

Copper shaft-hole axes and early metallurgy in south-eastern Europe: an integrated approach

Submitted by Julia Heeb to the University of Exeter

as a thesis for the degree of

Doctor of Philosophy in Archaeology

In May 2011

This thesis is available for Library use on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature:JuliaHeeb.....

Abstract

Although the copper axes with central shaft-hole from south-eastern Europe have a long history of research, they have not been studied on a transnational basis since the 1960s. What has also been missing is an integrated or holistic approach, trying to use as many methods as possible and better understand the production, use and context of these enigmatic objects. This present research therefore approaches the axes from different angles. A database was compiled in order to find answers on questions such as the patterns of distribution, context, fragmentation and deformation of axes. For the distribution of axes in general as well as different attributes like fragmentation and typology, the content of the database was imported into GIS software and analysed. Aspects of production were considered through experimental archaeology, metallographic analysis and a re-discovered axe blank with missing shafthole. Especially the missing moulds make it difficult to fully understand the production sequence. The typology was re-evaluated and modified to ensure comparability across modern national boundaries. The context and background was developed through a thorough review of the literature and combined with theoretical considerations. The integration of all these approaches yielded some interesting results. The great variability in shape combined with the results of metallographic analyses clearly shows that a variety of production techniques were used, but it is as yet difficult to relate these to specific geographic areas or even cultural groups. In fact the typology as well as the practice of marking the axes indicate that traditional archaeological 'cultures' rarely correspond to the distribution of a type or to the practice of marking the axes. They show instead that there were different spheres of influence, some even more localised and others much larger (like the Carpathian Basin) than specific ceramic traditions. These different levels of belonging, as well as the increasing visibility of the individual in the archaeological record, show that it was a period of complex cultural patterns and interactions. The axes were a part of these networks of the daily life on many different levels from the strict utilitarian to the ritualised placement in burial contexts.

Acknowledgement

For the completion of my thesis I would like to thank first and foremost my husband, daughter and parents for giving me the time and support I needed. Without my two supervisors Anthony Harding and Alan Outram, it would have also been difficult to plan and finish the work in time. They were a great help and therefore I would like to thank them. Financially this PhD thesis would not have been possible without the funding I received from the Arts and Humanities Research Council. The department of Archaeology at the University of Exeter and the Camborne School of Mines have also played a vital role in supporting my research both through supplying specialist equipment and valuable advice. I would like to thank in particular Barbara Ottaway, Gill Juleff, Bruce Bradley as well as Steve Pendray. I would like to thank the Historical Metallurgy Society for helping me carry out my pre-experiments through the Coghlan bequest, without which I would not have been able to buy all the materials necessary. I would also like to thank the group 'Experiment A' and Andrew Young for helping me on the way to become a practical metallurgist, and last but not least all my 'bellowers', Tine Schenck, Via Baker, Genevieve Hill and Sophie Thorogood. For letting me view and handle some of the original hammer-axes and axe-adzes I would like to thank the following museums and staff: Muzeul Național al Unirii Alba Iulia (H. Ciugudean), Munkácsy Mihály Múzeum, Békéscsaba (A. Gyucha), The British Museum (B. Roberts), Muzeul Național de Istorie a Transilvaniei Cluj (M. Rotea), Deri Museum Debrecen (J. Dani), Muzeul Civilizației Dacice și Romane Deva, Erkel Ferenc Museum Gyula (A. Gyucha), Herman Ottó Museum, Miskolc (P. Csengeri), Jóna András Múzeum Nyíregyháza (K. Almassy), Muzeul Țării Crișurilor Oradea (G. Fazecas), Baranya County Museum Pécs (C. Gáti), Muzeul de Istorie Sibiu (S. Luca), Mora Ferenc Museum Szeged (O. Lajkó), Wosinsky Mór Múzeum Szekszárd (Z. Gaál), Muzeul Banatului Timișoara, (A. Szentmiklosi) and the Museum für Vor und Frühgeschichte Berlin (A. Hänsel und A. Hoffmann) who also gave me access to the important rediscovery of the copper axe blank. And last but not least I would like to thank Rüdiger Krause, Stefan Suhrbier, Tobias Kienlin and Roger Doonan for their specialist advice and help.

