East)	R ² =0.079, p=0.663	-0.271 P=0.397	0.47 p=0.881	13
East Eurasia (including Madagascar and islands in the Indian Ocean)	R ² =0.359 p=0.061	-0.2278 P=0.256	0.446 p=0.079	16



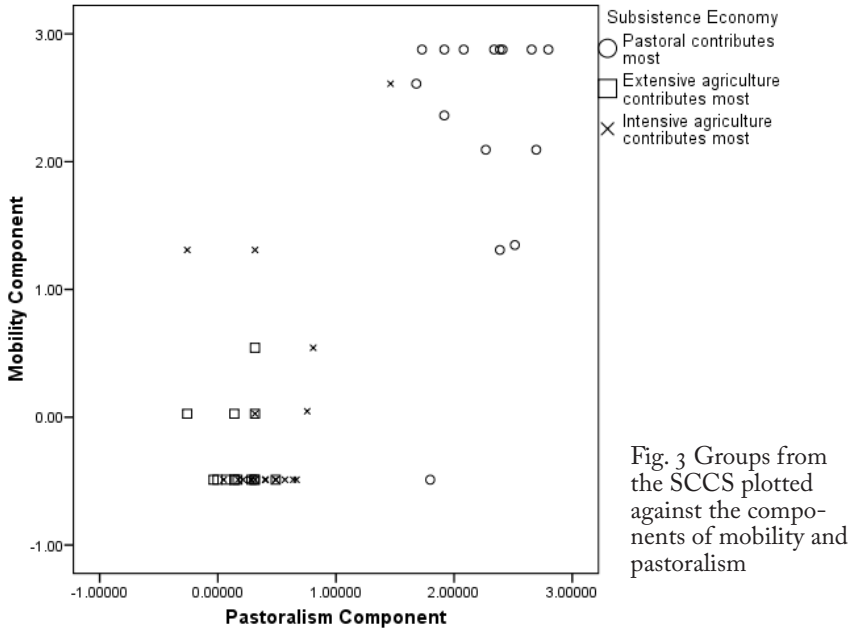


Fig. 3 Groups from the SCCS plotted against the components of mobility and pastoralism

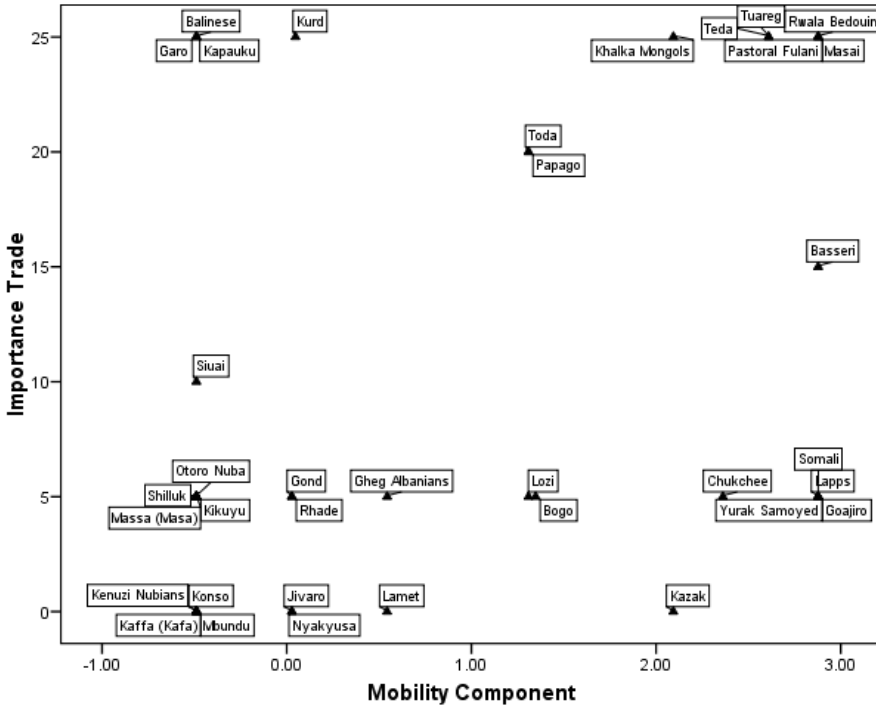
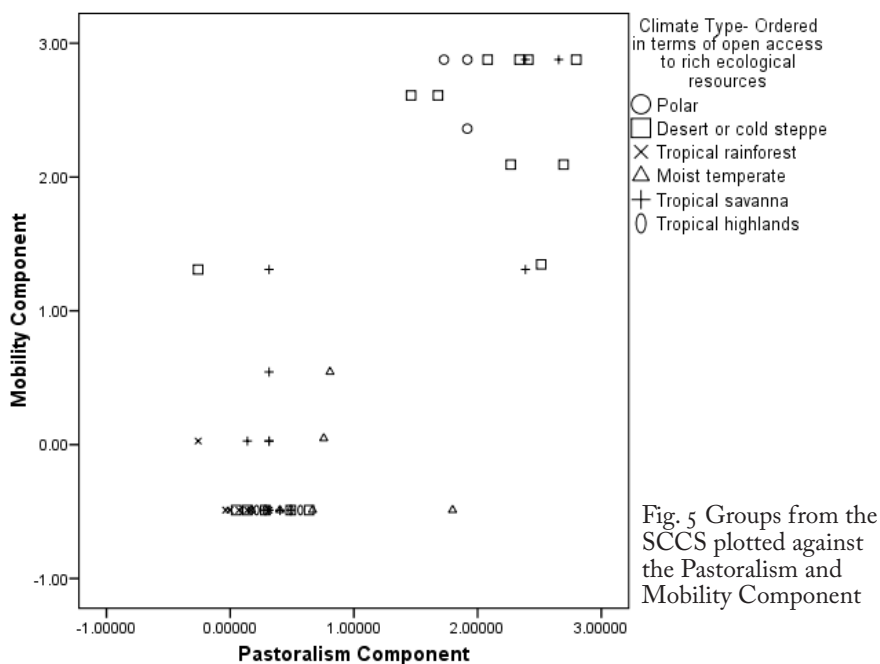


Fig. 4 Groups from the SCCS plotted against v819 (Importance of Trade) and the Mobility Component



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