Physical Barriers, Cultural Connections

A Reconsideration of the Metal Flow at the Beginning of the Metal Age in the Alps

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Foreword

This book grew out of my PhD thesis at the University of Oxford. After a Master's dissertation at the University of Milan ("An archaeometrical study of Early Bronze weapons from Northern Italy"), I wanted to enlarge the scope of the study to the entire Circum-Alpine region. This region has a dramatic topography, with the presence of many metal ores and the existence of many different archaeological cultures. I was particularly interested in the movement of metal and of ideas and technology linked to this movement.

In the course of my PhD I realised that there was a lack of adequate means to achieve my objectives: this shortage was both of the theoretical methodology and of practical tools. In particular, I realised that in previous archaeometallurgical studies geographical and topographical space had been given insufficient attention so I wanted to focus my project on developing a GIS technology to study archaeometallurgy. This idea has been an integral part of a broader vision of the study of metal that has been developing in Oxford, in particular with the efforts of Mark Pollard and Peter Bray.

The first part of this book is dedicated to a discussion of the major European archaeometallurgical publications since the origin of the discipline. In my opinion this is necessary to properly understand the framework in which the new technology is being developed. The following chapters are dedicated to the Oxford methodology. Chapter 4, in particular, is the one which explains in more detail why I believe in the necessity of a major involvement of GIS in archaeometallurgical research.

Chapter 5, 6 and 7 provide the necessary background to understanding the application of the methodology to a specific case study: the Circum-Alpine region in the Copper Age and Early Bronze Age. Chapter 8 provides technical information about the methodology applied.

The results are presented in the subsequent four chapters, divided according to the period, the material taken into consideration and the specific technique applied.

Interesting perspectives were revealed by the use of geostatistical analysis with GIS tools created ad hoc to understand the movement of metal in space, time and across different cultures. This approach allows research to advance the question of provenance of raw material and understanding of why and how metal usage spread, even over long distances, oblivious of the possible topographical barriers.

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1 Introduction

Overall this work aims to convey a new perspective in the study of the ancient metallurgy in the Circum-Alpine region. Most previous studies have focused on provenance and the technology (more specifically alloying practice) of ancient metals (e.g. Hartmann and Sangmeister 1972; Junghans *et al.* 1960, 1974; Krause 1989; Ottaway 1989; Otto and Witter 1952). A series of other important questions are more rarely considered: how metal was used and perceived by ancient societies, how it was moved, how it was manipulated, what happened to it in the time period between its extraction at the ore source to the time and place where it was deposited (see Chapter 3). The biographical cycle of metal, as shown by Ottaway, has rarely been considered in its entirety, with most studies focussing only on the first few events, such as pinpointing centres of production.

In other words, if the life history of an artefact may be seen as an alphabet, we know z (where the object was found), and most of the authors are trying to find out a (where the copper came from), but the rest of the story is underlooked. If we consider object biography not merely as birth (primary manufacture) and death (final deposition), but as a complex socially determined journey between the two, then it is this journey which, through evidence of re-use, recycling, movement, exchange and deposition, reveals the understanding of artefacts made of metal (Pollard *et al.* 2014). This is part of a new concept of the material culture: the Flow Model, that indicates how artefacts (in this case metal) were perceived in society, how they moved in space and through time and how these perceptions and movements changed the object's physical properties: the shape, colour, the weight and the chemical composition (Bray *et al.* 2015; Pollard *et al.* 2014; Sainsbury *et al.* in press) (see Chapter 3). The Flow Model has a strong theoretical underpinning, based on concepts such as the agency of objects (Gosden 2005) and the processes of innovation and acceptance of new material (Derevenski and Sørensen 2002). The entire life cycle of metal is studied, with its social implications: from smelting to the final deposition through a series of passages of use, reuse, recycling and reshaping.

The life cycle of metal has not been played out on a 2D sheet, but obviously occurred in a real, topographical,

