PRODUCTION AND USE OF FLINT AND GROUND-STONE AXES AT MĂGURA GORGANA NEAR PIETRELE, GIURGIU COUNTY, ROMANIA

Florian Klimscha

ABSTRACT
 Axes made from stone and flint found in the debris of burnt houses at the site Pietrele “Măgura Gorgana” are presented and the traces of production, working and repair are analysed. The grinding on ground stone axes reflects particular, preferred ways of working which are specific to single households and seem to reflect a teaching process that was limited to the inhabitants of a single house. Significantly, larger flint axes can be differentiated into tools used by left- and right-handed people and were used as symbols of social distinction in a similar way as copper axes.


Keywords: Copper Age, Chalcolithic, south-eastern Europe, stone axes, flint axes, copper axes, household-specific production traces; handedness, symbols of social distinction.

INTRODUCTION
 The following article deals with flint and ground-stone axes from the south-east European Copper Age (ca. 4700–4100/4000; cf. Bem 2000–2001) which have been excavated in the settlement site of Pietrele “Măgura Gorgana”, Muntenia, southern Romania. I will give a short overview of the archaeological data available at Pietrele and then develop an interpretation of the similarities and differences concerning the working traces that can be seen on the axe blades from several house contexts.

The tell site “Măgura Gorgana” near Pietrele in Eastern Walachia has been excavated by a Romanian–German team since 2002 (Hansen et al. 2003, 2004, 2005, 2006, 2007 & 2008). Today the tell is roughly 10 m high and includes layers from the Late Neolithic and Chalcolithic, that is the cultures called Boian (Comșa 1965, 1973, 1974 & 1975) and Giumelnița (Comşa 1976) (Figure 1). Several radiocarbon dates from sealed contexts of the uppermost layer show that the settlement was abandoned around 4200 BC (Hansen et al. 2008, 21). Two trenches, called B and F, are currently under excavation. Settlement activity at Măgura Gorgana is, however, not limited to the tell site itself. Geomagnetic surveys and Corona-satellite pictures revealed an outer settlement in the surrounding area (Figure 2); further north there is a ditch system, whose connection to the tell has yet to be verified. In 2009, excavations in the outer settlement dated it to the Chalcolithic; although a detailed correlation with the layers of the tell is not possible yet.

The settlement is part of the Gumelnița culture which is sometimes included in the larger Kodžadermen–Gumelnița–Karanovo VI “cultural complex” (KGK VI complex) (Figure 3). The KGK VI complex is characterised by the distribution of copper shafthole axes, clay figurines and tell settlements (Todorova 1978 & 1995; Fol & Lichardus 1988; Lichardus 1991). Recently, several authors have questioned the reliability of the archaeological data for the definition of this culture, especially the accessibility of the ceramic types used to define phases and (sub-) cultures, because the archaeological basis of certain phases is very sparse (cf. Hansen et al. 2003 & 2004 and references therein). However, it remains unclear, whether Gumelnița or the KGK VI complex provide the archaeological evidence for political, economic or ethnic unification as argued by some authors. Rather, they represent a loosely connected group of settlements with similar ceramic styles. This paper deals with the production and use of the stone axes found at Măgura Gorgana and uses them to try to interpret the work routines on a 5th millennium tell site.

1 Deutsches Archaeologisches Institut – Orient Abteilung, Podbielskiallee 69-71, 14195 Berlin, Germany. Email: fk@orient.dainst.de.
Figure 1. Pietrele “Măgura Gorgana”. Picture taken from an octocopter of the trenches currently being excavated (Photo: Konstantin Scheele/DAI Eurasia Department).

Figure 2. Pietrele “Măgura Gorgana”. Interpretation of the geo-radar scanning (Drawing: Baoquan Song/Ruhr-University Bochum).
THE STONE AXES — TYPOLOGY AND CONTEXTS

In Măgura Gorgana stone axes are mostly preserved in the debris of burnt houses. The alleys between the architectural units only contain fragments of axes or very small and heavily damaged pieces. These can very probably be interpreted as waste. In contrast to that, the burnt houses contain a large number of axes of different types, sizes and working stages. Four large groups can be differentiated:

Class I axes are defined as small ground-stone axes of rectangular, trapezoidal or triangular shape with an oval or rectangular section; class II axes as flat axes from ground-stone or flint (Figure 4), and class III axes as large flint axes with a rectangular or trapezoidal section (Klimscha 2005 & 2007) (Figure 5). Additionally, battle axes made from ground stone also exist in the settlement; good examples are found in the Varna graves, as well as throughout southern Bulgaria. In the following paper, however, I will mainly focus on the first three axe types.

