UNIVERSITY OF LONDON THESIS

Degree PhD. Year 2007 Name of Author SUSANNA MARY HARRIS

Cloth in Prehistoric Societies.

The social context of cloth in prehistory, with case studies from northern Italy and the Alpine region from the Neolithic to Bronze Age

Susanna Mary Harris

Submission for PhD

Institute of Archaeology, University College London

2007

ABSTRACT

The aim of this thesis is to explore the social context of cloth from the Neolithic to Bronze Age (c.5500-1000BC) in the central Alpine region of Europe. The time spans from early farming to metal using societies and includes changes in the way cloth is produced and used. The Alpine region is a good place to study cloth as it includes waterlogged, frozen and salt environments where cloth is preserved.

To achieve my aim I have reconsidered the definition of cloth as flexible, thin sheets of material that can be wrapped, folded, shaped and tied. The purpose of this is to approach the interrelated technologies of cloth types including animal skins, textiles, netting and twining.

A further methodological concern is to investigate these cloth types in a holistic manner, as they would have existed in the societies, that is, throughout the whole sequence of production and use. I called this method the extended chaîne opératoire. To develop these stages in the production and use of cloth I investigate social contextual themes, including issues of time and place, the use of tools and equipment in relation to techniques and the social identity of participants in terms of gender, age and role.

This approach is developed throughout the analysis of the extended chaîne opératoire and applied more specifically to case studies of selected sites in the region. The cases studies include the waterlogged lake dwelling settlement of Hornstaad Hörnle IA, Lake Constance c. 3900 BC, the frozen Iceman from the Italian Alps, c. 3300 BC, the representation of cloth on the stelae from Sion, Swiss Valais c. 2800 BC, the waterlogged lake dwelling settlement of Molina di Ledro, Trentino c.2300-1500 BC and the salt preserved cloth artefacts from the Bronze Age salt mines in Hallstatt, Austria, c.1400 BC.

CONTENTS

List of figures		*4-5*
List of tables		*6*
Preface		*7*
Acknowledgements		*8*
Part I	**Introduction**	
Chapter 1	Introduction: the social context of cloth	*9-28*
Chapter 2	The state of cloth research in the Alpine region from the Neolithic to Bronze Age	*29-43*
Chapter 3	Theory and method to investigate the social context of cloth	*44-57*
Part II	**The data**	
Chapter 4	The extended chaîne opératoire of cloth: the data	*58-165*
Part III	**The case studies**	
Chapter 5	Time and place structures in the production and use of cloth at Hornstaad Hörnle IA, Lake Constance, c. 3900 BC	*166-200*
Chapter 6	The Iceman from Alto Adige, Italy c.3300BC; sequence in cloth production and use.	*201-226*
Chapter 7	People and place in the representation of cloth on the stelae of Sion, Petit-Chasseur in the Swiss Valais, c. 2700-2150 BC	*227-256*
Chapter 8	Material and techniques in the production of cloth at Molina di Ledro lake dwelling c.2300-1500 BC	*257-280*
Chapter 9	Exploiting the properties of cloth through the use and re-use of cloth in the Bronze Age salt mines of Hallstatt, c. 1400 BC	*281-307*
Part IV	**Conclusion**	
Chapter 10	Conclusion: an archaeology of cloth	*308-322*
References		*323-350*
Appendix 1	*Glossary*	*351-355*
Appendix 2	*Cloth construction types*	*356-359*
Appendix 3	*List of cloth artefacts and related finds*	*360-388*

LIST OF FIGURES

Figure 1.1 Map of sites with cloth artefacts and related finds
Figure 1.2 Map of the case studies
Figure 4.1.1 Tree bast
Figure 4.1.2 Stripping tree bast
Figure 4.1.3 Growing and harvesting flax
Figure 4.1.4 Collecting grasses
Figure 4.1.5 Rooing sheep
Figure 4.1.6 Animal skins
Figure 4.2.1 Tree bast fibres
Figure 4.2.2 Preparing flax
Figure 4.2.3 Preparing wool
Figure 4.2.4 Processing skins
Figure 4.3.1 Hand spinning and drop spinning
Figure 4.3.2 Strips and threads
Figure 4.3.3 Reeling thread
Figure 4.4.1 Twined cloth
Figure 4.4.2 Examples of twining methods
Figure 4.4.3 Woven cloth
Figure 4.4.4 Weaving cloth
Figure 4.4.5 Knotted nets
Figure 4.4.6 Knotless netting
Figure 4.4.7 Methods of knotless netting
Figure 4.4.8 Scraping and stretching skins
Figure 4.4.9 Curing skins
Figure 4.5.1 Constructing cloth artefacts
Figure 4.6.1 Representations of clothing
Figure 4.6.2 Chaîne opératoire of clothing use
Figure 4.6.3 Cloth containers
Figure 4.6.4 Cloth artefacts for protection
Figure 4.7.1 The natural colour of plant fibres
Figure 4.7.2 Decorative techniques
Figure 4.7.3 Decorated cloth
Figure 4.8.1 Costumes (1)
Figure 4.8.2 Costumes (2)

Figure 4.8.3	Cloth assemblages
Figure 5.1	Location of Homstaad Hömle, Lake Constance, Germany
Figure 5.2	Excavation profile and plan of Homstaad Hömle IA
Figure 5.3	Building and land use
Figure 5.4	Thread and twined cloth
Figure 5.5	Plain weave and netting
Figure 5.6	Twined cloth
Figure 5.7	Bag and sieve
Figure 5.8	Hat with pile
Figure 5.9	Land use, fibre procurement and processing
Figure 6.1	Reconstruction of the Iceman's clothing
Figure 6.2	Cloth artefacts found with the Iceman, Alto Adige, Italy
Figure 6.3	Striped garment and quiver found with the Iceman
Figure 6.4	Sequence traced through the analysis of the Iceman's cloth artefacts
Figure 7.1	Site plan of Sion, Petit-Chasseur, Swiss Valais, Switzerland
Figure 7.2	Stelae 1-6
Figure 7.3	Stelae 7-12
Figure 7.4	Stelae 13-18
Figure 7.5	Stelae 19-23
Figure 7.6	Stelae 24-28
Figure 7.7	The identification of cloth artefacts on the stelae
Figure 7.8.	Patterns engraved on the stelae
Figure.7.9	Interpretative drawings of the cist burials
Figure 7.10	Stone spindle whorls and cloth
Figure.8.1	Site and reconstruction of building at Molina di Ledro, Trentino, Italy
Figure 8.2.	Balls of thread and spindle whorls
Figure 8.3	Tintinnabulum from Bologna and loom weights
Figure 8.4	Woven cloth
Figure 8.5	Woven cloth and knotless netting
Figure 8.6	Wooden weaving knives, daggers and pottery
Figure 9.1	Salt extraction methods and artefacts at Hallstatt, Austria
Figure 9.2	Hand leathers and wooden trough bucket
Figure 9.3	Woven textiles and skin strap
Figure 9.4	Hat, twill weave cloth and wooden spills

LIST OF TABLES

Table 1.1	Chronological table
Table 1.2	The case studies: summary of location, period and date
Table 4.1.1	Chronology and co-existence of raw materials
Table 4.3.1	Thread production times
Table 4.4.1	The number of skins needed to make various items
Table 4.4.2	Properties of fibres
Table 4.4.3	Properties of skins
Table 4.4.4	Chronology and co-existence of cloth types
Table 5.1	Seasonal cycles of fibre and food cultivation and processing
Table 5.2	Plant fibre growth cycles
Table 5.3	Time and place relating to cloth processing and people
Table 6.1	Clothing and cloth equipment of the Iceman
Table 6.2	Seasonal cycles associated with production of cloth types
Table 8.1	Thread and cloth artefacts from Molina di Ledro
Table 9.1	Skin and textile artefacts from the Christian Tuschwerk, Hallstatt
Table 9.2	Summary of the properties of cloth in the Hallstatt salt mines

PREFACE

Cloth in prehistoric societies

When I read an article about cloth in prehistory, I want the cloth to seem tactile; I want to know if it was soft or hard, plain or colourful. I want to know why one type of cloth was chosen over another. I want to know who made it, how and what conditions they were working in and who or what they were making cloth for. I want to know if the manufacture was a metaphor for other aspects of their life, if they told stories about the hunting of dangerous animals whose skins were then turned into precious clothing. In fact, I want the archaeological text to be more human centred, where we can be told of these details, and thereby learn about the things that make cloth come alive.

ACKNOWLEDGEMENTS

I owe my special thanks to Prof. R. Whitehouse and Dr.S. Hamilton for their invaluable encouragement, enthusiasm and advice in supervising this thesis. Thanks to other members of the department; in particular Dr.W. Sillar for his interest in my tree bast experiments in October 2004, 2005 and 2006.

In each of my fieldwork visits many people generously supported my research; thanks to Prof. F.E. Barth, Dr. A. Kern and Dr. J. Reschreiter, of the Naturhistorisches Museum Vienna for their permission to view the Hallstatt archives in November 2004. Thanks to Prof. A. Lippert, Dr. R. Hofmann-de Keijzer, K. Grömer (Mag.) and Dr. A. Distelberger for their advice during my visit to Austria. I am indebted to the kind advice and hospitality offered by Prof. A. Pedrotti, Dr. F. Cavulli and their colleagues at the Dipartimento di Scienze Filologche e Storiche, Università di Trento. Thanks to Dr. P. Bellintani and G. Ciurletti of the Soprintendenze per i Beni Archaeologici for their permission to view the textile artefacts from Molina di Ledro in March 2005 and to M. Bazzanella for her in depth discussion of the finds. Thanks also to Prof.H.Schlichtherle and Dr. B. Dieckmann for their permission to view the Hornstaad Hörnle finds at Hemmenhofen, Lake Constance and for the hospitality of their colleagues at the research centre. Thanks also to Dr.U.Leuzinger at Frauenfeld Museum for allowing me to view the finds from Arbon Bleiche 3.

This thesis was financially supported by a three-year grant from the Arts and Humanities Research Council and additional funding for fieldwork visits from my department. I am grateful for financial support for language training from the King Henry VIII Charities, Warwick and the Grad School, UCL.

Of course, a big thank you to friends and family; without their help and support this thesis would have been a more arduous process.

PART I

INTRODUCTION

CHAPTER 1

Introduction: the social context of cloth

There are many enchanting and fascinating accounts of the role of cloth in societies across the world. Historical, ethnographic and even fictional accounts of cloth present a world of colourful characters, intricate social relationships, and of constructed meanings. There are obvious problems with the study of cloth in prehistory that make an analysis of the social context difficult; foremost is the lack of texts giving contextual accounts. Then there is the problem of preservation and the scarcity of these fragile organic remains. As material culture, the scarcity of evidence makes it difficult to understand the finished cloth products. In terms of technology, it is difficult to relate the process of making, and the tools that were used for this, to the cloth product. Chronologically, the introduction or innovation of new methods of cloth production may be seen as either revolutionary or evolutionary change, but the social dynamics of these changes are difficult to pin down. Another problem is that cloth involves so many different parts of society that it is challenging to construct a method that brings these together. Cloth can readily be seen only as a material with utilitarian properties: as protection from heat or cold or as a means of acquiring food or shelter. But what traditional approaches have great difficulty in articulating is that cloth, both in the technology used to produce it and the way that it is circulated and used when it is made, is inherently a social phenomenon and it is this aspect which my research aims to focus on.

A social perspective sees cloth as part of people's lives in the past, something that shaped their daily activities, their appearance, their relationships and their identities. Cloth has social context both in the way in which it is made and as a finished artefact that is used by members of a society. Changes in the major type of cloth that was used in different periods need not be seen as inevitable, successive evolutionary stages that occur throughout time, but instead as locally centred in relation to the society and individual members of the society in which they were used. Through the acts of making, exchanging and using cloth, people express and transform their identities and relationships with other people, and in relation to the past. These acts may create new relationships, change relationships or maintain relationships.

One of the most striking differences between research into cloth in the social anthropological or social historical literature and archaeology is that in the former, cloth types are not only described by their technical features, such as the raw material, construction, decoration or use (which equates to feel, colour, strength, durability, visual information etc), but also by attributes such as who made them or where they came from, what they are used for, what the possession of cloth enabled people to do and the association of cloth types according to particular social categories or social roles. Similarly, cloth types may equally be related to daily activities or seasonal cycles that people undertake when producing or using cloth, and how this is part of a component and feature of individuals' and communities' lives. The production, possession and exchange of cloth types may have a politicised nature, whereby the ownership and ability to give or receive the cloth may bestow obligation or honour on those who participate (Schneider 1987, Schneider & Weiner 1989a). Another common feature of these approaches is to consider the co-existing cloth types that are used by societies, and to consider their contrasting physical materiality and culturally contextual qualities as socially embedded material culture.

In the archaeology of northern Italy and the Alpine region, the analysis of cloth types is normally studied according to the identification and analysis of cloth construction types (for example, Bazzanella et al. 2003c), geographical distribution, change of raw materials and construction type over time, the relationship of production tools to cloth type, and the appearance of new cloth types at particular chronological horizons (for example, Rast-Eicher 2005). The scarcity of cloth preservation has led researchers to hypothesise on what cloth types are available on the basis of the presence of artefacts related to cloth production or use. In addition, the presence of representations of clothing or, periodically, the discovery of clothed bodies, has led to discussion on the social context of cloth, especially as clothing (for example, Pedrotti 1998). While these technical and social approaches are valid and necessary, I also find it desirable to try to bridge the gap between the way that living societies experience cloth (as recorded by anthropologists and historians) and how archaeologists are able to research cloth from the remains that are preserved.

The aim of this work, is therefore, to investigate the social context of cloth from the Late Neolithic to Bronze Age focusing on the area of northern Italy and the Alpine region.

To investigate the social context of cloth, it is necessary to develop a method as a way to approach the archaeological evidence. I shall do this through the analysis of the cloth types that are known during this period, based on a socially contextualised chaîne opératoire. I shall then apply this method to five contrasting case studies.

Definition of cloth

At the beginning of this research I was interested in the social context of "textiles"[1], in the sense of woven cloth, expanding at the maximum to include cloth made from spun yarn, such as netting or cloth of matted fibres such as felt. This is the approach that has predominated in archaeology, defined by Barber in her seminal book on prehistoric textiles:

> "I have chosen to write this book about those objects which come under the broad category of cloth – large, thin sheets of material made from fibre, which are soft and floppy enough to be used as coverings for people and things. Technically the word *textile*, which comes from the Latin *texere* 'to weave', refers exclusively to woven cloth. But I also wish to include those large and floppy coverings, like felt or tapa cloth, which are used for much the same purposes (and are often hard to distinguish at first glance from woven cloth), but which are constructed from fibres that have been made to cohere by some means other than weaving". (Barber 1991: 5)

However, I found that the technological determinism of this definition was too narrow to achieve my aim to investigate the social context of cloth. When examining the social context of cloth it is precisely the diversity, co-existence and comparison of cloth types that must form the heart of the analysis, whether the cloth is made of spun fibres, felted fibres or animal skins[2], and whether it is woven, knitted, looped or tanned. The problem of defining cloth on the basis of technology has regularly created problems for "textile" researchers:

> "What exactly is a textile? Most textile scientists would agree that it can be defined as "a web of interlaced threads produced on loom." However, there are numerous objects that do not fall easily into that precise a definition, and there are several classes of fibres artifact that derive from related by separate technologies" (Good 2001:210).

The problem appears to be in the separation of different cloth producing technologies. This is helpful to some extent, but a different approach is necessary to understand the

[1] Note that cloth and textiles are used interchangeably in many English texts.
[2] As the term leather refers specifically to tanned skins, a method which is unproven in prehistory, I refer to these materials collectively as skins, and those with hair or wool attached as fur.

interrelationship between these contrasting cloth producing technologies. The relationship of animal skins to textiles is particularly problematic, both in techniques of production and the way they are used:

> "The technology of fibres and the technology of skins are closely related because they may both serve the needs of flexible material for binding, sewing, clothing, bag making, floor-covering etc. For some tools it is even difficult to say whether they were used in work with fibres or skins" (Troeng 1993: 123)

For this research, I define cloth by its physical qualities as *flexible, thin sheets of material that can be folded, shaped, wrapped and tied*. This definition deliberately reflects other definitions of cloth (for example; Barber 1991:5, Schneider & Weiner 1989b:1-4), but is different in that it does not state that cloth need be of "fibrous" raw material. Therefore, this definition includes the many different types of cloth that may vary according to construction, raw material, or intended use including animal skins, both furry and depilated, woven textiles, looped textiles, netting, felt and bark cloth. It is original in that the definition is based on the shared physical properties of the cloth, rather than the method of construction.

What is most unusual is that this definition includes animal skins. The separation of animal skins from other forms of cloth is common. In practice, however, comparisons between cloth of fibres and skins are made. My more inclusive definition of cloth primarily avoids this assumption and allows it to be explored as an aspect of the thesis. This excludes some materials that are usually considered together, such as basketry or matting, as although these may have a similar construction process, they are rigid and therefore do not fit my definition as they cannot be folded, wrapped or tied. I have also excluded birch bark, as although flexible and can be shaped when warm and wet, it is rigid when dry. This definition, therefore, crosses the boundaries that are usually created by the structure of archaeological research and subject specialisation, which divides fibrous cloth from animal skins. Instead, the definition recognises material culture items that are classified according to similar properties rather than a shared technological basis, which is the basis for a socially contextual approach.

One of the problems of creating such a category is that there is no entirely satisfactory word: the dictionary definitions of "cloth" or "textiles" use them interchangeably to relate only to woven cloth (Anderson et al. 2001:311, 1716). Used in this way, weaving as a technique certainly does exclude cloth of animal skins or other interlacing techniques.

Faced with these issues and short of creating a new jargon word, I have chosen the term "cloth", as I have defined it above, with the hope that I can convince the reader of the necessity of this category as a part of the method of research. All classifications or definitions result in exclusions or inclusions that differ from other definitions. As with any definition, there are some artefacts that will resist neat categorisation into one class or the other. In these instances, their exclusion or inclusion in the study will be discussed in the text.