Table of contents:

1 Introduction	15
1.1 The innovation of metallurgy in the old world.....	15
1.2 The copper axes with central shaft-hole.....	18
2 Methodology	22
2.1 Background	22
2.2 Terminology	22
2.3 The collection of data.....	24
2.4 Experiments.....	25
2.5 Metallography	26
2.6 Typology	27
2.7 Database/GIS	28
2.7.1 Composition	29
2.7.2 Context	30
2.7.3 Axe marks	31
2.7.4 Deformation	32
2.7.5 Dimensions	32
2.8 Summary and conclusion	32
3 Theoretical perspectives	34
3.1 Social technologies.....	35
3.2 Overcoming dichotomies	36
3.2.1 ‘Technology’ and the ‘social’.....	36
3.2.2 ‘Network’ and ‘meshwork’.....	38
3.2.3 The paradox of archaeological research.....	39
3.3 Change, invention and innovation.....	40
3.3.1 Unconscious and conscious change.	42
3.3.2 Approaches to the ‘a priori’ construction of past change.....	43
3.4 Conclusion.....	46

4 Context and background of the copper hammer-axes and axe- adzes from south-eastern Europe	47
4.1 Topography and climate.....	47
4.1.1 Topography.....	48
4.1.2 Climate.....	50
4.2 Vegetation, plants, animals and natural resources of the Copper Age in south-eastern Europe	51
4.2.1 Vegetation.....	51
4.2.2 Plants.....	52
4.2.3 Animals.....	54
4.2.4 Natural resources.....	55
4.3 Copper Age groups of south-eastern Europe – where, when and how they lived and died	56
4.3.1 Chronology – relative and absolute.....	57
4.3.2 Around 6000 BC.....	59
4.3.3 Around 5000 BC.....	60
4.3.4 Around 4500 BC.....	61
4.3.5 Around 4000 cal BC	65
4.3.6 The decline of copper metallurgy in south-eastern Europe	66
4.4 Summary and conclusion.....	68
5 History of research.....	71
5.1 The ‘discovery’ of the Copper Age	71
5.2 The origin and meaning of the copper axes	72
5.3 Typology, production and provenance	74
5.4 The creation of catalogues and scientific analysis	78
5.5 Summary	80
6 Copper Age metallurgy and shaft-hole axes from South-Eastern Europe – evidence, problems and potential	82
6.1 Ore deposits and Copper Age mines.....	82

6.2 Smelting.....	86
6.3 The production and use of metal artefacts.....	88
6.3.1 The copper axes with central shaft-hole – their shapes and distribution	88
6.3.2 Problems and possibilities of production – a re-discovered copper axe blank	92
6.3.3 The implications for the copper axes in general.....	103
6.4 Conclusion	104
7 The experiments	106
7.1 Experimental Archaeology – history definition and scope.....	106
7.2 Actualistic outdoor casting	107
7.2.1 Aim and materials	108
7.2.2 Casting session 1	110
7.2.3 Casting session 2	111
7.2.4 Casting session 3	112
7.2.5 Conclusion	112
7.3 Shaft-hole experiments	113
7.3.1 Brief description, aims and materials of the experiment.....	114
7.3.2 The clay core series	116
7.3.3 The punching series	117
7.3.4 The drilling series	118
7.4 Macromorphological results and observations	120
7.5 Summary and conclusion	122
8 Metallography	124
8.1 Preparation and recording of metallographic specimen	124
8.2 Results	126
8.2.1 Actualistic outdoor casts	128
8.2.2 Shaft-hole experiment	132
8.2.3 Archaeological axe	142

8.3 The results in their archaeological context	146
8.4 Summary and conclusion	156
9 A new typology for the copper hammer-axes and axe-adzes	158
9.1 Previous typologies	158
9.2 The new typology	161
9.2.1 The groups and types	162
9.2.2 The variants	166
9.3 Conclusion	175
10 Patterns and trends in the copper axe assemblage	177
10.1 Distribution and Context	177
10.1.1 Distribution	178
10.1.2 Context	181
10.2 Composition	186
10.3 Dimensions	196
10.4 Axe marks	202
10.5 Fragmentation and deformation	214
10.5.1 Fragmentation	214
10.5.2 Deformation	222
10.6 Summary	225
11 The copper axes and the living practices of the Copper Age in south-eastern Europe – considerations and conclusions.	229
11.1 Exploitation of the raw material (mining and smelting) – organisation and meaning?	231
11.2 Melting and casting – where is the archaeological evidence and how was it done?	236
11.3 Shape, size, decoration and use – human choices and the functionality of objects	243
11.4 Trade and Deposition	248
11.5 Conclusions.....	257
11.6 Future work.....	264

Appendices	266
I Typology	266
II Axe marks	270
III GIS Distribution maps	279
Distribution maps – Axe types	280
Distribution maps – Axe marks	301
IV Cluster distribution maps (from Krause 2003)	309
V-IX Micrographs (on CD only)	
X Access Database (on CD only)	
Bibliography	312