THE STONE AXES — PRODUCTION

Two basic types of production co-exist on the tell site: axes are either chipped from flint or ground from metamorphic rock. While flint axes very rarely show traces of polishing, ground stone ones are often very highly polished and polishing traces can still be seen with a magnifying glass on a large number of axes (Figure 6). 142 axes from Măgura Gorgana were studied for these polishing traces which were documented on six zones: the butt, the cutting edge, the two broader sides and the narrow sides. The traces were then classified into three categories: parallel, horizontal and vertical to the longitudinal axis of the axe blade (Figure 7). Even though the axes show some variability, there is also high degree of regularity (Figure 8).
While the butt is treated in diverse ways and is even pecked quite often, 80% of the cutting edges have parallel grinding marks. They were created by tools made of soft, coarse-grained stone into which grooves have been cut; these are frequently found on the tell site. The axe edge was placed into these grooves at a slightly inclined angle and moved back and forth. However, one-fifth of the axe blades also show other sorts of traces; therefore, differing grinding methods must have been in use. For instance, the axe could be held in one hand and polished by rubbing its cutting edge over a quern. The narrow sides are mostly ground parallel to the axe’s longitudinal axis. This pattern can be explained by practical decisions regarding the ease of axe handling. The easiest way to hold an axe in one hand is to take hold of it along the longitudinal axis. Holding it in this manner and moving the arm backwards and forwards on a grinding stone will cause parallel traces to appear. The broad sides, on the other hand, are polished in every possible direction.

Except for the butt, all zones are always polished. The traces can only be described as standardized on the cutting edge and the narrow sides; but this apparent “standardization” seems to stem from pragmatic choices about handling the axe blades rather than specialized production. Therefore, the axe blades seem to reflect non-specialist production. This interpretation is further strengthened by another observation: in most cases each face of the axe has been polished in the same manner. If one face was polished parallel to the longitudinal axis, the other was nearly always also polished parallel to or diagonally across the same axis. Diagonal polishing traces correspond mostly to diagonal or parallel traces, while perpendicular traces on the upper side most often correspond to perpendicular traces. In other words, if one face is polished in a certain direction, then usually the other face is polished in the same direction. This pattern seems to reflect the prehistoric manufacturer simply flipping the axe over after having finished one side, and maintaining a consistent working direction whilst shaping the rest of the axe.

The axes therefore seem to be individually manufactured. No standardized polishing traces, which would be the expected result of axes being produced in large numbers by specialists, are visible. On the other hand, the polishing traces have not resulted from the work of unskilled individuals, but, following André Leroi-Gourhan (1964–1965), reflect a certain degree of rhythm, i.e. a controlled and steady approach to manufacture. Some parts of the axes show a clear preference for working in a particular way. In some cases, these favoured gestures reflect simply prehensile preference — the easiest way of holding and handling the tools; however, it is still not clear why there is not more variation; why did the prehistoric manufacturers prefer certain motions over others when grinding a specific part of a stone axe? Particular ways of grinding the cutting edge, or the narrow sides, of an axe, for instance, seem to be widely shared. Most inhabitants had a common idea of how these
parts of an axe should be shaped. In this case, the shared technique seems to be the most efficient way of doing this work that allowed effective handling of the axes. If this conclusion is accepted, it seems plausible to assume that the people who produced the grinding traces (and, thus, finished or repaired the axe blades) had either done this work regularly or had been taught how to do it. Some individual experimentation clearly took place as only 50-70% of all traces show regularity.