A definition of the classification of sub-groups of cloth is found in the terminology of thread and cloth construction types (Appendix 2). For the sake of clarity, I will sometimes call cloth that is based on the interweaving of threads "thread-based cloth", as a way to separate it from skins.

What is the social context?

The idea of "social context" means so many things to archaeologists that the use of the term needs some explanation. My overriding concern is that the exploration of social context is a way to investigate cloth as part of people's lives. This concept of people's lives, however, is a matter of debate in the social sciences, including problematic terms and relationships such as individual and society, structure and agency, to touch on only two of the most common. Throughout this research I have regularly come back to Anthony Giddens' structuration theory, especially "The Constitution of Society" (Giddens 2003, first published 1984), a work which has been influential to many archaeologists. To investigate these issues further, archaeologists have developed methods and theories, usually in reference to single issues within this overall theory of society. In Chapter 3, I discuss theories and methods that I have found useful in terms of the overarching argument.

Scope

The study area is northern Italy and the central Alpine region covering the later Neolithic to Late Bronze Age (approximately 4000 BC to 900 cal BC). The location of sites with cloth finds is shown in Figure 1.1 and a map showing the location of the case studies is shown in Figure 1.2. This geographical area and time span are comparatively rich in cloth finds due to favourable preservation conditions. Recent finds include clothing and cloth equipment that have been recovered from the retreating glaciers of the high Alps. The waterlogged deposits of the Alpine lake dwellings are favourable to the preservation of organic material, including fragments of woven cloth of plant origin. Cloth is also preserved in the salt mines to the east of the study area. Traces of cloth are also known from impressions of cloth on other artefacts, especially as mineral replaced traces on metal. From this evidence it is known that various raw materials were used to make cloth: evidence suggests that this time span includes the earliest evidence of linen and wool used as a fibre. There is also a range of cloth construction types, including the treatment of animal skins, nets constructed with interconnecting loops or knots, and different types of weaving. There is evidence of whole artefacts, including clothing, containers or other cloth equipment. Other artefacts resist easy attribution of use.

Besides the primary evidence of cloth fragments, there are other lines of evidence: representations of cloth, looms and clothed figures, the tools used to manufacture cloth and clothing including early evidence for spinning and weaving equipment, needles for sewing and non-cloth elements in the assemblage of dress such as metal ornaments or necklaces.

I am interested in this time span as it covers contexts of social change and continuity. There are issues surrounding the introduction of domestic crops and animals and the intensification of farming. Debate continues to surround the social organisation of the societies of these periods. The role of grave goods and models of social organisation from social anthropology continue to be used to build theories of social differentiation, although the usefulness of these has been queried.

Chronology, terminology and periods

As a result of national boundaries and development of research largely within their limits, the terminology and classification of chronological periods has developed separately north and south of the Alps. The time span from c.5500-1000 BC is divided into the Neolithic, Copper Age and Bronze Age, based on changes in tool technology, economy and artefact types (Table 1.1). This categorisation is not ideal, but remains shorthand for periods characterised by particular queries and research issues (the main ones being outlined below). Although there is broad similarity in the classification following the three-age system, there are regional differences. One major disparity is between the period referred to as the Copper Age in northern Italy, which spans approximately one thousand years between the mid-fourth millennium and the mid-third millennium.

cal BC	*Northern Italy*			*Switzerland, Central Germany, Austria*			*General Chronology*
500		Iron Age 900 (beginning)				Hallstatt	Iron Age (begin) 800
1000		FBA 1200-900 BC LBA / MBA1500-1200	Final Bronze Age Proto Golasecca		Late Bronze Age 1200 – 750 BC	Urnfield Culture	LBA 1200 –800
1500	Middle Bronze Age 1600 (beginning)	Early Bronze Age 2300 – 1500 BC		Middle Bronze Age 1600 (beginning)	MBA 1500-1200 BC		MBA 1500-1200BC
2000	Early Bronze Age 2200 – 1600 BC		Peschiera Terramare Flavè Polada	Early Bronze Age 2200 – 1600 BC	Early Bronze Age 2300 / 2200 – 1500 BC	Arbon Singen Unetice	Early Bronze Age 2300 – 1500 BC
2500	Copper Age 3400 – 2200 BC	Copper Age 3200 – 2300 BC	Bell Beaker Remedello 2 / Isera 5	Final Neolithic 2800 – 2200 BC		Bell Beaker Auvernier Corded Ware Lüscherz	
3000			Remedello 1 Carasso	Late Neolithic 3400 – 2800 BC	Late Neoliithic 3900– 2300 / 2200 BC	Cham Tamins Horgen	Late Neolithic (Swiss) 4000 - 2300 / Copper Age (Italy) 3300 – 2300 BC
3500	Final Neolithic 4000 – 3400 BC	Recent Neolithic 3900 – 3200 BC	Lagozza	Recent Neolithic 4000 – 3400 BC		Late Cortaillod Mondsee Pfyn Altheim	Late Neolithic 3300 – 4000 BC
4000	Recent Neolithic 4500 – 4000 BC	Middle Neolithic 4600 – 3900 BC	Chassey VBQ 3	Middle Neolithic 5000 – 4000 BC		Hornstaad Schüssenried Early Cortaillod	
4500	Middle Neolithic 5000 – 4500 BC		VBQ 1-2		Middle Neolithic 4800 – 3900 BC	Rössen Pre-Cortaillod	Middle Neolithic 5000 – 4000 BC
5000		Early Neolithic 5200 – 4600 BC			Early Neolithic 5600 – 4800 BC		Early Neolithic 5500-5000 BC
5500		Mesolithic (ending) 5200				Linearbankeramik	
6000					Mesolithic (ending) 5600 BC		Mesolithic 8500-5500 BC
6500							
7000	*(De Marinis & Brillante 2000)*	*(Barfield et al. 1995: 20)*	*(De Marinis & Brillante 2000, Harding 2000: 16)*	*(De Marinis & Brillante 2000)*	*(Barth & Lobisser 2002:79, Kern 2005:9)*	*(Barth & Lobisser 2002:79,De Marinis & Brillante 2000, Kern 2005:9)*	
7500							

Table 1.1. Chronological table. Common subdivision into periods and cultural groups from the end of the Mesolithic to early Iron Age. The general approach in shown in the right hand column. Key: MBA=Middle Bronze Age, LBA=Late Bronze Age, FBA=Final Bronze Age.

Swiss, Austrian and German scholars instead refer to this period as the late or final Neolithic. This inevitably causes confusion with the Italian terminology where the Late Neolithic refers to an earlier time period. Table 1.1 shows the relationship between these two chronological traditions and the main cultural groups that have been identified. The name and division of periods varies locally and between authors, which makes this especially confusing. Where possible I have used absolute dates. In the case studies I have referred to the established local archaeological traditions and divisions.

The Neolithic

The Neolithic in the Alpine Region is dated roughly between c.5500-3500 BC. The classification of the archaeological evidence in the Neolithic is particularly dependent on the attribution of "cultures", that is, assemblages of material that are considered similar in composition, form and date. Significant to this thesis are the cultures associated with the lake dwelling settlements, as much of the archaeological cloth remains come from these. From around 4000 BC there are the Pfyn or Cortaillod cultures in Switzerland and southern Germany, contemporary with later phases of the Square Mouthed Pottery culture of Northern Italy and the early Chassen cultures of Southern France. Several centuries later are the so called Chassey-Lagozza cultures of northern Italy and the Horgen culture in the Switzerland (Bagolini 1992:299-302, Whittle 1996:148,fig.6.3, 293,fig.8.3).

Economy and society

The beginning of the Neolithic is associated with the introduction of farming. This contrasts with the preceding period, the Mesolithic when people were dependent on gathered and hunted resources. How this occurred is debatable; whether migration or colonisation, demographic expansion or the transmission of techniques between different groups (as summarised in Gallay 1990:24). Whether called Neolithisation (Biagi 1990), the Neolithic Transition (Ammerman & Biagi 2003), or the first farms or first farmers (Furger 1990, Price 2000), researchers debate the significance of the introduction of domestic crops and animals, in terms of food resources and social implications. The evidence shows that many communities exploited a range of farmed, hunted and gathered resources (for example Binder 2000:137). This evidence of continuity of what are classified as Mesolithic elements (non-agricultural food acquisition and aspects of material culture) by agriculturalists and the adoption of so-called Neolithic elements (polished stone axes, domestic flax and cereals, ceramics, sheep and goats) by communities otherwise considered as foragers (i.e. Mesolithic) (see Price 2000:15) adds to the questions of how agriculture was practised, spread and adopted. As a consequence, the dichotomy of Neolithic and Mesolithic or farmer and forager is brought into question in its ability to explain the societies in this period (for example Whittle 1996:360). There are issues surrounding the nature of settlements, especially the importance of long-lasting settlements (Whittle 1996:144), and the nature of the wooden-stake houses built close to lake-shores, known as lake dwellings (*palafitte* in Italian or *Pfaulbauten* in German).

In terms of gender, there are a small number of female figurines that may suggest female ritual specialists or deities (Whitehouse 2001:24-25). The significance of gender roles and the relationship between these remains a point of debate in the Neolithic and later periods (Robb 1994:20-23, Whitehouse 2001:17-28).

Cloth in the Neolithic

One of the main resources for studying cloth in the Neolithic comes from settlements called lake dwellings around the shores of the Alpine lakes. In these waterlogged conditions, fragments of cloth made from plant fibres are recovered; animal fibres and skins are not usually preserved. The main construction types from these villages are variations of twined cloth and netting, as well as some woven textiles. In terms of the raw materials for cloth, flax was one of the founder crops (Zohary & Hopf 2000:198). Although rare in the early Neolithic there are examples of flax from between 5500-5000 BC throughout Italy, including in the north (Rottoli 2003:68), and in central Europe (summarised in Bogaard 2004:14). Tree bast, from indigenous oak, lime and elm was particular importance as a raw material for cloth, to the extent that some researchers call the Neolithic the "tree bast culture" (Rast 1995:149). The Neolithic hosts early evidence of spinning with spindle whorls and the use of looms whose tension was created with ceramic or stone weights (Baioni et al. 2003:99); these types of loom are usually associated with woven textiles. Skins are not preserved, but stone scrapers, awls and needles are evidence that skins were used for cloth.

Regional differences are seen as important (Whittle 1996, Price 2000, Milisauskas 2002), as is the focus on diversity in lifestyles between groups in close proximity (Stöckli 1990:53, Whittle 1996:300) and similarities, such as shared pottery, ornaments and lithic types; there is also evidence of long distance exchange for flint, stone types and ornaments (Binder 2000:137). Indeed, it may also be argued that "becoming Neolithic" may have been a more ideological conversion than a change of food sources (Whittle 1996:8), with slow patterns of change where indigenous populations of foragers adopted domestic resources and ideas when it suited them (Whittle 1996:360).

The Copper Age / Late Neolithic

North Italian scholars classify the period between c. 3300-25 / 2400 BC as the Copper Age, based on the widespread use of copper and it is typically believed to mark a period of social changes. The Swiss, German and Austrian tradition refers to this period as the Recent Neolithic and subsequent Final Neolithic; together they are sometimes referred to as the Late Neolithic (as explained in Pedrotti 2000b:185). At the end of the Copper Age and beginning of the Bronze Age a distinctive set of material culture is ascribed to the Bell Beaker tradition across a wide area of Europe, including the Alpine Region (Champion et al. 1984:168, Nicolis 2001:220). The material culture includes decorated bell-shaped pottery, bone-shaped pendants and small metal items such as copper points and awls, daggers and axes (Nicolis 2001:209-214). It is debated if this represents an immigration of people or an ideological phenomenon.

Economy and society

The techniques of mining, smelting ores and the distribution of these goods from the regions with copper sources have been seen as a force of change in the social and economic structure of these societies, with a specialised work force and more complex social structure (for example Pedrotti 2000b:184) based on the assumption that metal was a sought after commodity and allowed people to amass wealth.

In the Alpine Region settlements are rare, and are often located in naturally defended positions. In addition there are temporary camps in rock shelters or at higher altitudes (Della Casa 2003:205). There is evidence that goods were moved into and across the Alps, especially apparent in the presence of polished greenstone axes and flint types found outside areas of the raw material sources (Della Casa 2003:205). Domestic plant and animal species are the main diet, throughout the Copper Age supplemented with hunting, particularly deer and the collection of wild plants, the relative importance of domestic and wild sources varies ~~these varies~~ (Della Casa 2003:206, Schibler 2005, Jacomet 2005). Andrew Sherratt identified the third millennium as a period when people started to exploit animals for secondary products of milk, cheese and wool, as well as to use animal traction to pull ploughs and wheeled vehicles (Sherratt 1981, Sherratt 1983). This is associated with pastoral or semi-nomadic lifestyles, either by specialised groups or whole communities (Pedrotti 2000b:184-185), some groups may have practised transhumance, exploiting higher pastures in summer and occupying the valleys in winter (Spindler 2003).

Cloth in the Copper Age

Lake dwellings continue to provide evidence for cloth from plant fibres at the beginning of the Copper Age and the plant fibre raw materials and construction types continue as in the Neolithic. In addition, the evidence of the frozen Iceman c.3300 BC has added to the understanding of how animal skins were used, and is unique as a full assemblage of clothing and equipment from the Copper Age. The absence of wool or linen woven textiles from the Iceman is sometimes considered surprising, as wool was probably exploited by some communities as early as the mid fourth millennium. As wool is not preserved in the waterlogged, alkaline conditions of the lake dwellings, the horizon of wool is partly understood through the evidence of sheep bones. This includes and increase in quantity in these periods and the age and sex of the animals in the flock. It is presumed that flocks of sheep kept for wool will include older or castrated males as these produce good wool. This contrasts with flocks kept mainly for meat which will include few adult males. Evidence of this type comes from some lake dwelling sites c. 3300 BC (Deschler-Erb & Marti-Grädel 2004: 246, 250-251). However, wool was probably not an important raw material for cloth until the third millennium (Schibler 2005:153). Another significant line of evidence in the Copper Age is the representation of cloth types and cloth decoration. This is also an important source of information regarding gender and status of clothing in the Alps.

Gender and representations of clothing

From the mid-fourth to late-third millennium stelae were erected throughout Europe, with several clusters throughout northern Italy and the Alps (De Marinis 1994a). Frequently associated with burials these engraved standing stones, often engraved as men and women, may represent deities, ancestors or important individuals (De Marinis 1994a:56). Through grave-goods with burials and iconography on stelae and in rock art, men are associated with weapons (mainly daggers but also bow and arrow, halberd, axe) and ploughs: in some cases women are associated with necklaces (Barfield 1986, Whitehouse 2001). Distinctions in clothing on the statue stelae suggest people wore variations of tunics, clocks and belts which were probably distinguished by gender and status (Pedrotti 1998: 311-312, De Marinis 1994a:47-48, Casini 1994c:94-95).

The Bronze Age

Dating from around 25 / 2400 to 1000 / 900 BC, the Bronze Age is sub-divided into the Early (c.2300-1500 BC), Middle (c.17 / 500-1200 BC) and Late (c.1200-1000 / 900 BC) (Barth & Lobisser 2002:79, Kern 2005:9). There is a distinction between the Late or Recent (c.1300-1150 BC) and final Bronze Age (c.1150-900 BC) (Barfield 1994a:130-140, Caradarelli 1992:368-369, Marzatico & Tecchiati 2002:45-55,) Although with significant regional diversity, there are a number of recurrent issues when studying Bronze Age societies.

Economy and society

In terms of the climate and therefore resulting environment, the Bronze Age is broadly speaking a warm and dry period, as opposed to the warm and wet climate preceding it, and the cool and wet climate following (Harding 2000:19). In terms of economy, the Bronze Age people farmed domestic plants and animals, including various types of grains and legumes, cattle, pigs, sheep and goats; some regions may have depended on pastoralism. The exploitation of wild plants and animals occurs at many sites, but only in small quantities (Harding 2000:144-150, Caradarelli 1992:388-391).

The movement of goods is a significant research theme in Bronze Age studies especially in relation to the social implications of production and exchange, and the significance of location specific raw materials such as metal and amber and the movement of finished goods, such as glass, faience, items of personal adornment and weapons (Harding 2000:188-193, Sherratt 1998:268). Cloth may have been a significant trade item, but difficult to investigate from the archaeological evidence. While "movement" may be traced through the source of raw materials or types of material culture, the social context of this movement, whether exchange, trade or movement of people is problematic. In the absence of money, spheres of either local or long-distance exchange are the preferred means of interpreting this phenomenon with implication for the larger concept of human interaction and the symbolic value of materials (Renfrew 1993), as well as economic and social implications (Harding 2000:195-196).

In an analysis of all the above issues, the concept of social organisation is of prime importance. Typically, societies of the Bronze Age are considered to show some level of social hierarchies and the "Emergence of Élites", has been proposed through the deposition of elaborate artefacts in tombs and control of limited resources (Sherratt 1998:245). Societies are sometimes described as "chiefdoms" (Harrison 2004:6). The expectations of what this type of social organisation meant in the Bronze Age and what it means to Bronze Age studies differ between researchers. Due to the association with the Homeric myths and related archaeological evidence, Bronze Age societies are considered as a period when men achieved status as warriors and heroes, represented materially through the acquisition of fine metal work and weapons (Jensen 1999, Sherratt 1998:245, Treherne 1995).

Cloth in the Bronze Age

The best source of evidence for cloth in the Bronze Age in the Alpine region comes from the Hallstatt salt mines. One of the major developments in cloth seems to be the dominance of wool as a raw material for woven textiles. This is understood through the increase in sheep and goat bones and the presence of older animals, and a change in the type of weight of loom weights and spindle whorls and the popularity of long bronze pins for fastening clothing (evidence summarised in Rast-Eicher 2005:127-128). With the lack of evidence for preserved cloth in the Alpine Regions, comparisons are made with the woollen cloth costumes of northern Europe (Broholm & Hald 1940, Broholm & Hald 1948, Bender Jørgensen 1992). The use of skins is rarely considered in the Bronze Age.