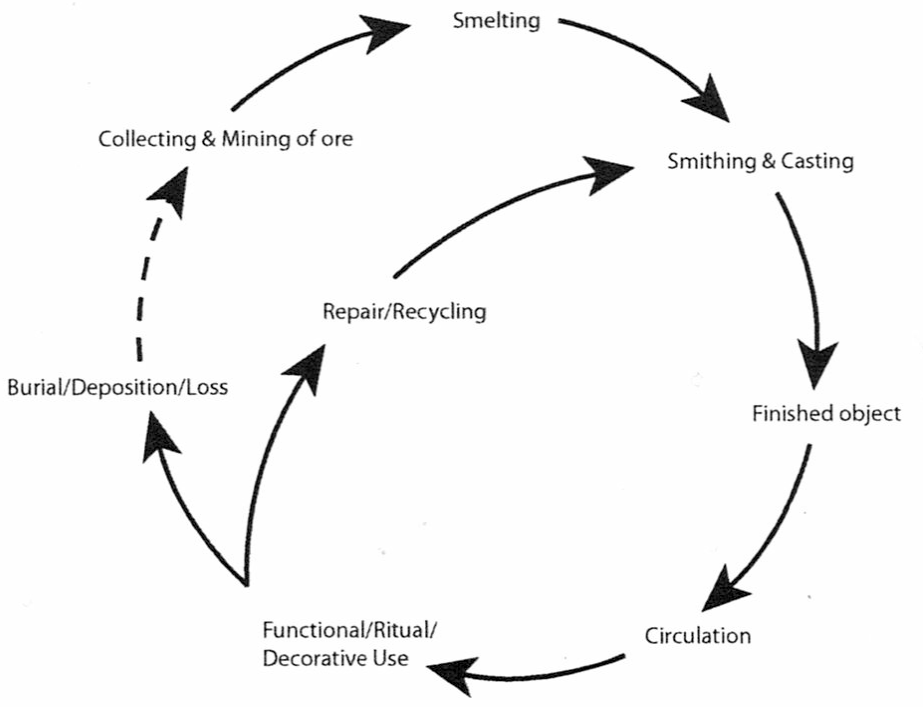

Figure 1: metal cycle from production to deposition from Jennings (2013), modified from Ottaway (2001).

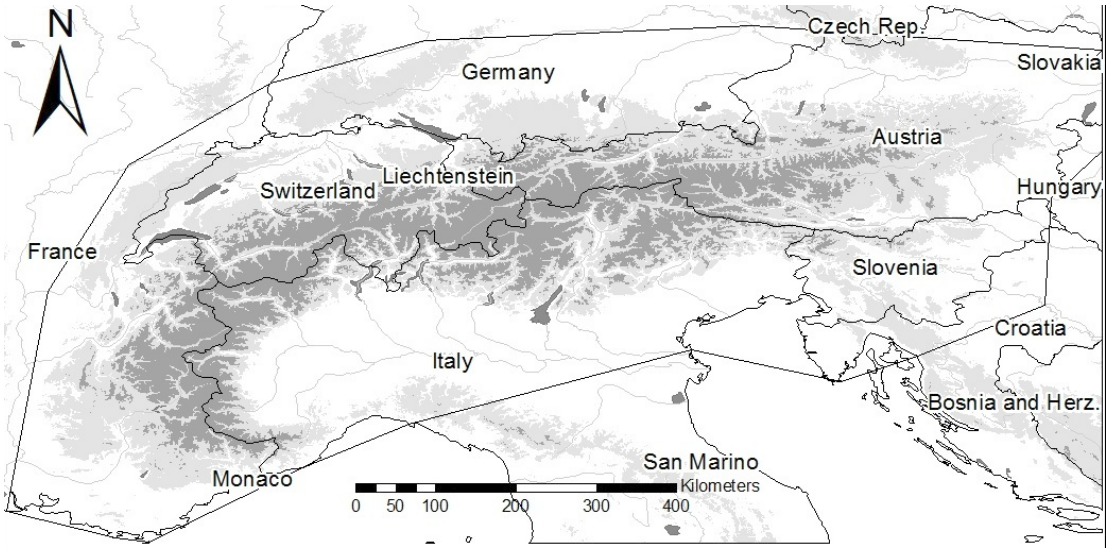

Figure 2: the study area of this book: the Circum-Alpine region.

world, therefore it is essential to fully utilise GIS approaches to explore metal flow. The use of GIS in archaeology has exponentially increased in the last 10-20 years. A series of key articles and books witness the growing interest of the archaeologist in this technology (see Chapter 4). Research has covered both the practical application of GIS and theoretical approaches, addressing questions such as how to study past landscapes, what was the landscape for human populations in the past and what did this landscape mean? Importantly, how do we avoid over-valuation of visible, detectible and mappable remains in the comprehension of the human interaction with space (see Chapter 4)? Landscape is no longer studied as a blank, objective background to human action but is now defined by the subjective perception of different cultures that move within it. This book aims to integrate archaeometallurgy with the on-going discussion about the relationship between space and human action, for instance Llobera (2001, 2000, 1996), Michelaki *et al.* (2014) and Ingold (1993). The Circum-Alpine region (Figure 2) in the transition from the Copper Age to the Early Bronze Age (*c.* 3600-1600 BC) has been chosen as a case study to test this new approach.

Adopting such a large scale of space and time is fundamental to properly understanding the complete life cycle of metal, many events of which may have occurred far away from the original mines. The prehistoric Alps are an interesting case study because of dramatic topography and the existence of many different possible sources of metals (see Chapter 5). Within the chosen time period there were different kinds of copper-based metals with different mechanical properties in circulation (see Chapter 6), so it is possible to speculate about the choices that led ancient people to use one metal rather than another. Moreover, there were a series of different archaeological cultures (see Chapter 7) and the relationships between their geographical range and the flows of metal may be explored. A key question is whether metal movement occurred independently of the presence of different cultures or if there were issues of acceptance of a type of metal that created cultural barriers.