The way in which this preference for certain working rhythms over others developed can be illustrated by looking at the finds from different house contexts (Figure 9). Since all three burnt houses excavated so far have produced axes which show different grinding patterns, it seems that each household utilised specific techniques of manufacture. People in the lower, burnt, central house in trench F preferred to grind the narrow sides parallel to the longitudinal axis and the butt, and the faces parallel or diagonally to it, while the cutting edge was almost always ground perpendicular to it. On the other hand, people living in the upper, burnt, central house in trench F preferred to use diagonal movements on the faces, parallel grinding for the narrow sides, and perpendicular movements for the cutting edge and the butt. The final context from within a house that produced enough pieces to allow for comparison was the eastern house in trench B. These showed parallel or perpendicular grinding traces in all zones except for the butt which was usually just pecked and not ground at all.

The axes were also quite often repaired, especially the cutting edge. The butt, on the other hand, seems to be the most neglected zone, a pattern which can be explained by the axes having been hafted within an antler sleeve. This sleeve not only made the butt invisible to the users but also made its degree of polish irrelevant to how the complete axe actually functioned.

Significantly, not all class I axes were produced from fresh raw materials; rather, many are the last element of a chain of reworking larger class II axes and battle-axes into smaller shapes. Some evidence for this progressive reworking is found on the butts of some class I axes, which still show traces of a former shaft hole.

**THE FLINT AXES — PRODUCTION**

Unlike ground stone examples, flint axes show differing modes of production (cf. Păunescu 1970; Ciută 1998; Comşa 1992; Klimscha 2008). It is currently unclear where these tools were manufactured. From the contemporary tell site Căscioarele “Ostrovel”, a context was excavated which is interpreted as a manufacture site; but the publications do not demonstrate the presence of production waste.
Figure 8. Polishing traces on ground-stone axes from Gumelnita sites (n=142).

Figure 9. Polishing traces from the burnt houses of Pietrele “Măgura Gorgana”.

Pietrele - Trench F upper, burnt central house (n=7)

Pietrele - Trench F lower, burnt central house (n=9)

Pietrele - Trench B Eastern house (n=12)
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Flint axes were very rarely polished. Microscopic analysis of the Pietrele material by Dr. Marvin Kay from the University of Arkansas showed slight traces of grinding on some pieces, but never to the degree known from the flint axes of the TRB and Globular Amphora cultures (e.g. Spinei 1970 & 1971; Nielsen 1977; Rech 1979; Nagel 1985). Under the microscope, the butts of some axes can also be identified as having originally functioned as the cutting edge of larger axes; thus, it can be suggested that there was an ongoing recycling of flint axes. Essential for this recycling is the status of the cutting edge.

The cutting edges of flint axes are either round, straight or nearly triangular (Figure 5). While both rounded and straight cutting edges are present on freshly made pieces, the area where the cutting edge curves tends to be easily damaged by shaping and use. The repair of these areas firstly causes the edge to become asymmetrical in cross-section, thus resembling an adze (Rech 1979), and, secondly, results in it becoming increasingly triangular with every repair. Use-wear analysis as well as morphological studies allowed the reconstruction of different stages of use of flint axes in Măgura Gorgana. The axes were repaired and even recycled after both major and minor damage. Thus, axes which differ in appearance represent transient working stages, rather than different chronological or function variants.

The most striking difference between flint axes and other stone axes is that flint axes were not hafted in antler sleeves as were class I axes. Once a flint axe became too short to be hafted, it was used as a hammer, as a core for the production of new tools, or even as a large scraper.

**THE FLINT AXES — USE-WEAR**

Experiments as well as use-wear analysis allow us to reconstruct the ways in which flint axes were actually used (Madsen 1984; Jørgensen 1985; Adameck *et al.* 1990). In contrast to modern axes, flint axes have to be used carefully, and do not cleave right through wood (Schweingruber 1975; Meier 1990). The axes cause concave separation planes and remove small splinters. The technique makes use of the asymmetrical cutting edge which works principally in the same way as a lever. Taking this into account allows us to interpret the steeper of the two surfaces of the cutting edge as the upper side of the axe during use.