Overview of the thesis

The thesis is divided into three parts. Part I is an introduction to the subject of cloth, with a review of current literature in the study area and methodology (Chapter 2 and Chapter 3). In the discussion of methodology I explain how I use the *chaîne opératoire* to divide the process of making and using cloth into different stages. I shall then describe how I intend to use a concept that I have called the *extended chaîne opératoire* to investigate the social context of cloth. This encompasses the process of making and using cloth, from the acquisition and processing of raw materials, the construction of cloth and production of artefacts to the use of cloth artefacts in assemblages of material culture. Through this broad methodology, I then discuss factors contributing to the chaîne opératoire that are particularly important for investigating the social context, including concepts of time and place, the symbolic nature of artefacts, techniques of the body, the relevance of sequence in the chaîne opératoire and the significance of culturally shared practices.

Part II, Chapter 4, is an analysis of the extended chaîne opératoire of cloth. The aim of this chapter is to investigate the evidence of contemporary cloth types that exist in different periods, their method of production and use. Through this analysis I show

how each cloth type is characterised by a particular chaîne opératoire and therefore a particular social context, showing how the cloth types in prehistory were not only differentiated technically, but also socially.

In Part III, I develop the themes and evidence accumulated in Part II through five case studies. The aim of the case studies is to offer a culturally based analysis of the social context of cloth types, by taking into account the specifics of the site and period.

The case studies are drawn from different areas of the Alpine region and surrounding areas (Figure 1.2), and were chosen to provide a broad range of chronology, preservation environments and to cover a wide range of the stages of the extended chaîne opératoire of cloth (Table 1.2). Four of the sites chosen have preserved cloth evidence; one has representations of cloth. These are just a few examples from the many sites with preserved cloth.

The earliest case study is Hornstaad Hömle IA, Lake Constance, Germany. A waterlogged lake dwelling site on Lake Constance. Dating to c.3900 BC, this site benefits from a thorough, modern excavation, detailed analysis and publication. A particular strength of the site is the botanical analysis and reconstruction of land use, as well as the analysis of the raw materials, cloth construction techniques and use of artefacts at this site. The stages of the extended chaîne opératoire of the site include the procurement and processing of plant fibres, the construction of cloth through twining, net making and weaving and evidence of cloth use for equipment and containers. The preservation conditions enabled the preservation of flax and tree bast cloth types, but not animal skins, which would also have been used at the site. In this case study I develop the themes of time and place as social phenomena.

The next case study examines the evidence for cloth found with the Iceman from Alto Adige, Italy dating to c.3300 BC. The frozen preservation conditions allowed the preservation of all materials including cloth of animal skins and plant fibres constructed by twining and netting. The Iceman benefits from substantial investment in detailed research, with the result that the cloth finds have been comprehensively analysed. The strength of this find is therefore not only the rarity of many of the artefacts, but also the detailed knowledge of the raw materials, cloth artefacts and cloth assemblages as well as information on cloth processing, decoration and construction. In this case study I develop the theme of sequence and social interaction in the preparation and use of this cloth assemblage.

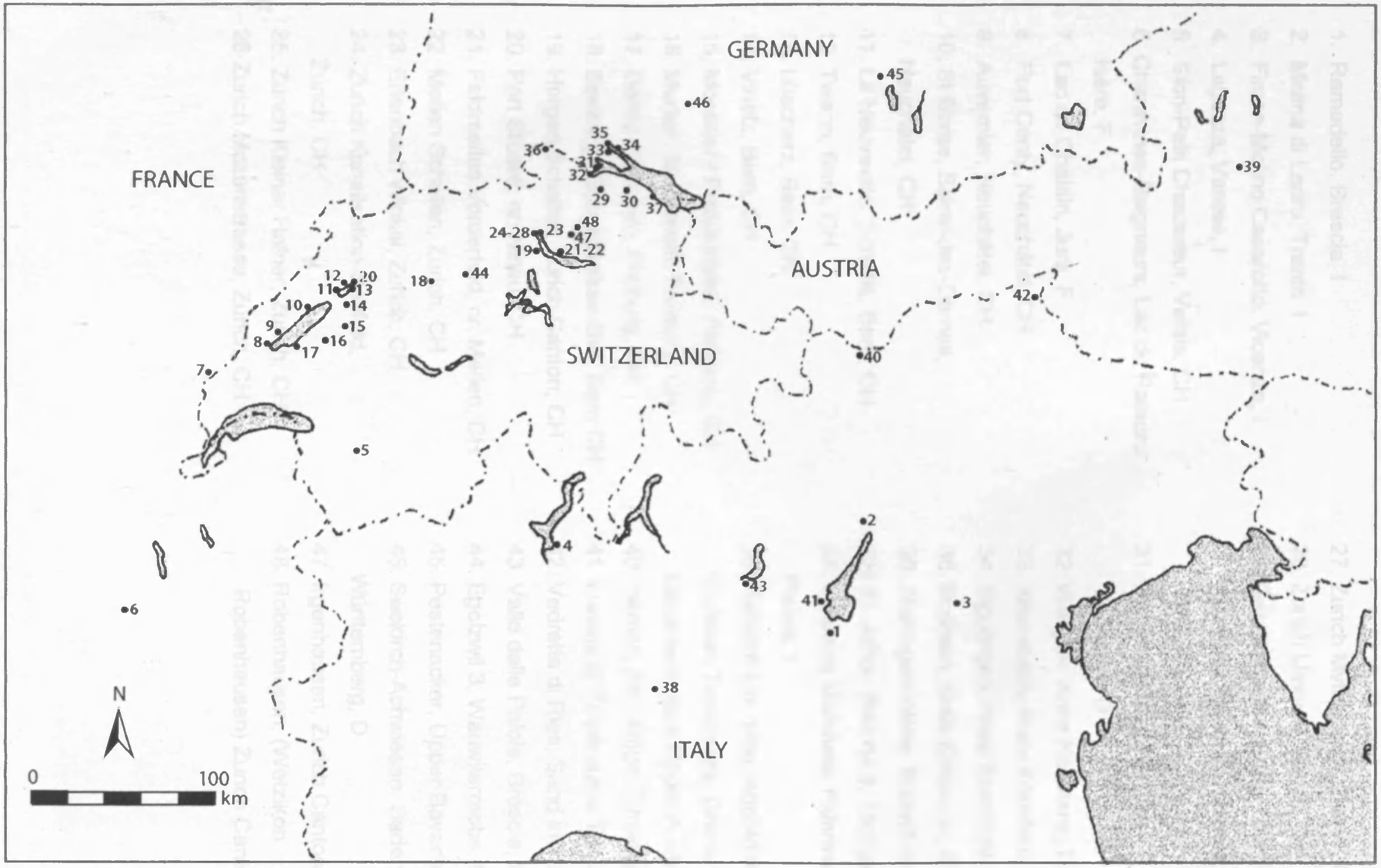


Figure 1.1. Map of sites with cloth artefacts and related finds in the Alpine region and surrounding areas (added to and adapted from Bazzanella & Mayr 1995b:108, fig.1)

List of sites marked on Figure 1.1

1. Remedello, Brescia, I
2. Molina di Ledro, Trento, I
3. Fimon-Molino Casarotto, Vicenza, I
4. Lagozza, Varese, I
5. Sion-Petit Chausseur, Valais, CH
6. Charavines-Baigneurs, Lac du Paladru, Isère, F
7. Lac de Chalain, Jura, F
8. Port Conty, Neuchâtel, CH
9. Auvernier, Neuchâtel, CH
10. St Blaise, Bains-des-Dames, Neuchâtel, CH
11. La Neuveville, Schafis, Bern, CH
12. Twann, Bern, CH
13. Lüscherz, Bern, CH
14. Vinelz, Bern, CH
15. Montilier / Platzbünden, Freiburg, CH
16. Murten, Murtensee, Freiburg, CH
17. Delley Portalban, Freiburg, CH
18. Seeberg / Burgäachisee-SW, Bern CH
19. Horgen Scheller, Zurich Canton, CH
20. Port Stüdeli, nr. Nidau, CH
21. Feldmeilen Vorderfeld, nr. Meilen, CH
22. Meilen Schellen, Zurich, CH
23. Erlenbach Winkel, Zurich, CH
24. Zurich Kanalisation-Seefeld, Zurich, CH
25. Zurich Kleiner Hafner, Zurich, CH
26 Zurich Mozartstrasse, Zurich, CH
27. Zurich Mythenquai, Zurich, CH
28. Zurich Utoquai, Zurich, CH
29. Gachnang-Niederwil, Thurgau, CH
30. Ermatingen-Westerfeld, Thurgau, CH
31. Hornstaad Hörnle, Kreis Konstanz, D
32. Wangen, Kreis Konstanz, D
33. Allensbach, Kreis Konstanz, D
34. Sipplingen, Kreis Konstanz, D
35. Bodman, Kreis Konstanz, D
36. Thayngen-Weier, Schaffhausen, CH
37. Arbon Bleiche 3, Thurgau, CH
38. Castione Marchesi, Fidenza, Parma, I
39. Hallstatt salt mine; Appoldwerk, Christian Tuschwerk, Grünerwerk, Landsteinerkehr Upper Austria, A
40. Iceman, Alto Adige, Tyrolean Alps, I
41. Lucone di Polpenazze, Brescia, I
42. Vedretta di Ries, Sand in Tures, I
43. Valle delle Paiole, Brescia, I
44. Egolzwil 3, Wauwilermoos, CH
45. Pestenacker, Upper Bavaria, D
46. Seekirch-Achwiesen, Baden-Württemberg, D
47. Irgenhausen, Zurich Canton, CH
48. Robenhausen, (Wetzikon Robenhausen) Zurich Canton, CH

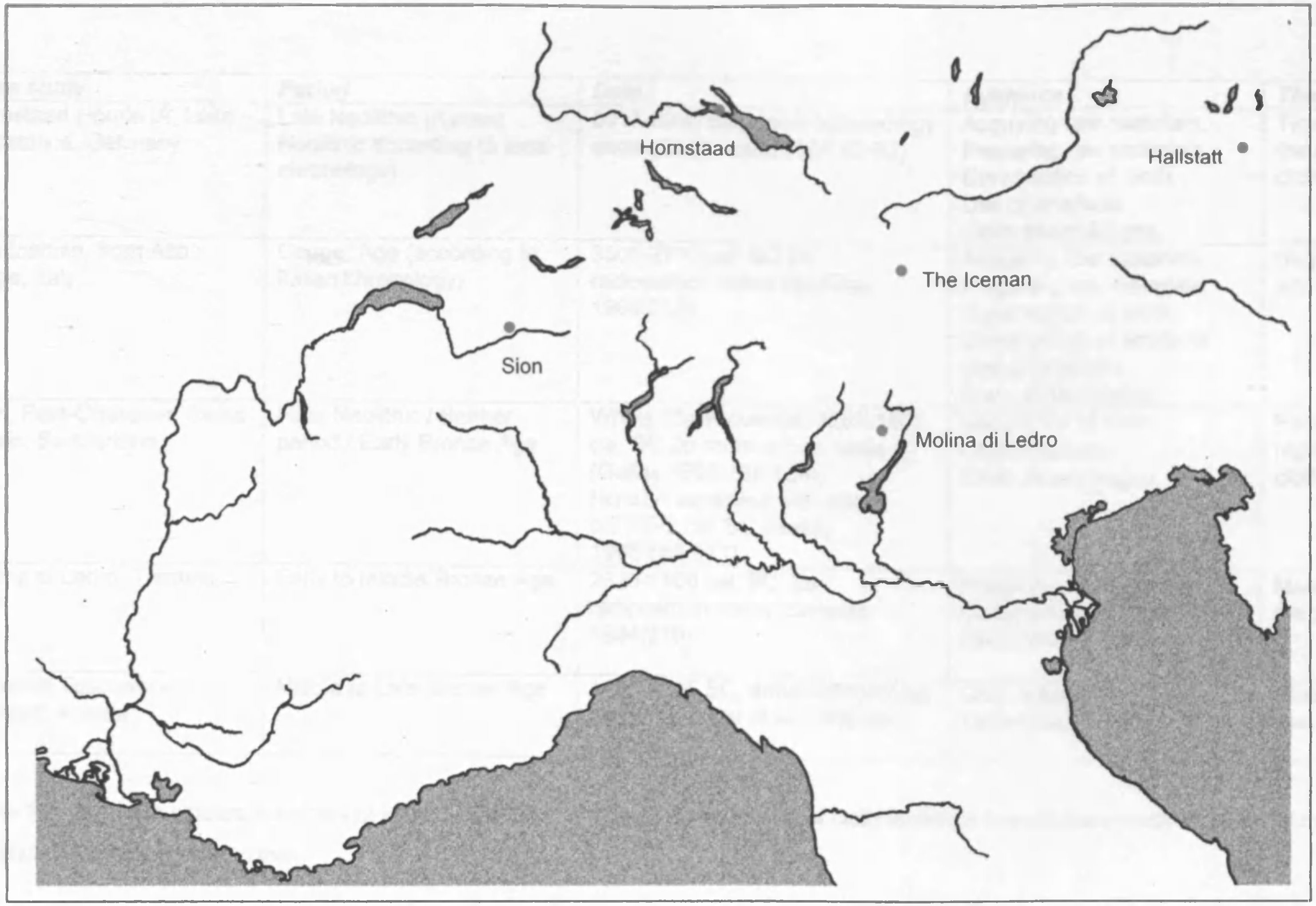


Figure 1.2 Map of the case studies.

Case study	***Period***	***Date***	***Evidence***	***Themes***
Hornstaad Hörnle IA, Lake Constance, Germany.	Late Neolithic (Recent Neolithic according to local chronology)	3917-3905 BC, dendrochronology dates (Dieckmann 1991:92-93)	Acquiring raw materials. Preparing raw materials. Construction of cloth. Use of artefacts. Cloth assemblages.	Time and place structures in the production and use of cloth.
The Iceman, from Alto Adige, Italy.	Copper Age (according to Italian chronology)	3501-2910 cal. BC 2σ radiocarbon dates (Skeates 1994:215)	Acquiring raw materials. Preparing raw materials. Construction of cloth. Construction of artefacts. Use of artefacts. Cloth assemblages.	Sequence in the production and use of cloth.
Sion, Petit-Chasseur, Swiss Valais, Switzerland.	Final Neolithic / Beaker period / Early Bronze Age.	Whole site sequence: 3260-1693 cal. BC 2σ radiocarbon dates (Gallay 1995:188-189), Horizon supérieur with stelae c.2700-2150 BC (Gallay 1995:168-171)	Decoration of cloth. Cloth artefacts. Cloth assemblages.	People and place in the representation and use of cloth.
Molina di Ledro, Trentino, Italy.	Early to middle Bronze Age	2329-1100 cal. BC, 2σ radiocarbon dates (Skeates 1994:216)	Preparing raw materials. Construction of cloth. Decoration of cloth.	Materials and techniques in the production of cloth.
Christian Tuschwerk, Hallstatt, Austria.	Middle to Late Bronze Age	1460-1245 BC, dendrochronology dates (Grabner et al. 2006:45)	Cloth artefacts. Cloth assemblages.	Properties, cloth use and re-use.

Table 1.2 The case studies: summary of location, period and date. The main area of cloth evidence in each case study listed in column four and social contextual themes in column five.

Looking at cloth assemblages from quite a different context, I then examine the representation of cloth on the anthropomorphic engraved stones (stelae) of Sion Petit-Chasseur, Switzerland. Dating between c. 2700-2150 BC, the stelae are intricately carved with artefacts including patterned clothing and were originally erected in rows at a funerary site and later re-used in stone cist burials. Unlike the other case studies, these are representations of cloth, mainly as clothing, on anthropomorphic figures. The representations provide evidence of decoration on cloth, an idea of cloth artefacts and assemblages of cloth artefacts especially clothing. In this case study I develop the idea of the people and place with an examination of the stelae at the burial ground and the evidence for regional differences in clothing assemblages.

In the fourth case study, I look at the evidence for cloth from another waterlogged lake dwelling, Molina di Ledro, Trentino, Italy. First excavated in the nineteenth century, this site lacks the precise dating and stratigraphic analysis of modern excavations, but does have several interesting cloth finds especially significant as cloth is poorly represented in the Alpine Region during the Bronze Age. Of particular interest at this site is the variety of cloth construction and decoration techniques. In this case study I concentrate on the materials and techniques of producing cloth.

In the final case study I look at the evidence of cloth from the Bronze Age galleries of the Hallstatt salt mines, dating to the Middle Bronze Age c.1460-1245 BC. Preserved by the high concentration of salt, there are skin and fur artefacts as well as woven cloth of wool and linen. There are a number of whole artefacts clearly associated with mining activities, as well as numerous rags and scraps of both woven cloth and skins. In terms of the extended chaîne opératoire, the construction and use of cloth artefacts and cloth assemblages are best represented. In this case study I have focused on the properties of these cloth types and how these were used and re-used in the salt mines.

Finally, in the conclusion, I draw together the main findings of my research and its position as an original contribution to cloth studies and I readdress issues associated with cloth from the Neolithic to Bronze Age in the light of the understanding I have gained through the application of my method and analysis.

Appendix I is a glossary of terms and Appendix 2 is an illustrated explanation of cloth construction types. Appendix 3 is a table cloth artefacts listed in the test; ordered by a four letter site code and three digit number (for example HORN-001).

CHAPTER 2

The state of cloth research in the Alpine region from the Neolithic to Bronze Age

As the aim of this chapter is to review the study of cloth in the Alpine Region, the first question is certainly to ask what is cloth research? Because cloth is so prone to decay there is usually no direct evidence of it. Where cloth is preserved, it can be studied in detail. However, these cloth remains are usually fragmentary, discoloured and misshapen. More importantly, and most commonly, cloth is simply not preserved. As a result, cloth is often investigated through the raw materials it was made of, such as the presence of flax cultivation; the tools associated with its production, most noticeably stone skin-scrapers, spindle whorls and loom-weights; representations of cloth, especially clothing; the tools associated with artefact construction, such as needles, and inorganic remains of cloth products, for example, fastenings associated with clothing. So, unlike other areas of study, such as ceramics or lithics that depend on the presence of the subject material, the study of cloth often involves the assemblage of a wide range of related data and, because of this, the evidence and literature is extensive. Cloth research, therefore, involves the detailed study of cloth artefacts and representations of cloth, the artefacts associated with cloth production, and the artefacts associated with cloth use.