Archaeometrical studies in this region have mainly been focused either on the northern or the southern regions of the Alps. Transalpine contacts between people who lived in the north or the south have been hypothesized by some archaeologists (e.g de Marinis and Brillante, 1998), but there is no archaeometric study of the development of the ancient metallurgy in the Circum-Alpine region as a whole (see Chapter 3). It is undoubtedly a very significant region for the beginning of the Metal Age: for the frequency of metalliferous deposits, the number of possible mines and the evidence for exploitation of some of them from a very early period. It must be remembered that Monte Libiola is the oldest mine with evidence of exploitation in western Europe (4th millennium: Maggi and Pearce, 2005). The substantial evidence for prehistoric mine exploitation is discussed in Chapter 5. Metallurgical contacts within the region are cited in a number of works (see Chapter 2), but there is still a lack of an overview, and, above all, a lack of a shared methodology to look at ancient metallurgy in different regions.

These differences are mainly due to the different academic schools linked to different countries. The German school has created a growing interest in an interpretation of ancient metallurgy that takes into consideration the biography of metal (Ottaway 2001), but without taking recycling into consideration. This provides some social interpretation about the production and use of metal (in particular, Krause 2003, Kienlin 2010: see Chapter 2).

However, their attention has been primarily focussed on the Carpathian Basin and the central-eastern zone of the north Circum-Alpine region. The work of Cattin (Cattin 2007; Cattin *et al.* 2009, 2011) could link Switzerland to this narrative. On the other hand, in Italy the situation is dramatically different. As Dolfini has observed, there is still a perception of archaeometry as a complementary subservient discipline of archaeology, which, in turn, still thoroughly relies on typochronology. As a result, the narrative is simplistic, if not wrong, as new radiocarbon dates and analyses demonstrate (Dolfini 2010, 2014b). This picture is further complicated by the fact that in the Circum-Alpine region there is also a lack of regional scale chronological and archaeological synthesis, as shown in Chapter 7. This work cannot have the ambition of giving the ultimate word on such controversial and complex issues, but it aims to at least draw a synthetic picture under one theoretical perspective, namely the Flow Model.

This book proposes to reconsider the available chemical, chronological, and geographical data using a new model, and to work towards a new regional synthesis. In particular, the objectives of the project are to:

1. Order the data in a structured manner;
2. Develop new tools to combine chemical, archaeological and geographical data;
3. Understand the flow of different types of metal (copper, copper with impurities, bronze) within the region and across time;
4. Evaluate the importance of re-melting and remixing of metal within this flow;
5. Understand the role of topography in the movement of metal.

The first seven Chapters of the book provide the context and background to tackling these objectives. Chapter 2 is an overview of the most important prehistoric archaeometallurgical work in the Circum-Alpine region (the south-east of France, Switzerland, southern Germany, Austria, Slovenia, northern Italy). Chapter 3 discusses more specifically the need for new perspectives and new methodologies in the study of ancient metallurgy and highlights how the approach developed in this book can add to previous conclusions. Moreover, it explains about the creation of different 'copper groups', namely how different trace elements associated with copper are used to define different compositional groups. Chapter 4 is dedicated to the theory and use of GIS, highlighting its possibilities, limitations, and why it is an appropriate tool to study the flows of metal. Chapter 5 provides information about the region, its geology, the possible metal ores and the topography. In Chapter 6 there is a description of the material taken into consideration in this book: copper, arsenical copper, copper with impurities and the tin-copper alloy, bronze. Chapter 7 considers the chronological periods utilised in this research and the cultural groups identified by the archaeologists in the Copper Age and the Early Bronze Age.

Chapter 8 is dedicated to the first and second objectives of the research: the creation of an ordered database. Information about each field of the database is provided, discussing specific issues that may occur during the compilation of a large database created by acquiring information from different sources, which in themselves used different analytical methodologies and utilised differing chronologies. There is also an explanation of the GIS tools specifically created and used for this research.

The third and fourth points of this work are developed in Chapter 9 for the Copper Age and 10 for the Bronze Age. Ubiquity analysis (Banning, 2000: 109) is combined with geostatistical analysis to plot the average loss of volatile elements (particularly arsenic) from copper-alloy over distance and time, as discussed by Bray and Pollard (2012). In Chapter 11 some specific issues about the introduction and the use of tin in the Alps are dealt with using the Flow Model as the interpretive key.

The fifth objective is examined partly in Chapters 9, 10 and 11, and more fully in Chapter 12. Using GIS the frequency of occurrence of each of the compositional groups of material and how this frequency changes over space and time are highlighted. This analysis allows the possibility to suggest the location of the original centres of production for each group, and the extent to which these groups have spread over time - so that hypotheses regarding possible metal exchange routes can be proposed, and specifically how these routes were influenced by the presence of mountain topography. Chapter 12 is more specifically related to topography: in particular, the role of mountains as a barrier to movement and of rivers as a means of transport are tested.

In conclusion, instead of focusing attention only on the provenance of metal, in this work the movement of metal in the Copper Age and Early Bronze Age in the Alps is analysed: how it changed over time, how it was influenced by cultural choices, and whether the topography of the territory had a direct impact on the nature of the flow of metal.