Twenty-one axes and axe-fragments retained gloss on the cutting edge; these traces of gloss were usually applied diagonally, and this angle can be measured. The angle was always measured on the upper side, and two discrete units can be discerned. Seventeen pieces have an acute angle of more than 150° and four axes an obtuse angle of less than 30° (Figure 10). Therefore, the two groups were regularly used in opposite directions during woodworking; consequently, the use-wear formed in opposite directions on the tools. My interpretation is that this pattern reflects their use by right-handed and left-handed persons. This observation has two major implications. First, it is obvious that such regularity in use-wear on left-handed axes could only be achieved if those tools were used regularly only by left-handed persons (Jankuhn 1978), implying that

![Figure 10. Pietrele “Măgura Gorgana”. Examples of gloss traces on flint axes belonging to class III (drawings by author).](image-url)
the axes belonged to particular individuals. In contrast to what has been suggested for LBK axes for which Mischka (2004) argues, they were communal property — the Gumelnita axes were used, and probably owned, by individuals or a household. Secondly, the number of left-handed axes (18%), is relatively high compared to contemporary population estimates (10% left-handers), suggesting that Gumelnita society was quite tolerant towards left-handed people. Nico Becker (2008, Hansen et al. 2009, 50–56) could differentiate between left- and right-handed spoons from Măgura Gorgana and can identify three bone spoons made just for left-handed use (Becker 2008, 24); that is, 18% when compared to the right-handed spoons or 13% when compared to all spoons (including those which could, due to fragmentation or other reasons, be attributed neither to right- nor left-handed use). These results support my interpretation of the axes, affirming the relatively large quantity of artefacts used by lefthanders. Even if the proportion of left-handed flint axes drops when all the pieces without visible traces are taken into account, it still appears that people in Pietrele “Măgura Gorgana” practised a relatively high tolerance towards lefthanders. It is also striking that one or two left-handed axes were found within each of the burnt house contexts, implying that this tolerance resulted in left-handed persons living (or working) in every single house yet discovered.

AXES IN INDIVIDUAL HOUSES

Finally, I would like to analyze the axes of Măgura Gorgana on the level of individual households (Figure 11).

It is unclear whether the production of ground-stone or flint axes was the work of specialists; however, the repair and finishing of the axes was, in fact, carried out by members of each household who seem to have shared their personal experiences and techniques with their housemates. This sharing of ideas about how to make and repair an axe blade resulted in specific preferences in the working directions of the surface treatment of axes. The human skeletons from burnt house contexts excavated to date suggest that these housemates can probably be seen as a family with children and, perhaps, elderly people living together with one male and one female adult (Hansen et al. 2009, 50–56).
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Figure 12. Distribution of concentrations of three or more copper and flint axes during the 5th and early 4th millennium in south-eastern Europe (mapping by author).

2008, 82–89). All four houses excavated to date share a relatively large amount of class I axes (60-70%). Only the lower, burnt, central house in trench F deviates from this, having a significantly higher number of class II and III axes. If it is accepted that these axes were personal possessions, we can identify this house as a household which possessed more and better axes than the rest of the settlement. Since it does not contain either special forms of axes or an unusual range of axe types, when compared to the other houses, the idea of a woodworking specialist’s household seems implausible.

Ethnography suggests that accumulation of axes in one household can be the demonstration of social status (e.g. Højlund 1978). A New Guinea saying claims that the best man also has the best axe (Godelier 1982). The inhabitants of the lower central burnt house distinguished themselves (sensu Pierre Bourdieu 1979) by the possession of their axes. The implication is that larger axes were more important for establishing one’s position in society.

CONCLUSION

This interpretation needs to be discussed further. Returning to the manufacture of the axes, there are important arguments for the idea of flint axes being prestigious items used for identifying a person’s social status. A number of flint axes have cutting edges that are splayed out at either side. This can best be explained as copied from contemporary copper axes, a trait that would connect them with a group of jadeite axes from Western Europe which have this type of cutting edge (e.g. Petrequin et al. 1996 & 2002). Additionally, a number of flint axes show traces of blade production on one face, having been used as a
core before being transformed into an axe. Since axes are usually between 12 and 20 cm long, the blades which would have been produced from them would resemble the so-called “super-blades” found in south-eastern Europe. These blades, which are more than 14 cm long, are regularly found in the richest graves at Tiszapolgár and Varna (Manolakakis 2002; Bogner-Kutzian 1963).