Research topic areas

On this basis, the literature on cloth research can be split into several main topic areas:

1) Artefact studies that are concerned with typology, classification and scientific analyses of the cloth and associated artefacts.
2) Research concerned with the wider chronology of cloth and related artefacts, including issues of introduction, continuity, change and decline.
3) Research that deals with social issues such as specialisation, gender and regional practices.
4) Literature concerned with integrating the evidence of cloth into the wider archaeological evidence of the societies in question.

In this chapter I shall review the literature on cloth research that is relevant to this thesis. Where appropriate, I shall consider this debate in the wider context of European archaeology, as there are several important subjects of cloth research that are mainly dealt with in other areas of Europe. From this basis, I shall evaluate the strength of this research and some of the problems and omissions. I shall then compare the archaeological approach to cloth with research of cloth from a social anthropological and social historical perspective, and bring the chapter to a close by considering the relevance of these themes to investigating the social context of cloth.

Artefact studies: terminology, documentation and analysis

Terminology

Even when it includes the analysis of animal skins and non-woven cloth (Keller 1866, Hald 1980, Bazzanella et al. 2005), the majority of cloth research usually comes under the title of "textiles" or "textiles and basketry" (for example, Vogt 1937, Barber 1991, Bazzanella et al. 2003b). Within this, most studies are artefact based; by which I mean that the authors are concerned with the analysis and documentation of the physical artefact, its date and archaeological culture.

Conformity in terminology of cloth construction techniques is problematic, exacerbated by the nuances of translation across four languages (French, German, Italian, English). The standard text on cloth construction terms is Seiler-Baldinger's work, although it is not systematically followed (Seiler-Baldinger 1991, Seiler-Baldinger 1994), usually due to the history of terminology in a particular discipline.

Documentation

Documentation criteria for cloth made from threads, such as weaving or netting, are relatively consistent and include: the dimensions of the preserved cloth, the preserved colour, the species of fibre material, the number of threads per cm of woven cloth, the spin direction, the weave structure or other construction technique such as sprang, looped techniques and netting as well as evidence of starting borders, selvedges, lower edges and fringes (cataloguing summarised in Walton & Eastwood 1988; for catalogues following these conventions see Bazzanella & Mayr 1999, Bazzanella, Mayr, Moser, & Rast-Eicher 2003b, Rast-Eicher 1997, 368-70, for site analysis of this nature see Leuzinger 2002:132, Schlichtherle 1990:193-198, Grömer 2005b: 20-25, for explanation of individual artefacts: Bazzanella 1999:210, Rast-Eicher 1995:171).

When carried out, the documentation of animal skins includes the identification of species, as well as observations on shape, preservation or tanning methods and possible use (Barth 1992, Groenman-van Waateringe 1993, Ryder 1993a). However, skin artefacts receive less attention than their textiles counterparts. For example, despite Barth's publication of the skin artefacts from the Hallstatt salt mines (Barth 1971, Barth 1994, Barth 1992), the textiles finds are much nearer complete documentation and are the subject of extended research analyses, such as for dye chemical analysis and experimentation (Grömer 2005b, Hundt 1959, Hundt 1967, Mautendorfer 2005, Hofmann-de Keijzer et al. 2005). A similar situation is seen with the frozen cloth finds from Vedretta de Ries, Bolzano, dating to the Iron Age (Bazzanella, Dal Rí, Maspero, & Tomedi 2005).

Scientific analysis

Many of the elements described above can be analysed in the first instance by eye and with basic training, for example spin direction and construction technique; others, particularly raw material identification and dye analysis are most accurately assessed by using a light microscope, scanning electron microscope, or chemical tests. This makes the analysis more skilled and time consuming, and therefore less common. However, efforts are made to carry out these important analyses, and many of the published textiles and animal skins in the Alpine Region have been analysed in this way and include discussions of methods (Körber-Grohne & Feldtkeller 1998, Rast-Eicher 2003a; for animal skins see Groenman-van Waateringe 1993).

Beyond determining the fibre, detailed Scanning Electron Microscope (SEM) and light microscope analysis has been used to identify aspects of construction techniques. Rast-Eicher has identified the splicing technique of spinning thread (Rast-Eicher 2005: 119). Körber-Grohne and Feldtkeller identify the characteristics of tree bast treatment including retting and heckling (Körber-Grohne & Feldtkeller 1998). Bender-Jørgensen made a systematic study of the spin direction of threads used to make cloth and looked at the regional distribution of these throughout Europe (Bender Jørgensen 1990). There are a number of good archaeobotanical and faunal analyses of plant and animal species that provide the raw materials to make cloth (Lundström-Baudais 1984, Rottoli 2003, Riedel & Tecchiati 2003, Riedel & Tecchiati 2001, Schibler 2005:153, Zohary & Hopf 2000, Zohary 1989,).

Few dye analyses have been carried out on Neolithic to Bronze Age finds, mainly due to their carbonised state of preservation (for Iron Age examples see: Hofmann-de

Keijzer, van Bommel, & Joosten 2005). These detailed studies can be used to clarify aspects of the sequence of events (or chaîne opératoire) of the technical process of producing cloth artefacts.

Artefacts associated with cloth

The analysis of the relationship between cloth artefacts and the tools used for their production by reconstruction or comparison to historically or ethnographically known practices is an old one (the use of warp-weighted looms in Keller 1866:332-4, various looms in Vogt 1937, ch.IV). This type of analysis is now considered under "Experimental Archaeology". Experiments with weaving on assorted looms are most frequent (see Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:104-6, Bazzanella et al. 2003a, Bazzanella et al. 2003d, Moser & Medard 2001, Schierer 2005b, Schierer 1987), followed by those concerned with spinning (Grömer 2005a), with interest also in imitating dyeing methods (Hartl & Hofmann-de Keijzer 2005), tree-bast hat construction (Feldtkeller 2004:58), and animal skin tanning (Groenman-van Waateringe 1995). These allow a relationship between technique and artefact to be better understood.

Representations of cloth, most particularly clothing, are shown on the stelae of the third millennium BC and occasionally on small figurines of the Neolithic or Bronze Age. These have been studied as evidence of costumes and cloth types (Bazzanella 1999, Feldtkeller & Schlichtherle 1987, Goedecker-Ciolek 1993, Harris 2004, Rast 1990b, Winiger 1995).

Artefacts that are classically related to textile production, such as spindle whorls and loom weights, or skin working, including awls, needles and scrapers, may be studied by specialists in the materials they are made of (for example, Anastasiu 1991), as part of site reports (numerous examples, such as Barfield & Bagolini 1976: 68-72), as part of typology and classification (Bartoloni et al. 1980:162-3) or as part of a study of cloth at a particular site, cultural group or region (Cornaggia Castiglioni 1955, Dieckmann 1991, Baioni, Borrello, Feldtkeller, & Schlichtherle 2003, Médard 2000). Detailed use-wear analyses help associate tools to cloth production (Maggi et al. 1997, Pawlik 1998). This is a huge area of research, as so many sites have these artefacts, which are researched and published in a number of ways.

Experimental archaeology

There are a number of experiments related to cloth production and use, with different aims: reconstructions of clothing for museum displays and recreation events are relatively common (see photographs of garments from the Museo Civico di Riva del Garda, Italy in Pedrotti 1995 figs.18&22, and photographs of a participant in period-dress at the Pfahlbaumuseum Unteruhldingen, Germany in Krauß et al. 1999), but there is relatively little analysis of these garments at research level. Several short articles about the reconstruction of the Iceman's clothing are informative (Wood 2004, Wood 1999). Errors occur, as for example in the case of the tree bast hats (for example, photographed in Krauß, Schöbel, & Walter 1999) which are made to a larger scale than the rather small preserved originals (Schlichtherle pers. comm.). Experiments in relation to tree bast processing by Körber-Grohne and Feldtkeller allowed them to compare the archaeological samples with their evidence and suggest that water retting was not practiced in some instances (Körber-Grohne & Feldtkeller 1998:154-155).

Outlook

Compared with the few publications of the early to mid 20th century, research and literature into cloth and related artefacts is currently at an all-time high, with an explosion of interest and documentation across the Alpine Region since the 1980's. The study of cloth in terms of the documentation and analysis of artefacts is currently in a good state and is frequently carried out to a high standard. This is good news for all cloth research as the basic documentation is the key to all further research.

However, still lagging behind is the study of skins: archives remain untapped and finds in the same context as thread-based cloth remain at the peripheries of research, for example at the Hallstatt salt mines and Vedretta de Ries, Bolzano. The rarity of skins means that there are fewer specialists in this area, leading to less research. Otherwise, the difference in research may have something do with the elitism of research, where woven textiles seem to be associated with civilised societies, while skins remain utilitarian and hard-wearing with little regard to appearances. This attitude is most explicit in older work, such as the early research by Keller on textiles and leather:

> "Amongst all the antiquities found in the lake dwellings, probably none are of more interest, or have a greater bearing on our ideas as to the civilisation of the inhabitants, than the various manufactures of 'bast' or vegetable fibre, and of flax" (Keller 1866:323).

"The earliest clothing of the inhabitants of Switzerland cannot materially have differed from that which we see in our own day amongst the uncivilised people of the far north" (Keller 1866:335).

While no-one promotes these views today, the legacy of this perspective possibly remains in the way artefacts are researched.

Research into the chronology of cloth and related artefacts

Under this heading I am concerned with work that actively seeks to provide a chronological framework for the introduction, continuity and decline of cloth types, whether these cloth types are defined by raw materials, construction techniques or use. As already highlighted, evidence for the chronology of cloth depends on a wide range of evidence, including archaeobotanical and faunal remains (evidence from the Swiss lake-villages summarised in Schibler 2005:153, linen: Rottoli 2003, Castelletti et al. 2000; animal bones: Riedel & Tecchiati 2003). Another aspect is the chronology of weaving and cloth construction techniques. This subject is closely related to artefact studies, as these are concerned with dating the artefacts and archaeological context, but are separate in that a wide range of artefacts and evidence is taken into consideration in chronological analyses. The chronology for particular cloth types will be considered in chapters 3-8.

Cloth chronology

The current research on cloth chronology in the Alpine Region is led by Antoinette Rast-Eicher who has worked on this subject for over a decade. Her knowledge of cloth evidence across the Alpine region is wide-ranging and unsurpassed. This includes the awareness of the "tree-bast culture" of the Neolithic on the basis that tree bast was much more common than linen for cloth production (current position summarised in Rast-Eicher 2005): a raw material that was surprisingly under-appreciated in previous research (notably Vogt 1937 and Barber 1991). In terms of cloth construction techniques, she attributes cordage, netting (knotted and knotless types) and rigid twining techniques to Mesolithic and later periods, while flexible twining and weaving are seen as new in the Neolithic, and twill weave as an Early Bronze Age advance in weaving technology (Rast-Eicher 2005:118-128, Rast-Eicher 1992a:63).

There is some question as to how far weaving differed from other types of cloth production and how these chronological changes occurred. Some of the chronological issues are under question, notably the presence of flexible twining constructions and textile weaving in earlier periods, even the Upper Palaeolithic, with evidence of tools and representations from north-east Europe (Soffer 2004, Soffer 2000, Soffer et al. 2001). Rast-Eicher has pioneered the analysis of finer chronological divisions according to archaeological cultures in the Alpine lake-villages of cloth types according to raw materials and cloth construction types (Rast-Eicher 1992b, followed by Cardon 1998). While these could be criticised due to the problems of preservation and statistical analysis, the significance of increasing and decreasing cloth types is an advance in understanding.

With the problem that wool is not preserved in the alkaline, waterlogged lake dwellings of the Alpine Region, a horizon for the earliest evidence of wool has always been hard to define. Based on the evidence of sheep bones and garment pins, Sherratt proposed that wool became more important in the Early Bronze Age / late third millennium BC as part of a "secondary products revolution" (Sherratt 1981). This seems to have stuck, albeit with the addition of new evidence, including changes in the weight of spindle whorls apparently relating to wool spinning as opposed to linen. Rast-Eicher supports this basic chronology (Rast-Eicher 2005: 127). In the light of recent discoveries of wool in fourth millennium contexts both within the study area (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:184) and further a field (Russia: Shishlina et al. 2003) this debate will continue.

The discovery of the Copper Age Iceman raised the question the use of both skins and twined cloth for clothing and other equipment (for example, Winiger 1995). The chronology of change and continuity in the exploitation of animal skins remains largely untouched. Mostly skins are seen in the context of their apparently inevitable decline in relation to an increased frequency of wool as a fibre for weaving.

Undoubtedly influenced by the improvement and increase in artefact studies, there have been significant advances in the study of cloth chronology in the Alpine region. Tree bast has been recognised as one of the major raw materials used to make cloth in the Neolithic of the study region. The influence of the wider European evidence is felt, especially regarding the debate on wool, where dates have been published that are at least a millennium earlier than previously supposed. The role of animal skins has come more to the fore through the evidence of the Iceman.

As with the artefact studies, the study of animal skins themselves lags behind those of textiles, not in quality, but in quantity. In addition, mainly due to the lack of preservation, issues of chronology lack precision; the largest quantities of plant fibre cloth come from the Neolithic, mainly after 4000 BC, leaving earlier periods difficult to interpret in relation to presence or absence of these cloth types. Similarly, the earliest evidence for wool has shifted a millennium in the last 20 years, if the wider European evidence is taken into consideration, yet without clear implications for the study region. However, differentiation between the earliest appearance and periods of intense use need to be taken into consideration.

While issues of chronology are relatively well discussed and open to debate, the reasons for decline and increase of certain cloth types are less critically approached and are too dependent on a utilitarian approach, which under-estimates the social significance of cloth as material culture.

Research concerned with social issues

By this body of research, I mean studies that attempt to focus on issues relating to the socially contextual aspects of cloth: whether the agency of people producing (often referred to as craft-workers) and using cloth, the role of cloth production in wider social structures, such as home production and specialisation, the contribution or burden of cloth production on the economy, differentiated cloth use in clothing, and issues such as regional clothing, containers or production styles. These are problematic issues that probably cannot be resolved concretely, with the result that conclusions drawn about them may seem flimsy in comparison to the security of artefact studies.

The secondary products revolution

One of the most influential works on the social context of raw materials is the proposition that wool was part of a larger phenomenon of the use of secondary products from animals in the fourth and third millennium BC (Sherratt 1981:282-283). Viewed as a replacement of linen cloth, wool is seen as part of wider changes in the relationship of humans and animals. As a resource that could be obtained from marginal land, wool may have provided a medium for exchange in areas that were not optimal for arable production (Sherratt 1981: 262). Other aspects of what Sherratt calls the Secondary Products Revolution include the larger scale of animal keeping, the ability to exploit marginal land using the plough, and the intensification of agricultural production (Sherratt 1981: 285-290). Sherratt proposes that these inter-relationships and the changed exploitation of resources is the impetus for a profound change in social relationships (Sherratt 1981: 297-299). However, in my opinion, gender roles in relation to woollen cloth production are over-simplified in Sherratt's account (Sherratt 1981:283).

The Secondary Products Revolution is one of the most substantial theories concerning the social context of a wool economy. Other raw materials are not similarly considered in context. Cultivated flax is accepted as part of the Neolithic "package" both as an oil-bearing and a fibre resource, but the wider social context of this fibrous plant resource is rarely argued. On the basis that many whole fragments of cloth are rather narrow and small, Winiger proposes that the characteristic narrow weaves in linen of the Neolithic were first used as babies' nappies or swaddling clothes in the cold winters of the Alps, being of little effective use as clothing (Winiger 1995: 183). He proposes that the advent of large pieces of cloth belongs to the Bronze Age in association with the introduction of woollen yarns. In my opinion, this functionalist approach does not provide a sufficiently complex concept of cloth as material culture, reducing cloth to utilitarian values.

Gender

Another influential work is Barber's book "Women's Work: the first 20,000 years", throughout which she considers the role of women in relation to cloth, including gender roles in agriculture, spinning, weaving and clothing (Barber 1994). With gaps in the evidence as to the role of women in these tasks, she bases her ideas on the model of the division of labour by Judith Brown, which argues that much of women's work (including spinning and weaving) depends on its compatibility with childcare (Barber 1994:29). This lively and beautifully written book is of its time, in relation to gender studies in archaeology (see also Brumfiel 1991), looking for positive roles for women in the past, and is successful in this.

Another means of investigation of gender that archaeologists use is by analogy with the gender division of labour in the ethnographic literature. The classic study on this was by Murdock and Provost (1973 and related articles), where they looked at the gender attribution of common tasks around the world and attributed them to either predominantly male, predominantly female, or equal participation (Murdock & Provost 1973:table 1, referred to in Costin 1996:120-123). Within the results, spinning was one of the tasks most strongly associated with women and loom weaving associated with women in nearly two thirds of the cases (Murdock & Provost 1973:table 1). While this does not prove gender attribution in past societies, especially as it shows that men were also associated with these tasks in a number of cases, it does show some general patterns for archaeologists to use for discussion. Possibly most importantly, as Costin points out, these results show how strongly tasks are gender associated and how rarely men and women participate in the same tasks, using the same tools, for the same "customers" (Costin 1996:21-123).

More firm approaches to gender are from burial evidence where the skeleton can be sexed, or from representational evidence, although these are not without problems of identification. Sørensen refers to Wels-Weyrauch's work on female gender divisions identified though bronze costume elements in Bronze Age burials in Germany (Sørensen 1997:100-1). Pedrotti considers the gender, rank and social status of the costumes represented on the stelae of the Alpine Region (Pedrotti 1998:311-2). Still sometimes having an influence, although largely discredited, is Gimbuta's relationship of pattern types to women (Gimbutas 1989).

Regional groups and specialisation

In terms of regional and group specialisation, the analysis of the early appearance of spindle whorls in different regions of Switzerland is considered by Pétrequin in relation to the environmental constraints of sheep rearing and neighbourly rivalry (Pétrequin 1993:58-60). While Altorfer and Médard consider the surprising absence of spinning equipment at the site of Wetzikon-Robenhausen, Zürich, where there is plentiful evidence of threads made by spinning, they consider three possible solutions: the spindles are not preserved, not identified, or the thread was spun elsewhere (Altorfer & Médard 2000:65). The third option may suggest that spinning was a specialised activity not carried out at every site.

Where social issues are raised in relation to cloth, they raise important issues that, considering that cloth production and use seems to have occurred in all societies, ~~has~~ have wide implications. However, in contrast to artefact studies, the literature relating to the social context of cloth is poorly represented. Possibly researchers know that they can work on a small section of the sequence of events in the production and use of cloth and be sure to get it right. Although it is possible to criticise aspects of Sherratt's Secondary Products Revolution in light of more recent evidence, or Barber's "Women's work" as over-vigorously in search of women, these two approaches are courageous and have created discussion of the relevance of cloth to individuals and societies, and should be seen as a basis for debate rather than the last word.

Cloth in the wider archaeological literature

There are two main issues to consider in relation to the way cloth is integrated into the wider archaeological literature, by which I mean syntheses and overviews of periods or regions by non-cloth specialists. The first, is how much cloth is taken into consideration, and the second is the way in which cloth is portrayed as part of the evidence for the social dynamics of the period. In this section of the review I have chosen examples of recent, high-profile books and/or theories as an indication of the contribution of cloth studies to the construction of evidence for societies in these periods. These are mainly by British or American scholars, who are tackling issues of social context that are in line with my own approach. Therefore, I have not looked at literature that is more concerned with defining cultures through artefact assemblages or simply attributing artefact to period without explicit theoretical goals of social interpretation.

The Neolithic

Of the current approaches to interpreting Neolithic societies, Whittle's book "Europe in the Neolithic: the Creation of New Worlds" (Whittle 1996) and Thomas's "Understanding the Neolithic", albeit about southern Britain (Thomas 1991) are most concerned with social interpretation. Whittle rarely refers to cloth production and use; when he does, loom-weights and spindle whorls or clothing are listed as artefacts (Whittle 1996:109, 315-316), rather than a line of evidence for the "Creation of New Worlds" that he suggests from evidence of housing, stone tools, monuments and agriculture (Whittle 1996:ch.10). Thomas similarly focuses on evidence of pottery, monuments, funerary and depositional practice, subsistence economy and regional variation (Thomas 1991:221). Both works are explicitly selective about the lines of evidence they use and do not claim to be comprehensive (for example, Thomas 1991:221). However, neither chooses to use cloth or cloth-related artefacts as its main line of evidence.

Interestingly, in Hodder's book "The Domestication of Europe" particular types of craft production, including spinning and weaving are seen as activities that occur within the house, and therefore part of the *domus* (Hodder 1990:67-9:fig. 3.5). The *domus* describes a cluster of traits associated with the house, as a domestic space, and possibly an area both conceptually and spatially with domestication both of nature and of society through women (Hodder 1990:68). Skin-working is not among the activities identified by Hodder. Unfortunately, Hodder does not develop the theme of cloth production, or use, further. Yet, it does suggest potential in seeing cloth production as part of a wider ideology in society associated with the relationship between the use of space, gender and subsistence activities during the Neolithic.

It is worth bearing in mind, that cloth in the Mesolithic (and for that matter Palaeolithic) is characterised mainly by furs for clothing and nets for fishing based on what appears to be a long history of research (concerns highlighted by Clark 1952:see 80, 83, 208). There is mention of flint scrapers for hide-working, small game hunting for furs and meat and fishing nets (Mithen 1998:99,107,132, Pitts 1979). But as for the Neolithic, these are not integrated into wider interpretations of the social dynamic of the period. I mention the Mesolithic, because it contrasts with the Neolithic, where the cloth most likely to be referred to is woven cloth, through spinning and loom-weights.

The Copper Age and Bronze Age

In the mid-third millennium BC, roughly straddling the Copper to Early Bronze Ages, Andrew Sherratt proposed that wool was part of the Secondary Products Revolution. This has ensured that cloth, or at least woven woollen cloth, was considered one of the factors contributing to the social fabric of the Bronze Age (Sherratt 1981, Sherratt 1983): the implications for social dynamics of the introduction of wool have been discussed above. Wool as cloth is recognised as a possible source of wealth; as a commodity that could be stored, traded and exchanged (Champion, Gamble, Shennan, & Whittle 1984:163,179,183), although the date of this increased exploitation of sheep's wool for cloth, whether to the Copper Age or Early Bronze Age, remains elusive, which makes any adjoining statements as to social influence complicated.

The focus on weaving to produce cloth remains in the general literature. In the book "European Societies in the Bronze Age", Harding has a comprehensive section on weaving (Harding 2000:254-264), with a brief mention of "plaited textiles", which based on his reference (Schlichtherle 1990) would refer to a cloth construction technique called twining. He also dedicates a section to clothing and ornamentation in his analysis of people's appearance (ibid:368-377). There is no corresponding section on working skins, although leather is mentioned throughout the book, for example in relation to armour, weaponry and horse-riding equipment (Harding 2000:275). The relationship of cloth technology with clothing is recognised as important, but not developed further: "Since these textiles were for the most part utilised on people's clothes, they represent a very personal statement about technology in daily life" (Harding 2000:264).

Where the evidence for cloth as an aspect of social dynamics is taken into consideration, which from the Neolithic to Bronze Age in the general literature is predominantly the subject of woven wool cloth in relation to the Secondary Products Revolution, it been readily accepted as a worthy source of evidence for wide-ranging social change; from production to trade and exchange and sources of wealth. What is rather surprising is that the evidence for woollen cloth is exceptionally scant; far less than that for tree bast or linen cloth in the Neolithic, which generally plays a small role in the interpretation of Neolithic societies. This seems to lead to the unspoken conclusion that furs and flax were not particularly important in relation to social dynamics.

Clothing

The consideration of cloth in relation to clothing is discussed in all periods, and appears to be seen as the main use of cloth, with little consideration for cloth as containers, equipment or components of housing. Another issue with the general literature is that a single cloth type is taken as dominating in each period, whether defined by raw material type, such as furs, or construction type, such as weaving. In addition, less familiar cloth types, such as twining or tree bast constructions are rarely shown. While the implications for this may be justifiable at a detailed research level, the absence of engagement with cloth leads to the creation of stereotypes.

There are two general stereotypes: the first is that a single cloth type dominated each period, the second is that there is an evolution from furs to weaving. No-where does this come out so much as in illustrations, where artists are forced to grapple with the issue of cloth types or promote nudity. For example, in a guide book to Prehistoric Archaeological sites in Britain, the Neanderthals are clothed in untailored furs, the Neolithic farmer and prehistoric traders are in roughly tailored fur clothing, the clothing of the Bronze Age wandering smith is ambiguous (artist Jeffrey Bum in Cavendish 1983:8,70,77,109), while the Celtic "Druid" is represented in a flowing white, presumably woven robe (19th type illustration supplied by Weidenfeld & Nicolson in Cavendish 1983:143). Fedele's illustrations in "L'uomo, l'Alpi, La Valcamonica" show a similar sequence from fur dressed Palaeolithic hunter to a mix of Neolithic woman grinding cereals in tailored furs and Neolithic farmers in wrapped woven clothing, and Bronze Age man in dyed woven wool cloth (Fedele 1988:54,58,68 & 128). A similar sequence is found in children's books (for example: Martell 1995). While it does not seem that any researchers are really saying that this evolutionary sequence is real, it may be that the lack of engagement with the subject of cloth allows these views to be perpetuated in underlying assumptions.

Outlook

While the absence of preserved cloth artefacts, and the consequential dependence on related evidence that is laborious to collect and potentially less conclusive, means that cloth research is unlikely to become a major line of evidence, it should not be completely ignored in relation to social interpretations. Where it has been discussed as an aspect of social context, its contribution is not disputed.

I conclude this review of the archaeological literature with two quotations encouraging the development of such research. In her short article "Invisible Crafts", Andersson questions why the related crafts of textiles and skins receive so little discussion in relation to contextual issues such as their contribution to economy, specialisation gender, status and social status, and concludes by saying:

> "We must dare to ask questions and discuss even if we do not always get tangible and easily interpreted answers. If we avoid problematic issues, we run the risk of getting a false image of the prehistoric period" (Andersson 1995:7).

At a slightly later date, Good concludes a review of current research in archaeological textiles with:

> "These cumulative data[3] we now have at our disposal are amply suited for a new generation of comparative studies and syntheses for addressing some basic anthropological questions. Fresh textile and fibre perishables data can now be interpreted with the aid of a large interdisciplinary framework built from what we know, rather than simply documenting in site reports and appendices and forgotten, as they often were just 20 years ago (sic)" (Good 2001).

The current state of the literature relating to cloth in the Alpine Region certainly fits this pattern. Substantial documentation, analysis and publication in the last 15-20 years have resulted in a large body of good quality data in terms of the identification of cloth types, chronology and synthesis of change over time. However, the engagement with this data at a theoretical level lags behind and the interpretation of the artefacts remains archaic in respect to the broader changes in archaeological approaches and

[3] i.e. artefact and chronology studies

criticism of a-theoretical frameworks. There are several solutions to these problems. It is important to re-evaluate the role of cloth in society and to use these insights to address the archaeological data from new perspectives. To assist this it is necessary to reconsider the classification and typologies of cloth artefacts to break down the thinking these impose. From this ~~is it~~ it is necessary to consider alternative methods of approaching the same data to obtain alternative results and new conclusions. In the following chapter I propose a method and theoretical approach to investigating cloth from the Neolithic to Bronze Age.

CHAPTER 3

Theory and method to investigate the social context of cloth

As I concluded in the previous chapter, the social context of cloth needs to be investigated with a theoretical awareness of societies and material culture and the development of a methodology specific to this aim. In this chapter, I look briefly at the philosophical approaches of Giddens and Bourdieu, that is, of structuration and the *habitus* and the way that material culture studies have interpreted these. Then I look at the social anthropological and historical literature to investigate cloth as a particular type of material culture. On this basis, I draw on methods used by archaeologists to investigate material culture and technology and the socially contextual themes of people, material properties, sequence, time and place, techniques and tools. In combination, these methods are used throughout the thesis to investigate the social context of cloth.

Society and practice

Gidden's structuration theory

Giddens' structuration theory as outlined in "The Constitution of Society", first published in 1984 and subsequently reprinted (Giddens 2003), offers an approach to the interrelating dynamic of society. Giddens explores the nature of human action through the negotiation between agent and society, based in the situated context of these occurrences (Giddens 2003: xiii-xxxvii). In his theory, the interchangeable terms of agent or actor (ibid: xxii) are used to encapsulate Gidden's idea of people, who operate within and in turn act upon the social institutions that they are part of. Neither the structure of the society, nor the individual agents, are awarded dominance over one another. From this basis, Giddens develops issues in relation to the contextual nature of social reproduction and social transformation (Giddens 2003:xx). This includes unconscious routines of social activity that characterise social life (ibid:xxiii), through bodily movements or gestures and their positioning in time and space(ibid xxiv). He considers the daily and lifelong flow and cycles of a human life and issue of locales as places of social interaction and also places of chronological significance in terms of timed meeting places (ibid xxv). Giddens considers human action and enclosure or disclosure in relation to confinement and display (ibid xxvi) and principles of constraint and motivation (ibid: xxvii-xxviii). These relate to large-scale processes of change (ibid: xxix); and physical resources (ibid: xxxi). Giddens' theory offers archaeologists an opportunity to explore societies, as aspects of these themes are accessible through detailed studies of material culture.

Bourdieu: practice and the habitus

Bourdieu's idea of the *habitus* is a theoretical concept where a society and the agents who reproduce the world they live in, whether through adherence to its values or rejection of them. The concept of the habitus is developed in two works; "Outline of a Theory of Practice", first published in English in 1977, with subsequent reprintings (Bourdieu 2003), and "The Logic of Practice", first published in English in 1990 and also regularly reprinted. The *habitus* refers to the shared, learned principles that agents adhere to through the body, an "embodied history, internalised as a second nature and so forgotten as history... a spontaneity without consciousness or will" (Bourdieu 1990:56).

Through a shared *habitus*, which resonates with ideas of "common-sense principles", or shared dispositions, a group of people will face the situations presented to them in a shared, and potentially predictable way. This does not mean that they all react in the same way, or even agree, but that their definitions of possible, impossible and probable in terms of their reaction to an experience would have elements of shared practices and aspirations (Bourdieu 2003:78-80). These are likely to be unconscious decisions taught and learned through participation in a society from a young age (Bourdieu 2003:81). Through this process agents interact and create social relationships; however, because they are disposed to the perceptions of the *habitus*, their interaction is not limited to an individual to individual relationship, but placed within the confines or possibilities of the shared (or conflicting) *habitus*. An example of this is to consider the disposition as to how people negotiate physical space, such as through the distance between them when standing or the use of space in a house (Bourdieu 2003:82,90). While the *habitus* may create shared and sustained dispositions, it may also create transformations: "In short, the *habitus*, the product of history, produces individual and collective practices, and hence history, in accordance with the schemes engendered by history" (Bourdieu 2003:82).

Society and material culture

Archaeologists and anthropologists are particularly interested in the way in which people, and therefore societies, engage with material culture. In both disciplines there has been a focus on understanding the role of material culture in societies in relation to the concepts of society advanced by sociologists such as Giddens and Bourdieu. I particularly like the way that Miller presents the concept of material culture:

> "That is, artefacts appear as given concrete forms, but human societies have always striven – through their construction, alteration, consumption and application of meaning – to make them internal to, and in part definitional of, themselves" (Miller 1994: 396).

Therefore, although material culture may be explicitly associated with a defined primary purpose, such as a shoe to wear on the foot, a sieve for grain, or bedding to sleep in, the social context of such artefacts is created and understood through the intentions and motivations of the people who make and use them. Individuals may use material culture to follow traditions or break from it, to negotiate space, to mark time, to orchestrate meetings, form alliances and other socially negotiated acts. .

This adds complexity to the process of making and using material culture, such as cloth, transforming it into a value-laden activity with value-laden goals. From this perspective, it is proposed that

> "Artefacts are a means by which we give form to, and come to an understanding of, ourselves, others, or abstractions such as the nation or the modern" (Miller 1994:397).

On this basis, artefacts are not only imbued with their functional role of sieving grain or protecting feet, but have symbolic qualities that are exploited, read and understood, if not always perfectly.

From this theoretical basis, it is necessary to consider the nature of cloth as a material and the particular role of cloth in societies. I have investigated this through social anthropological approaches to cloth.

Cloth in society

At the beginning of this research, I was struck by the disparity between the way that cloth is described in the social anthropological and historical literature, and in the archaeological literature. From this difference, I recognised that there was a benefit in studying the social context of cloth as analysed by anthropologists in known or historically known societies and to use this as a way of gaining a concept of the way that cloth is part of people's lives, or using a more technical phraseology, a perspective of the social context of cloth.

Social and political saliency

In this respect, Jane Schneider and Annette Weiner's edited volume "Cloth and Human Experience", is a benchmark (Schneider & Weiner 1989a). In the introduction they consider how the properties of cloth lead it to be worn as clothing, used in contexts of covering and display, can conceal and disclose, and through the variety of cloth types can readily be imbued with meanings that make it appealing to symbolise power, social and political roles. This symbolic potential of cloth they see as particularly important in relation to the social and political saliency of cloth as a means "in which people use cloth to consolidate social relations and mobilize political power" (Schneider & Weiner 1989b:1-3). In particular, the complex issues surrounding clothing in particular have been discussed in a number of volumes and papers and from different perspectives, such as gender and ethnicity (for example Banerjee & Miller 2003, Barnes 1993, Barnes & Eicher 1993, Hoskins 1993). The preference for particular cloth types and related clothing styles is seen as an important means of inclusion or exclusion and is significant in many contexts (Hauser-Schäublin 1996:102-103, Oakes & Riewe 1996:192, Velásquez Nimatuj 2003:201-210).

Production as social context

The use of cloth is readily interpreted in relation to culturally specific meanings, but the production of cloth is the result of human actions and intentions that are based in society. These actions and the ways they are carried out (with or without tools, as part of an assemblage or alone) may be as much definitional of the society as the cloth itself (Thomas 1995:131). The process of making or acquiring need not only be viewed as a means to an end: the activities themselves may add significance or value to the cloth or the person carrying them out. The activities at different stages of production may be associated with the personal virtue or characteristics of the maker (Barnes & Eicher 1993:5, Thomas 1995: 131-133), just as a person may be defined in part by their role in producing cloth. Another type of relationship is between the time cycles of cloth production and other cultural cycles: seasonal practices of cloth production may be defined by or define other seasonal practices (Heringa 1993), or significant life-cycle phases (Adams 1971:321-322). I shall develop these examples and others in relation to the social contextual themes, discussed below and in the case studies (Chapters 5-9).

Contexts, traditions and beliefs

Culturally specific beliefs, meaning and traditions, whether old and established or associated with new and outside influences, surround the practices and social context of cloth production, acquisition and use. Clothing is anobvious example of the way in which cloth is used as symbolic material culture and used as a cultural tool to represent concepts of the self and society (Andrewes 2005:ch.2, Miller 2005). Cloth types with a meaning in one context may be perceived quite differently in another (Küchler & Were 2003:3), or gain a new meaning through the transformation of the social environment (Rovine 2001:7-8). While many studies focus on one type of cloth, the combination of cloth types available to a culture is significant as they may have different roles and values on the basis of their co-existence. Another symbolic type of material culture relating to cloth is representation of cloth and clothing. To study this I look towards Gell's concept of the artist, prototype, index and recipient (Gell 1998:ch.2), which I discuss in more detail in Chapter 7.