However, the extraordinary richness of the Varna graves (gold items, heavy copper axes (“Schwergeräte”, super-blades etc.) is only partially reflected in Gumelnita sites, with the cemeteries, in particular, being much more sparsely furnished (Comşa 1995). Even though gold and super-blades are known from Pietrele and thus can be connected with the rich graves at Varna, heavy copper axes are not very often found in Muntenia. These items are more common on the Black Sea coast and in the Carpathian Basin. Nonetheless, other copper objects, particularly awls and pins, are relatively common. Clearly, copper was available but not preferentially used for axes.

Flint, on the other hand, was also available in the complete KGK VI complex, but it was only extensively used to produce axes in certain regions. Since flint axes are rarely found in the largest or most extensively excavated tell sites, this distribution does not simply reflect research intensity. In fact, smaller, less intensively excavated tell sites have actually generated more axes; axe representation is therefore not related to settlement size but to how settlements are connected to the Danube (Klimscha 2008). On the other hand, this pattern is only derived from tell excavations. If the outer settlement at Pietrele is not a unique occurrence, then it is likely that many more tells had settlement structures within their vicinity. A further consideration when interpreting distribution maps is the fact that research in south-eastern Europe focuses preferentially on larger tell sites, rather than smaller tells and flat settlements.

These caveats aside, the number of large axes found at each tell does seem to reflect how it was involved in the exchange of goods along the Danube and its tributaries. The contacts between social elites, marriages, alliances and politics which go hand in hand with this kind of communication (Mauss 1950; Polanyi 1974; Godelier 2008) are very important for the social reproduction of a society; and only in a very few cases can prestigious goods be taken out of an exchange network. The ability to remove axes from exchange networks can result from a “surplus” of axes; although sometimes societies also indulge in the destruction of goods which cannot be replaced, for instance the potlatch (cf. Mauss 1950; Jonaitis 1991; Andersen & Halpin 2000).

Therefore, the different amounts of flint axes seem to reflect control over the supply of the necessary raw materials, allowing for the production of more prestigious goods. Eric Thirault (2004 & 2005) has called the control of exchange networks the equivalent of political power in Neolithic Europe. Thus, the occupants of settlements on the Danube managed to collect and control high quality flint, distributing the “super blades” made from this material. Apart from Pietrele “Măgura Gorgana” (Berciu 1956; Hansen et al. 2004, 2005, 2006, 2007 & 2008), other settlements where the inhabitants were engaged in this exchange network are the tell sites of Sultana “Măgura Sultanei” (Andriescu 1924), Ruse (Georgiev & Angelov 1952 & 1957; Bojažiev 2007; Slavchev 2005; Zlateva-Uzunova & Slavchev 2005), Cascioarele “Ostrovel” (Stefan 1925; Dumitrescu 1965; Marinescu-Bilcu 1965) and Oltenita “Tell Gumelnita” (Dumitrescu 1924, 1925 & 1966). This restriction of a single raw material was achieved by manipulating the social connections in which the transfer of goods was embedded. After gaining hold of the raw materials, the prehistoric inhabitants of settlements along the Lower Danube kept most of the cores and re-used them to produce large axes.

When either copper or flint seems to have been favoured for the production of axes, it is to the exclusion of the other material; when concentrations of three or more axes of each material are mapped, their distributions are mutually exclusive (Figure 12). However, the lack of copper axes does not reflect an absence of the raw material, as there are smaller pieces of copper from Pietrele; particular social practices or prohibitions may have prevented it from being used to manufacture prestigious items (cf. Hansen et al. 2004, 2005, 2006, 2007 & 2008). As demonstrated above, copper and flint axes share certain morphological traits. They are also roughly the same size and
weight. Some settlements along the lower Danube re-used the cores used to produce highly valued, long, flint blades and transformed them into tools which showed off their owners’ status, whilst other regions preferred copper for this sort of status display. To return to Măgura Gorgana near Pietrele: I think the most convincing interpretation of the houses with the most axes is that they belonged to “families” who displayed their important role in the exchange of prestigious goods in the 2nd half of the 5th millennium.

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