From social anthropology to archaeological method

From the social anthropological literature, there are several aspects that I see as especially important in understanding cloth in societies. One the one hand, it is necessary to consider the range and juxtaposing types of cloth in society as it is within this context that cloth is made, used and defined. In other words, this is the way people encounter cloth around them. Another point I am concerned with is that people encounter cloth, in its various stages of production and context of use, through their own involvement or that of others. This includes the sequence in which cloth and elements of cloth or cloth artefacts change hands and are received in passing from one stage to the next. It is also readily apparent that cloth is vested with meaning and symbolism that significantly affect the way in which people interact with it. In addition, the way the physical properties of cloth may be valued and used is variable as each cloth type has a number of properties that may or may not be the aspect that is of importance at any one time. I have drawn on these sources to devise my methodology and to investigate the social context of cloth with the following research questions.

Research questions

As discussed above, I consider it necessary to know what type of cloths exist at any one time, in other words, the cloth culture of a society, and what each of these cloth types was like in terms of appearance and properties as well as the way it was produced and used. To understand these details it is then necessary to ask who produced the cloth and who used it? How was the cloth made and how was it used? Was cloth exchanged and between whom? Where and when was the cloth made and where and when was it used? What was the cloth made for and why was a particular cloth type chosen? These questions establish a means to develop a systematic and detailed understanding of the range of cloth types that was available at a given time.

Through this information it is then necessary to question the relationship between these cloth types at any given time and why the production, use and role of cloth types changed over time? More specifically, why was flax introduced in the Neolithic? Why did weaving with a warp-weighted loom and spinning thread with a spindle whorl become popular? What is the significance of tree bast in the Neolithic? What role did skins have in relation to thread-based cloth from the Neolithic to Bronze Age? Does the use of wool for woven textiles in the Bronze Age replace the use of cloth for skins? And how do technically similar cloth types have different social contexts in different places and times? These research questions ultimately stem from a wish to understand societies and the role of material culture in relation to individuals and groups in these societies.

The Methods

Co-existing cloth types

As mentioned above, one of the methods I apply in this thesis is to consider the many types of cloth that co-existed in a society as comparable and interrelated. These co-existing cloth types I call the "cloth-culture". This is a means to understand how different cloth types are perceived in the context of society. While each cloth type has individual properties that make it unique, many properties are shared between cloth types, allowing people to make choices between which cloth type is employed for a particular purpose. This selection amongst various possibilities can be described as "technical choices" (Lemonnier 1986: 156). Through choices in materials, processes and other variables, the production and use of cloth can be seen as itself a culturally based activity that is stylistic, whereby attitudes to materials, processes and effects are based in the cultural attitudes that are held by the society (Lechtman 1975: 4, 10).

Noticeably, "choices" are not based simply on the physical limits or possibilities of the material: cultural factors are equally compelling (Schiffer & Skibo 1997;Tite & Sillar 2000:17). "That technological choices of societies are thus established by means of 'criteria' which are not at all material will pose problems to whoever would advance the hypothesis that material life, and notably the relations among individuals during activities of production, play a fundamental role in the functioning of societies..."(Lemonnier 1986: 156). Through comparing cloth types it is possible to understand the contrasting social context of all the cloth types that were available at any one time, and therefore gain a better understanding of the socially contextual choices that were available.

The chaîne opératoire

To investigate the production and use of cloth I have looked towards the chaîne opératoire as a method used by archaeologists to explain the sequence of events that occur from the transformation of raw materials to usable artefacts. Originally defined by Leroi-Gourhan (Leroi-Gourhan 1993:230) and elaborated through the work of Lemonnier (for example, Lemonnier 1986), Cresswell's definition of the chaîne opératoire is often referred to in the literature and is worth quoting as a reference point: "Pour moi, il s'agit d'une série d'opérations qui mène une matière première de l'état naturel à un état fabriqué..." (Cresswell 1976:6); translated as "a series of operations which brings primary material from the natural state to the fabricated state" (Cresswell 1976:6 referred to in English in Lemonnier 1986:149, also quoted by: Dobres 2000:169, Tite & Sillar 2000:4). The term, chaîne opératoire, is most frequently used in French, but may also be translated as operational sequence[4] (Lemonnier 1986:149). The advantage of the chaîne opératoire as method is that, through its apparent simplicity, it can be readily applied to the analysis of archaeological materials and is flexible enough, and can encompass sufficient complexity to adapt to a wide range of research approaches.

Factors in the chaîne opératoire

The complexity and adaptability of the chaîne opératoire arises from the fact that recognition of the factors contributing to the chaîne opératoire can be made at numerous levels, and can be separated into different spheres. Leroi-Gourhan referred to techniques as the relationship between gesture and tool, organised in a sequence with syntax, and applied to the material by the brain through memory (Leroi-Gourhan 1993:114, in Audouze 1999:168). Another approach suggests the analysis of five main

[4] Catena operativa, in Italian

areas: the raw materials used to make the artefact, the tools used to work the materials (raw or processed), the energy source that drives the tools (whether human or animal energy, fuel or natural sources of energy), the techniques that are used to work on the materials, and the sequence that links these events (in terms of frequency, place, the order they occur in) (Tite & Sillar 2000:4). Another division suggests: "matter, energy, objects, gestures in sequence, and knowledge" (Lemonnier 1989 in Dobres 1999:125). These categories are useful to show that the physical transformation of material is achieved through the interaction of various spheres, including the physical properties of the material and the essential contribution of the technician and their tools placed within the context of their society.

The limitations of the chaîne opératoire

The limitation of the chaîne opératoire as a method for this research is that it is usually applied only to the production of an artefact: in the case of cloth this typically includes the processing of the raw materials, for example the stages of rippling (removing seeds), scutching (scraping and beating) and hackling (combing) flax stems are usually listed, and the construction of cloth such as weaving or curing skins. Going back to Creswell's definition of the chaîne opératoire, as cited above, it refers to the sequence of events, which concludes when the primary materials have been made into the fabricated state.

This, however, begs the question: what is the fabricated state? Or even, what are the primary materials? And further: when is the process finished in the eyes of the maker? Where does it begin? What does the user of the artefact expect the outcome to be? Can we separate the two? For a start, the raw materials of cloth often seem to arrive in the hands of the artisan with no previous history: flax is introduced as an agricultural crop, then all of a sudden linen is being spun. What about the farmer who dedicated land to that crop, who planted it, weeded it, worried about insect attack, prayed for rain and eventually had to make a judgement about when to harvest it to get the best yield for the intended purpose? At the other end of the production sequence, cloth may be the finished artefact in its own right, but just by looking at some of the terms used to describe cloth artefacts: cardigan, blanket, bag, fishing net, shroud, table-cloth, red carpet, it is clear that cloth is an aspect of material culture that in its context of use may be constantly combined with something else, either permanently or as part of a temporary group. So, for example, cloth invariably plays a significant role in dress, although there are other components to dress, especially ornaments and fastenings (Eicher & Roach-Higgins 1993, Sørensen 1997:95-98). These components cannot actually be removed without destroying the finished dress assemblage. So, therefore, is the finished artefact actually the whole costume?

The problem seems to be that the chaîne opératoire can be readily divided into small chunks, and studied meticulously, but that this does not incorporate the full extent of the chaîne opératoire of the cloth artefact. Therefore, the limitation of the chaîne opératoire to this research is in the differentiation of certain technical activities, namely production, from other activities related to material culture. The difficulty of the separation of these spheres has been debated in a number of arenas. If at its broadest level, technology is "the way people do things" (White 1940:142 in Sigaut 1999:423) then it would be easy to object, as Ingold does: "Is there anything, the sceptic might ask, about human culture and social life that is not technological?" (Ingold 1999:vii). The problem appears to be the separation of theoretical approaches to "technology" from theoretical approaches to "material culture". But if the problem is purely of scope and definition, rather than the role of cloth in society, perhaps it is most effective to combine those activities related to production and those related to use.

The extended chaîne opératoire

To develop this method further I have chosen to use an analytical tool that I have called the extended chaîne opératoire. This term deliberately invokes the analysis and theoretical concerns of the chaîne opératoire in studies of technology. The purpose of the extended chaîne opératoire is to follow the sequence of events from the acquisition of raw materials through to the context of use of cloth. The theoretical implications of this are that it combines what has traditionally been discussed in archaeology as the technology of cloth, with the role of cloth as material culture. The extended chaîne opératoire is therefore a method to investigate the holistic context of cloth from production to use and a way of understanding the interrelationship of all these aspects of cloth in society.

I first became focused on this idea when I was reading an article on dress written from a cross-cultural perspective of understanding dress and gender (Barnes & Eicher 1993:4). I have adopted one of their statements which is "To understand the role of dress in a given society, an analysis of the creative act of making dress is essential" (Barnes & Eicher 1993:4) for my own purposes. By switching the focus to cloth, I consider: to understand the role of cloth in a given society, an analysis of the creative act of making cloth is essential. Which could just as well read: To understand the creative act of making cloth in a given society, an analysis of the role of cloth is essential. Why this little word game? Because I like the way it pinpoints how the process of making and the result of making are interrelated in society.

Social contextual themes

Accordingly, the extended chaîne opératoire is a method to study cloth holistically in societies; yet this broad method needs to be focused further to ensure that it is used to achieve my aim of understanding the social context of cloth. I have focused on socially contextual themes, of the properties of materials, people, time and place, tools and techniques and sequence. This is based on themes from the social theories of Giddens and Bourdieu, and expressed in other applications of the chaîne opératoire as discussed above.

Properties

Material properties are a fundamental aspect of materials. They can be investigated through mechanical and chemical tests of the archaeological materials, or comparative modem examples. However, while these may seem absolute and scientific, in a social context properties are also subject to culturally specific criteria. This leads back to the question of technological choices explored at the beginning of this chapter. I investigate this in relation to process of working materials in Chapter 4 and further in Chapter.9.

People as social beings

By people, I refer to questions of who? This refers to issues of social identity, such as age and gender, ethnicity, role and status. It also refers to the situation of an agent acting in society. Unlike their counterparts in other disciplines, archaeologists are often faced with material culture that is no longer associated with its makers or owners and have had to devise particular methods of investigating this. Gender studies have led this area of study, by creating methods that move beyond a simplistic approach where people are distinguished by biological sex, to the gender approach in which male and female are recognised as socially constructed genders based on roles constructed through practice, appearance and cultural expectations (Whitehouse 2001:2). I shall refer to specific methods to investigate gender as appropriate throughout the thesis.

Archaeologists are currently in a state of flux in relation to investigating social identities such as ethnicity. The traditional approach to "cultures" based on pottery and artefact styles, as if they were ethnic groups, has been seriously questioned over several decades. However, terms to describe these recurrences of material culture are entrenched in the way archaeologists write about and describe their data, and are still used, although no longer viewed as ethnic groups. Similarly, ideas of social evolution that were used to classify the power structures in society, whether an egalitarian band, big-man, tribe, chiefdom, or state, brought into question the significance of these structures for social interpretation, although the actual application to archaeological data is criticised (Champion, Gamble, Shennan, & Whittle 1984:170). Although outdated, such approaches remain necessary framework of reference to formulate interpretations of material culture and different periods.

Currently some archaeologists approach people through the idea of agency. This term is used to describe people as situated beings with intentions and the ability to act on their own, while also part of a society. Such social agency is recognised as the basis for forming relationships and networks and creating meaning in people's lives (Dobres 2000:1). Agency builds on issues of social role in terms of gender, status and ethnicity but, rather than seeing these as pre-defined by the society, views them as aspects that are negotiated and reproduced through action and intentions.

Place as landscapes and locales

The issue of place relates to questions of where? Reference to place and the location of activities or perceptions of these places is relevant to exploring the social context. Ingold's definition of landscape as "the world as it is known to those who dwell therein, who inhabit its places and journey along the paths connecting them" is used to encapsulate the inseparable and negotiated relationship between environment and humanity (Ingold 1993:514). A similar aspect of place, is described by Giddens as "locales", which "refer to the use of space to provide the setting of interaction, these in turn being essential to specifying its contextuality" (Giddens 2003:118). A locale may be a fixed place, the presence of the body, an artefact or a mixture of these; the way people encounter locales, their features and actions within them is a means by which people interact in social life (Giddens 2003:119). The exploration of place, whether through Ingold's concept of landscape or Giddens concept of locales, is therefore not simply a grounded location or resource, but where social life is created and made meaningful. Both Giddens and Ingold relate these concepts of socially contextual place to time and timing. Place is explored by archaeologists through the location of archaeological finds in a landscape or more specifically in the context of a village or house plan or through the place of artefacts, such as clothing on the body.

Time as temporal structure

By time, I address questions of when and how long? Aspects of time are relevant to investigation of the social context of cloth, as time considerations and time consciousness are arguably at the heart of the way in which a society views its world and perceives its practices (Lucas 2005:67). One of the methods of investigating time that Lucas proposes is through structures of time-indication; a common form of measuring time through the practices of a society in relation to astronomical (sun, moon, stars) and seasonal (climatic and biological cycles) events (a term from Nilsson 1920, in Lucas 2005:68). That some activities are time-structured, for example, harvesting crops, participation in a festival on a specific day or the sequential timing of production (van der Leeuw 1993 in Lucas 2005:69). Of this, I find it useful to make a distinction between fixed time (when), related to time of day, a day or season, and time-duration (how long), which is the length of time ascribed to a particular practice or existence. These two may be interrelated, in that a time-duration may begin or end at a fixed-time, or they may be separate, in that a time-duration may begin at any time or alternatively a practice starting at a fixed-time may have an ambiguous time-duration. Archaeologists can explore this through environmental data for seasonal cycles of plants and animals. These data may be interpreted in relation to historically known practices.

Sequence as socially contextual actions and motivations

By sequence, I refer to questions of in what order? The sequence in which acts of the chaîne opératoire are put together is at the very heart of the definition of an operational sequence (Tite & Sillar 2000:4). The notion of sequence encompasses both the material influences, including the material, technical and knowledge aspects of the sequence, as well as what may be explained as economic or culturally based influences, such as modes of production including specialisation (Tite & Sillar 2000:5-7), and other closely related issues such as trade and gift exchange, where artefacts move from one person to another in a sequence that is informed by their society, economy and culture.

In some studies, it is considered sufficient to describe sequence as the transformation of the material, for example the sequence of obtaining wool from sheep: the wool is shorn, or plucked from the sheep, then teased to separate out the naturally matted wool and remove obvious foreign bodies before being sorted into grades and scoured in hot or cold water, possibly with soap, to remove the naturally occurring lanolin etc. (Hodges 1995:124). While, from the alternative view, technology is nothing if not the social relationships between people and the way they "forged, mediated and made meaningful" their social relationships through material culture production and use (Dobres 2000:1); therefore through the chaîne opératoire of materials, we question the relationships between people. The issue of sequences, therefore, combines the agency of the producer and user and the social relationships that are negotiated between people through their interaction with material culture.

Techniques of the body in society

Techniques relate to the use of tools and the body, or the body on its own; they are concerned with questions of how? I am concerned with techniques through which people interact with cloth. Mauss' work on "The notion of body techniques" brought to attention the relevance of what he calls body techniques and the learned accumulation of these by individuals acting within a society (Mauss 1979a). He argues that these apparently technical actions (swimming, walking, running) are not casual methods of doing, but are learned, whether through deliberate education, or apparently subconscious copying. Seeing the body as the instrument, the mastery of such body techniques is an integral part of individuals' socialisation into a group and their identity within It (Mauss 1979b;104).

In understanding the chaîne opératoire, Sillar and Tite's factor of "techniques used to orchestrate the raw material, tools and energy to achieve a particular goal" are bound to the body technique: "... most of these techniques are enacted through the potter's body and his/her manipulation of the tools" (Tite & Sillar 2000:4). Despite being easily associated with the use of tools or the use of a particular type of material culture, techniques are not confined to it. Bremmer's approach to researching the written evidence for "Walking, standing and sitting in ancient Greek culture" is an account of exploring the association of social values to these body techniques (Bremmer 1991). While the paper concentrates on the body techniques that are separable from the use of tools, in several cases the body technique of walking etc. is described as inseparable from the type of clothing, although it is not the clothing that is necessarily constraining, it is a part of the overall effect (Bremmer 1991:19, 24). This shows how techniques refer to interaction with cloth use, just as much as cloth production.

Whether approaching body technique in relation to a technology of production or a technology of using material culture, these examples convey how techniques are also body techniques, which are performed and visible to others. It is the expression and reading of these body techniques that makes them as much components of social life as the artefacts that they involve.

Towards a methodology for researching the social context of cloth

My method involves considering the extended chaîne opératoire of cloth, including the procurement and processing of raw materials, the construction of cloth, the use of cloth to create artefacts and the use and re-use of cloth artefacts in assemblages. The aim of the extended chaîne opératoire is to inform a holistic approach to cloth, as people interact with cloth in both its production and use. This in itself, however, does not entirely fulfil the concept of social context; to do this it is necessary to focus on socially contextual themes within the chaîne opératoire. I have considered these through themes of properties, people, time and place, sequence, techniques. These are to investigate the questions of what, who, when and how long, where, how and in what order?

In this chapter I have explained the theory and methods that I have chosen to investigate the social context of cloth. I have put these together as a strategy to explore the data in new ways, which will inform an original approach to the social context of cloth. This is the area of research that I believe is in most need of attention at the current time in relation to cloth from the Neolithic to Bronze Age in the Alpine region. In the following chapters, I use a wide range of sources, with evidence from many disciplines, including history and social anthropology and environmental studies as well as from craft workers on a home or industrial scale and from many sub-disciplines within archaeology.

PART II

THE DATA

CHAPTER 4

The extended chaîne opératoire of cloth: the data

The aim of this chapter is to investigate the evidence for the extended chaîne opératoire of the way cloth was produced and used from the Neolithic to Bronze Age in the study area. This collates a large amount of evidence and different sources including archaeological evidence and artefact analysis, as well as a wide range of ethnographic and historical sources relating to the methods of producing and using cloth. I use the data from this chapter in the case studies. To deal with the data logically, I have divided the extended chaîne opératoire into eight sections, which each form a section of this chapter:

			Page:
•	4.1	The procurement of raw materials	*62-82*
•	4.2	The processing of raw materials	*83-93*
•	4.3	Threads for cloth	*94-103*
•	4.4	The construction of cloth	*104-132*
•	4.5	The construction of artefacts	*133-135*
•	4.6	Cloth artefacts	*136-144*
•	4.7	Decorative techniques	*145-155*
•	4.8	Cloth assemblages	*156-165*

I have sub-divided these sections into subject areas. In each I define the material, the archaeological evidence, the methods of production and use, and analyse these according to socially contextual themes, including issues of time and place, gender and social identity, technique and tools.

Tables of cloth artefacts

Many of the cloth artefacts I refer to are numbered with a four-letter code in capital letters, followed by an individual cloth number. For example CHRI-004 refers to a cloth artefact from the Christian Tuschwerk site of the Hallstatt salt mines. ~~A map and~~ Details of these cloth artefacts are listed alphabetically in Appendix 3.

Sources of archaeological evidence

Preserved cloth fragments are an important source of evidence for cloth research, and can be analysed to identify raw materials, construction method and, where possible, its use. Tools and objects associated with cloth artefacts are also a source of evidence; other sources of archaeological evidence inform different aspects of the extended chaîne opératoire.

The largest body of evidence for cloth made of plant fibre (flax, tree bast and grasses) is from lake dwellings and dates to the Late and Final Neolithic (or Copper Age). The so-called lake dwellings were settlements around the water's edge of the Alpine lakes. As artefacts fell from the wooden buildings, either during the occupation of the buildings or during catastrophes such as burning, they were incorporated into the muddy surroundings. These waterlogged, alkaline environments supported the preservation of plant materials. Animal materials such as wool or skins are not usually preserved, even when other evidence suggests that wool and skins were important raw materials for cloth. Besides a few occasional finds, there are two large sources of preserved animal skins from the Alpine region in this period; one is the Copper Age Iceman from Alto Adige and the second is the Bronze Age Hallstatt salt mines. These finds point to the importance of skins, as in both cases skins form a larger quantity of cloth remains. Plant and wool fibres are also preserved in frozen environments and in the salt environments of the Hallstatt mines.

As the main preservation environments for cloth fragments in the Alpine region are the lake dwellings, there is a significantly higher proportion of cloth remains from plant fibres than animal sources. To judge the proportion of cloth types that were available at any time requires an analysis of other sources such as tools, dress ornaments, faunal and botanical remains.

Sources of historical, ethnographic and experimental evidence

To understand the methods of working and contexts of using cloth types I have used a wide range of historical and ethnographic literature as well as the results of archaeological experiments by other researchers and those that I have carried out myself. I carried out three, four-day sessions of experiments with lime tree bast thread making and cloth construction with undergraduate students from the Institute of Archaeology in October 2004, 2005, 2006. I also experimented with curing a deer skin with fat and smoke in May 2005. Where possible I visited craft practitioners to understand processes I was not familiar with, including a visit to Riitta Skinkkonen-Davies in Wales who grows and prepares flax fibres for weaving and is involved in museum reconstructions of archaeological artefacts from the Neolithic lake dwellings.

Where relevant, I have expressed what is understood of the chaîne opératoire of subject areas in flow diagrams with the sequence between stages marked with arrows (for example, Figure 4.1.1.c). These summarise the main stages of the task and express possible variations in these methods through separate arrow sequences. These are not definitive as there are often numerous variations, which I have indicated in the text.

4.1 The procurement of raw materials

If cloth fragments are well preserved, the best evidence for raw materials comes from the identification of plant or animal species though microscopic examination of their cell structure as each species, has unique cell characteristics. These are identified using either optical microscopy, scanning electron microscopy (SEM) or infrared spectroscopy (Rast-Eicher 2003a, Körber-Grohne & Feldtkeller 1998:152-169, Groenman-van Waateringe 1993:121-122). Other methods of identification are possible using chemical tests, especially if the artefact is too poorly preserved for visual examination. Further observations can help identify species, for example the size and hair colour of animal skins (Groenman-van Waateringe 1993:121-122). The accuracy of the identification depends on the preservation of the cell features.

The identification of raw materials is liable to misinterpretation. Ryder substantially revised the identification of wool in prehistory and his research led to the rejection of some earlier analysis that identified wool, showing that these materials were actually flax (Ryder 1983:47, referred to in Barber 1991:141). Current research has shown the importance of tree bast as a plant fibre in the Neolithic (Rast 1995:149), a distinction which was not made by earlier writers (especially Vogt 1937). Seeds, bone assemblages and tools that are associated with working raw materials are particularly relevant to the many sites and periods where there is no preservation of cloth.

Tree bast

Tree bast is the inner-bark of the tree, found between the cambium layer and the outer bark. Tree bast is found just underneath the bark and is removed when the bark is striped from the wood (Figure 4.1.1.a&b). Historically in Europe, lime, oak, elm, juniper and willow were the most common species exploited for their bast and accounts of these practices are sources to understanding the procurement of tree bast (Myking et al. 2005:66). The tree species exploited for fibres from the Neolithic to Bronze Age are native to the Alpine region.

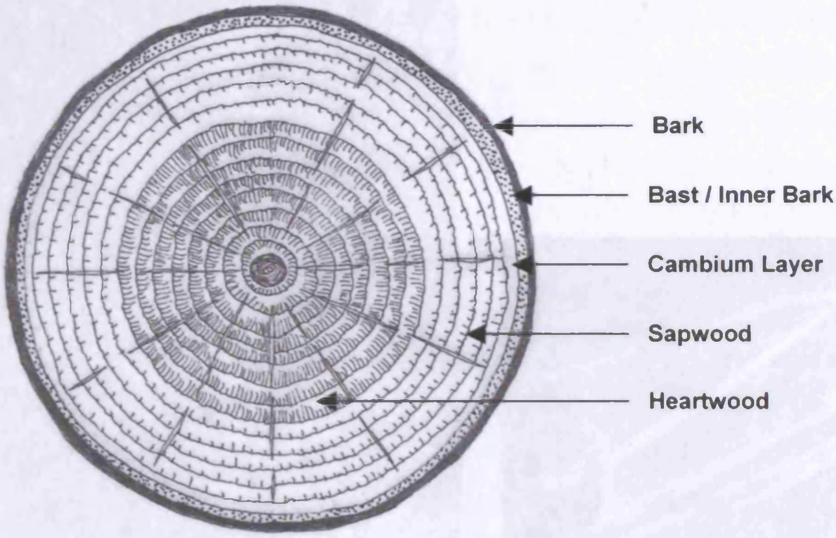
Archaeological evidence

Most of the evidence for tree bast fibres for cloth comes from the Neolithic lake dwellings. Bast of lime (*Tilia*), oak (*Quercus*), rarely willow (*Salix*) and elm (*Ulmus)* is attested throughout the Neolithic, to the extent that some researchers name this the "Tree bast culture" (Rast 1995:149). Tree bast continues to be used in the Copper Age. In the Early to Middle Bronze Age it is difficult to asses the use of tree bast for cloth as there is a lack of preservation environments; tree bast fibres are still in use in the Middle to Late Bronze Age, but they no longer seem to be important for cloth production. They are associated with rope-making in the Bronze Age salt mines of Hallstatt (Barth 1994:28).

Method of procurement

To obtain the tree bast, the bark and bast layers need to be removed from the trees. This can be assisted by a lever type tool; debarking tools of bone and wood are known worldwide (Médard 2003:82), Figure 4.1.2. Artefacts of similar morphology are known in the Neolithic from bone or antler, but it is difficult to attribute their use to bark removing. Use wear analyses have been used to identify some possible bark scarpers at Cuiry-lès-Chaudardes and Mairy, Aisne, France (Maigrot 1997, quoted in Médard 2003:82). Levers could have been sticks, knives or bones, but such omnipresent tools could easily have been for general tasks rather than specific to tree bast. Axes are common from the Neolithic to Bronze Age, whether of stone or metal; again some may well have been used for bark removal. Historical examples of axes show that the shape of the blade and length of the handle of axes varies according to their task with some shapes particular to bark removal (as for example Kezich et al. 2002:104-108), Figure 4.1.1.c.

The best sources of tree bast are young trees about 10-15years old with few side shoots, young branches from a mature, coppiced or pollarded tree are particularly suitable. Evidence of forest management is difficult to detect. However, dendroecology research suggests that there were periods of regeneration in woodlands following periods of felling that may be equated with coppicing (Billamboz 1990:199-201) (see Chapter 5).



a)

b)

Chaîne opératoire of the procurement of tree bast

Locate desired species of tree with suitable branches or trunk

↓

Fell the tree or cut off suitable branches from the tree

Select a suitable area of a live tree trunk or branch

↓

Remove the smaller branches and shoots

↓

Cut the bark

↓

Pull strips of bark from the tree

↓ Remove all the bark

↓ Leave some strips of bark on the tree to prevent it from dying

c)

Figure 4.1.1.Tree bast: a) Cross section of a tree: tree bast is located under the bark (Drawing by Susanna Harris). b) Tree bast that has been naturally exposed to water and weathering beside a lake (Photograph Susanna Harris). c) Chaîne opératoire of the procurement of tree bast.

a)

b)

c)

d)

Figure 4.1.2. Stripping tree bast: a) Lime trees, London 2005 (Photograph Susanna Harris). b) Pruned lime branches (Photograph Susanna Harris). c&d) Experiment with stripping tree bast using a metal knife as a lever (Photographs Susanna Harris).

Flax

The bast fibres used to make linen cloth are extracted from the stem of the flax plant, *Linum usitatissimum*. This is an annual plant. Wild flax (*Linum bienne*) is widespread across the Atlantic coast of Europe and the Mediterranean, as well as the Near East, northern Iran and Caucasia (Zohary 1989:366). The evidence suggests that flax was first cultivated in the Near East and introduced into other areas with other domestic crops (Rottoli 2003:68). The analysis of plant remains and seeds in the study area shows the plants are characteristic of cultivated flax (*Linum usitatissimum*), not wild flax (*Linum bienne*) (Körber-Grohne & Feldtkeller 1998:187).

Archaeological evidence

The earliest evidence for flax in Italy comes from a single seed at Sammardenchia, Udine, northern Italy dated to 5620 – 5470 cal BC (Rottoli 2003:68). Evidence for flax cultivation and use continues throughout the Neolithic in the study region, peaking at the end of the 4th millennium (Rast-Eicher 1995:169). Numerous seeds are known from the Middle to Late Neolithic sites of Isolino di Varese and Lagozza (Rottoli 2003:68). Flax seeds are found at Bronze Age sites including Fiavé and Volano S. Rocco in Trentino, northern Italy (Rottoli 2003:68). Although it may be possible that flax fibres were use to make cloth from the Early Neolithic, the earliest evidence for linen cloth in northern Italy and the central Alpine region date to around 4000 BC (Rast 1995:149). Either due to the different preservation conditions, or representing an actual decline in use, there are fewer examples of linen cloth from the Bronze Age. However, the finds from the Early Bronze Age at Lucone di Polpenazze, Brescia (LUCO-001-006) (Bazzanella & Mayr 1999:15-18), the Middle Bronze Age at Irgenhausen (IRGE-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:227) and the Middle to Late Bronze Age Grünerwerk, Hallstatt salt mines (Hundt 1960:126-150,Taf.14.2) attest to a continuing tradition, even if in diminished quantity.

Method of flax growing

As flax is a domestic crop, flax may be grown for oil, fibres or both. However the quality of fibres in the Neolithic and Bronze age is not so high that it would need specialist cultivation and stems with seeds removed (for oil) and roots attached (harvested for fibres) (Körber-Grohne & Feldtkeller 1998:152) suggest it was harvested for both.

As a crop, flax plants require a good water supply, and are best grown in fertile, well-drained, deep soils (Renfrew 1973:124) but will grow adequately on a range of soils and in different climate zones (Flad 1984:6-7). Young flax plants are vulnerable to the cold when young and may be killed by a light frost. They are equally sensitive to drought and extremes of temperature during the flowering stage (Renfrew 1973:124). Unhealthy plants are susceptible to fungal disease and pests; the seeds are vulnerable to birds (Fraval 1997). Sown either in early winter or late spring into well-prepared soil (dug or ploughed), flax grows over the summer months and is harvested late summer or early autumn by pulling it up by the roots so as not to damage the fibres (Durie 1979:2-3, Evans 1985:15-17, Flad 1984:10-13). The tools and techniques used in the cultivation of flax vary according to farming techniques, whether using digging sticks or ploughs to prepare the ground. As in historic times, the Neolithic flax harvest was pulled up by its roots and there are preserved flax stems with roots found in Neolithic settlements (Körber-Grohne & Feldtkeller 1998:152), Figure 4.1.3.a-c. If well stored, these dried stems last for years.

Hemp

Hemp seeds are known from the Neolithic in central Europe, including sites in Switzerland, Lower Austria and Romania.

Archaeological evidence

The earliest radiocarbon date for hemp seeds is from a German site attributed to the Linear Pottery Culture, radiocarbon dated to 5500-4500 cal. BC (Barber 1991:16). Barber discusses the possibility of hemp use as a fibre in the Neolithic and Bronze Age, but in the absence of actual cloth fragments was forced to leave the discussion at this stage: there is evidence for hemp cloth in the Iron Age (Barber 1991:18-19). A recent discovery from the US Navy Support Site, Gricignano d'Aversa, Campania, southern Italy of a mineral-replaced cloth on a metal blade has been identified as hemp. The site spans the Copper Age (southern Italian sequence) 3300 - 2250 BC to Early Bronze Age 2250 - 1400 BC (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:210-211). This single piece of evidence suggests that hemp was known as a raw material for cloth before the Iron Age, although not in the area currently under study. Due to the lack of evidence, whether reflecting the actual situation or poor preservation, hemp cloth will not be considered further in this thesis.

a) b)

Chaîne opératoire of flax growing:

Obtain or own suitable land
↓
Acquire seed
↓
Decide where to grow flax
(part of crop rotation system)
↓
Prepare the ground dig, plough,
remove stones, weed, and manure
↓
Sow seed at end of winter or late spring
↓
After germination tend plants: watering, weeding,
pest control, protect from animals
↓
After approximately 3 months,
decide when to harvest
↓
Harvest crop by pulling plants by hand
↓
Tie flax plants in bundles
↓
Stack to dry

c)

Figure 4.1.3. Growing and harvesting flax: a) Field of flax in flower, England 2004 (Photograph J. Cooke-Sanderson). b) Harvesting flax, (Drawing by Susanna Harris after a photograph in Flad 1984:12,Abb 5). c) Chaîne opératoire of flax growing.

a)

b)

Chaîne opératoire of collecting grasses:

Locate suitable grasses
↓
Cut lengths
↓
Strip the leaves and other unwanted elements, such as bark
↓
Collect grasses into bundles
↓
Store in suitable way to prevent drying out before use

c)

Figure 4.1.4.Collecting grasses: a) Lakeside grasses, Lake Constance, Germany (Photograph Susanna Harris). b) Grass warp fibres and tree bast weft of the twined garment from the Iceman (ICEM-010) (Photograph from Egg 1993:81, Abb.31). c) chaîne opératoire of collecting grasses.

Grasses and other wild plants

The use of grasses and other wild plants is limited in cloth construction. Grasses are usually used as whole stems, are therefore rigid and susceptible to break under pressure (Rast-Eicher 1992b:10). Most examples come under my definition of basketry, but there are some that were used to create cloth.

Archaeological evidence

From the Neolithic to Bronze Age grasses, reeds and rushes were mainly used for basketry due to their rigid nature; they were often used in combination with more flexible fibres (Rast-Eicher 1992b:12, Körber-Grohne & Feldtkeller 1998:167). Some species of grass were more flexible and this is the case with the outer garment of the Iceman which was made using grasses for the vertical thread system and tree bast for the horizontal thread system, Figure 4.1.4.b (Goedecker-Ciolek 1993:109-110). As in this example, grasses are mainly used for the warp (passive thread system) and a more flexible thread is used for the weft (active thread system) (Rast-Eicher 1992b:10). Other raw materials are known: for example nettles in northern Europe (Barber 1991:19). Hints suggest at local diversity and the use of other resources, such as wild clematis used to make cord in Germany (Farke 1991).

Method of collecting

Suitable species of grasses and other wild plants can be collected from their natural habitat and prepared by trimming the coarse end, removing the leaves and a number of other processes, such as soaking or heating (Pedley 1992:25, van Velthem 2001:201), Figure 4.1.4.c.

Animal fibres: wool and hair

Animals' coats consist of thick hairs (*kemps*) and a downy undercoat (*wool*). Depending on their length and texture the hair and wool may produce fibres suitable for spinning into thread for cloth. Fibres suitable for spinning threads can be collected from a number of animals; however, there is poor evidence of animal fibres from the Neolithic to Bronze Age, mainly because the preservation environments of the lake dwellings are not conducive to their survival.

Archaeological evidence

Goat hair has been identified on a pair of Iron Age leggings from Vedretta di Ries, Bolzano, Italy (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:180), however this identification has been disputed by other researchers.

a)

b)

Chaîne opératoire of rooing a sheep

The flock is gathered in an enclosed area such as a pen

↓

The animals are taken out of the pen individually

↓

Immobilise the animal

↓

The wool is pulled from the sheep in handfuls.

c)

Figure 4.1.5. Rooing sheep: a) Modern woolly sheep (Photograph by Susanna Harris). b) Rooing a sheep by pulling of handfuls of the fleece (Drawing by Salvatore Notaro after a photograph in Christiansen 2004:12,fig.1). c) Chaîne opératoire of removing fleece from a sheep (note this table does not include the stages of looking after sheep).

Horse hair is another distinct possibility in the Bronze Age and although none are known from the current study area, horse hair fibres were used for a band with tassel in a hoard in Cromaghs, Armoy, Ireland, dating to the Irish Late Bronze Age c. 700 - 800 BC (Wincott Heckett 1998:30-32). There are a number of other species that were used for fibres historically (Puliti 1987:12) and could have been used for fibres from the Neolithic to Bronze Age, notably from cattle (*Bos Taurua*), mountain hare (*Lepus Timidus*) or even human hair.

I am highlighting the possibility of animal fibres besides sheep's wool as this area of research is poorly understood. However, on current knowledge, only sheep's wool has been identified in the study area, so I shall concentrate on this.

Sheep's wool

The coat of wild sheep consists mainly of hair (*kemp*) with a short wool undercoat; the dominance of wool in domestic sheep has been selected through thousands of years of selective breeding. Preserved wool cloth is very rare from the Neolithic to Bronze Age in the Alpine region, due to the lack of preservation of animal fibres in the alkaline deposits of the lake dwellings. This makes it difficult to establish the use of wool as a fibre for cloth through preserved cloth alone.

Sheep fleece

Although sheep and goats were among the first domesticates in the Early Neolithic (for example in northern Italy, Riedel & Tecchiati 2003:73), the earliest sheep probably did not have suitable fleece for fibres. Research on the evolution of the sheep's fleece was carried out by Michael Ryder and published in several reports (Ryder 1969, Ryder 1983, Ryder 1984, Ryder 1993a). By measuring the diameter of fibres from prehistoric cloth samples throughout Europe, North African and the Mediterranean, Ryder charted the characteristics of sheep fleece and the evolution of the sheep fleece through time. He proposed that the fleece evolved to become less hairy and more woolly between the earliest domestication in the Neolithic and the Roman period, with variation between the sheep in a flock, and the types of fleece that dominated in each period (Ryder 1969). Most of the European evidence for wool cloth comes from the Bronze Age Danish oak coffin burials and the Hallstatt salt mines. In the Bronze Age the most characteristic sheep fleece was similar to the modern day Soay sheep from the Outer Hebridies, with dark to light brown fleece and a mix of predominantly hairy or woolly sheep in each flock (results summarised in Wild 1988:15). This is a stage between the primitive hairy sheep and an evolved fleece that is more like a modern one (Ryder 1969:505), which is first evident in the Iron Age (Ryder 1993a:71).

Preserved wool evidence

There are a few stray wool fibres on a twined cloth from Lagozza di Besnate, Varese (BESN-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:184) dated to the recent Neolithic (Baioni 2003:183), c. 3800-2800 cal.BC (Skeates 1994:222-223). This is unusually early evidence for wool, albeit only individual fibres. The fibre of a plain weave cloth find from Castione Marchesi, Fidenza, Parma excavated in the nineteenth century was recently analysed and found to be wool and is dated to the Middle Bronze Age (CAST-001) (Bernabò Brea 2003:199, Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:200). A tiny plied thread from the inside of a tubular bead from Hauterive NE-Champréveyres, Switzerland, has been identified as wool; it is dated to the Late Bronze Age (HAUT01) (Rast-Eicher & Reinhard 1998:285). The largest collection of woven wool cloth in the Alpine region comes from the Bronze Age Hallstatt salt mines and clearly indicated the importance of wool as a fibre (Grömer 2005b, Hundt 1960, Hundt 1967).

Other sources of evidence

Despite the lack of preservation of wool, other sources of evidence indicate that it was an important fibre for spinning and weaving cloth. Through the analysis of sheep bones it is possible to detect the age and sex of sheep at death. Flocks that include a high proportion of old, possibly also castrated, adult males may indicate that the flocks could have been kept for wool, as these are the prime wool producers. These flock patterns are not a prerequisite for the availability of wool, as young and female animals also provide wool, however they do indicate the likelihood that the flock owners were interested in the wool. There is evidence for such flocks at Arbon-Bleiche on Lake Constance (3384-3370 BC) (Deschler-Erb & Marti-Grädel 2004:246, 250-251). Furthermore, changes in spindle whorls and loom weights in the Late Neolithic, also suggest that wool as a fibre was becoming more important at this time (Rast-Eicher 2005:127).

The oldest wool fibres worked into textiles identified so far is from the Majkop Culture, North Caucasus, Central Asia, dated between 3700-3200 cal.BC (Shishlina, Orfinskaya, & Golikov 2003). It is possible that wool was in use in the Alpine region from the mid fourth millennium. However, the mid third millennium is acknowledged as the period in which wool became more important in the Alpine region, based on evidence of animal bones (Schibler 2005:153). This agrees with the earlier proposal by Andrew Sherratt that wool was part of the Secondary Products Revolution in the mid third millennium, using evidence of the maintenance of mature adults in the flock and the abundance of dress pins thought to be associated with wool clothing, along with the decrease in finds of linen cloth (Sherratt 1981:282-283).

Looking after sheep and removing the fleece

Sheep can occupy many different habitats, depending on the resistance of the breed: from dry to wet, flat to mountainous, wasteland to fertile pasture (for many examples see: Ryder & Stephenson 1968). As with all domestic animals, sheep would need daily care throughout the year. They may have been kept close to a settlement, or herded further afield. Some forms of transhumance may have been practised either in relation to the exploitation of upland pastures during the summer in the mountains or across land (Spindler 2003:220). Healthy animals produce the best quality wool (Ryder & Stephenson 1968: 562). Wild sheep moult either once or twice a year (Ryder & Stephenson 1968:599) and completely shed their fleece in spring (Ryder 1969:495). In a domestic flock the fleece may be shorn once (in the spring) or twice (spring and autumn) a year. The sheep fleece grows annually, providing a fleece or two every year throughout its life span.

Another aspect of the evolution of the sheep fleeces includes the change from the wild sheep that moults seasonally, to the domestic sheep that retains its fleece and needs to be sheared (Ryder 1969:516). Ryder proposed that primitive sheep, including those of the Bronze Age were plucked (fleece pulled off) rather than sheared (fleece cut off) (Ryder 1993b:310). This process of plucking is called rooing, Figure 4.1.5.b&c. Further support that rooing may have been the method of removing fleece comes from the writings of Varro at the time of the Roman republic, (116-27 BC) (Radice 1973:245). Varro implies that shearing was more common during his lifetime, although the older practice of plucking (rooing) sheep still persisted (Varro, "On farming", quoted in Hughes & Forrest 1984:8).

The quality of the wool depends on the way the animals were cared for including nutrition, husbandry, pasture management (Ryder & Stephenson 1968:562) and varies according to the area of the fleece (Goodwin 2003:18) (fig 3.9). For the best wool rich pasture is necessary throughout the breeding season and summer to encourage wool growth; during the winter, suitable fodder may have been collected (Ryder & Stephenson 1968:8)since poor nutrition will result in poor quality wool.

Animal skins

Skins are removed from an animal carcass after it is killed. The skin of most animals, whether mammal, bird, fish or reptile can be cured to produce cloth.

Archaeological evidence

Despite the lack of preserved skins in many contexts, it seems likely that skins were actually a common and important source of cloth. Where skins are found alongside other cloth types, they are found in significant quantities compared with thread-based cloth types. This is the case with the varied and numerous animal skins used for clothing and equipment with the Iceman from Alto Adige, Italy dating c. 3300 cal.BC (Groenman-van Waateringe & Goedecker-Ciolek 1992) (discussed in Chapter 6) and a number of artefacts from Bronze Age the Hallstatt salt mines (Barth 1993, Harris 2006), (discussed in Chapter 9).

There are some occasional finds. Skins (noted as leather) were found during the early excavations of Robenhausen, Switzerland, although not illustrated or stored (Keller 1866:335), these were dated roughly between the Middle to Late Neolithic and Bronze Ages. A small piece of skin was used to form the point of a tree bast hat from Pestenacker, Upper Barvaria (PEST-001); the site is dated by dendrochronology to 3491 BC (Bartel & Schönfeld 2004, Bartel 2004).

Wild and domestic animals for skins

Of these preserved skins some are from wild animals and others from domestic ones. The soles of the Iceman's shoes and his cap are made from brown bear skin (*Ursus arctos*) (Groenman-van Waateringe 1993:126). The upper of the shoes and the tongues of the leggings, were identified as red deer (*Cervus elaphus*) (Groenman-van Waateringe 1993:126). The other items could not be precisely identified and may include chamois (*Rupicapra rupicapra*), ibex (*Capra ibex*), roe deer (*Capreolus capreolus*) or elk (*Alces alces*) (Groenman-van Waateringe 1993:123). The identification of the Iceman's cape and leggings is not secure, but may be of goat skin and the belt pouch is calf skin; however it is impossible to distinguish whether it is of domestic or wild cattle (Groenman-van Waateringe 1993:125-128). Ryder analysed a sample of skins from the Hallstatt salt mines including Bronze Age and Iron Age artefacts. From his total sample of animal skins, nearly 90% of the animal species used for skins are domesticated, including cattle, goats and sheep; others may include chamois (*Rupicapra rupicapra*) or steinbock (*Capra ibex*), dog or other small fur-bearing animals (Ryder 1993a:107). The Bronze Age miners' sacks from the Hallstatt salt mines are made of cow skin (Barth & Lobisser 2002:13).

The faunal record

As skins are rarely preserved, the exploitation of animals for skins may be better indicated from other lines of evidence. On a broad level, the range of species in the faunal record indicates the animals that societies commonly killed and butchered, so these skins would have been available. Wild and domestic species are present in the faunal remains from the Neolithic to Bronze Age. However, a marked decrease of wild species from the Neolithic to Bronze Age is a common pattern (for example Riedel & Tecchiati 2001:107). By definition, domestic animals include cattle, sheep, goats and pigs (Riedel 1996:72-73). They first appear in the archaeological record in the Early Neolithic and it is difficult to imagine that they were not exploited for their skins. Other domesticates including horse and dog cannot be excluded as skin-providing animals, although the idea may seem strange in the present day. Although wild species represent a low proportion of the faunal remains in the later periods, some of those present may have been used as sources of skins. For example, in the Early Bronze Age settlement of Molina di Ledro, Trentino, there are bones from red deer and brown bear (Riedel 1996:72); both of which provide good skins and furs.

Chronology

Due to the scarcity of skin remains, it is impossible to trace accurately the species of animal exploited for their skins; this may have varied regionally and over time, according to cultural traditions. However, there must have been a horizon of change when domestic animals were introduced in the Neolithic, providing a new source of skins. These could have been processed in the same way as skins from wild animals, but the chaîne opératoire of acquiring the skins is different.

Obtaining animal skins

To obtain fresh skins to work into cloth, the animal, whether obtained from a domestic or a wild animal needs to be killed and skinned. Wild animals would have been hunted or herded using appropriate strategies. The practice of hunting and the weapons used for hunting change over time. Spears, bows and arrows, harpoons and throwing tools are known in the Neolithic (Ramseyer 2000:141). The bow and arrow is known throughout the Neolithic and Bronze Age although the weapons change: chipped stone arrow heads of the Neolithic are replaced by socketed bronze arrow heads in the Middle Bronze Age (Harding 2000:284-285). Bows and arrows appear both in iconography, for example on the Copper Age stelae of Sion, Petit Chasseur, Swiss Valais (Figure 7.4.f & 7.5.c) and Aosta, Valle d'Aosta c. 2750-2400 BC (Zidda 1998:170), and in Copper Age burials, for example, Spilumberto, Modena (Bagolini & von Eles:69-134). The wide mesh net carried by the Iceman may have been used to catch birds (ICEM-003) (Spindler 1995:118): larger animals may also have been hunted with nets. Usually associated with fighting (Harding 2000:281), spears, and for that matter dogs, may have been used to hunt. A rock art depiction of a deer being killed with a spear, accompanied by dogs belonging to the Late Bronze Age / Early Iron Age (Anati 1994:59-65) from the Valcamonica, Italy, suggests that this was possible.

Wild animals, such as deer, may have been killed as they were a nuisance to agricultural crops or domestic herds (Riedel & Tecchiati 2001:107) and predators such as wolves, foxes and bears may have been killed for protection; in either case this would make their skins available. In a domestic herd, it is common practice that skins come from animals also butchered for their meat (Douglas 1956:4). However, some animals may have been killed primarily for their skins. The skin may be chosen for the qualities of the animal's fur, its size and the thickness of the skin.

For optimum quality furs, the time of year is especially important if the fur is required since there are many factors that affect the texture, density and condition (Kellogg 1984:22). Each animal will have its own seasonal cycle. Generally summer skins are the poorest quality as they have the least fur and it is of the poorest quality. All animals moult and shed, usually in the spring and autumn. However, a rough distinction can be made between land fur bearing animals, which have prime fur in winter, and aquatic fur bearing animals such as the beaver, which have prime fur in late spring early summer. If an animal skin is tanned when it is moulting, it will continue to moult after tanning (Kellog 1984:22).

Drought, inadequate grazing and lack of nutrition affect skin quality (Douglas 1956:72-73). Infectious diseases, pests and parasites, cause holes and skin damage (Douglas 1956:12, 72). The way the animal is killed and butchered also affect the skin: rips, tears and puncture wounds will need to be patched, repaired)Douglas 1956:74, Kellog 1984:30). The age of the animal affects the thickness of the skin: young animals have thinner skins than mature animals (Kellog 1984:22). The range in breeds and size of animals will affect the size and grade of the skin (Douglas 1956:4). Domestic animals may have defects including yoke marks, damaged skin from rough handling or fighting, branding or disease (Douglas 1956:12). Fighting, fur chewing and urine stains damage the fur and cannot be reversed in the treatment process (Kellog 1984:24).

Skinning

The skin is most easily removed from the carcass when it is still warm. The animal might be hung from a tree or beam or laid on the ground. The skin is separated from the skin from using a very sharp tool to cut and a gentle pulling action (Kellogg 1984:33). There are a number of ways to cut the skin to remove it from the animal, for example Figure 4.1.6.a-f. Removing the skin can leave characteristic marks on the bones. These include cut marks across the paws (front and back), snout or on the lower limbs (Charles 1997:256, 258-259, Simoncini 1933:109-112). These marks vary according to different practices of skinning and sometimes no marks are left (Charles 1997:259).

Analysis of bone deposition may provide further evidence for the exploitation of animal skins. In post medieval periods skins were dispatched to the tanner with hooves and horns still attached, these were then detached and thrown away (Thomson 1998:4, Leguilloux 2004:42). This presents the possibility that large quantities of these animal parts can be used as part of the evidence to identify skin processing activities in archaeological sites (Leguilloux 2004:42). Similarly, the absence of paws in faunal remains could suggest that the animals were skinned at the site and the skin with paws attached transported for further treatment (Charles 1997:258, Klein 1973:56). If an animal is only exploited for its skin, this may additionally result in the remaining skeleton left in an articulated state (Charles 1997:258-260, Klein 1973:56). This type of analysis has mainly been applied to bone deposits in the Palaeolithic, but it could prove useful from the Neolithic to Bronze Age to provide evidence for the processing of skins at particular sites.

Hunting and gender

As I discussed in the introduction (Chapter 1), representations of men and men's burial good include weapons such as bow and arrow in the Neolithic and Copper Age (Barfield 1986), although not exclusively (Whitehouse 2001). This is also the case in the Late Bronze Age in Europe, as men are associated with weapons (axes, spears and swords) in burials and representations (Anati 1976:113, Harding 2000:271, Treherne 1995). While this associates men with weapons, these are probably symbolic a)

b)

c) d) e)

Chaîne opératoire of acquiring animal skins

Locate animal by tracking / hiding / chasing | Separate domestic animal from other animals

↓

Kill animal

↓

Hang up carcass or move it to a flat working area

↓

Skin by cutting off and pulling skin, preferably when the carcass is still warm

↓

Cool, salt or dry the skin to prevent decay and store | Start to treat immediately

f)

Figure 4.1.6. Animal skins: Diagrams showing cut marks to remove the skin from a cow carcass: a) cows head with cut marks, b) skin shape when removed from the animal in this method, c) cut mark around the hoof d) cut mark on the hoof at the back e) cut marks on skin around head, abdomen and legs (Drawing by Salvatore Notaro after diagrams in Simoncini 1933:110-113, figs 57, 62, 64, 66). f) Chaîne opératoire of acquiring animal skins.

contexts and still leaves in question whether men actually hunted. However, it does seem likely that this was ideologically, at least, a male gendered task.

Another line of argument to support this is from a series of papers by Murdock and collaborators during the 60's and 70's (particularly Murdock 1967, Murdock & Provost 1973). They made a statistical analysis of the sex division of labour of subsistence activities in a number of different cultures, based on cross-cultural sources. Their results shows a very strong tendency for men to hunt large land fauna (Murdock & Provost 1973:tab.1.). There are a number of criticisms of this analysis (Costin 1996:121-123,Owen 2005: 13-17), not least that in every category there are exceptions. However, it does offer support to the archaeological evidence, that hunting was probably carried out predominantly by men, although women need not have been excluded from these tasks. Owen, in particular points out the shortfalls of such an approach in understanding the gendered labour division of task associated with skin processing. Using ethnographic examples from North America, she shows that while women may not have hunted, they were responsible for skinning and skin processing (Owen 2005:86).

Chronology of raw materials

In Table 4.1.1., I present the evidence for the raw materials used to make cloth that I have discussed above in a schematic diagram according to chronology. The purpose of this diagram is to show the range of cloth types that existed at any one time.

Wild plants, such as grasses, were probably used from much earlier periods, but leave scant archaeological evidence. I have represented them as a continuous source of fibres for cloth, as occasional examples are found when there is suitable preservation.

The tree species used for tree bast from the Neolithic to Bronze Age are indigenous to the Alpine region and were probably used was probably used for cloth before the Neolithic. Like grasses, they leave scant archaeological evidence. However, where they are preserved in the Neolithic lake dwellings, they are the most commonly preserved cloth type. They do not seem so important in the Bronze Age, but there are occasional examples of tree bast thread or rope, so I have shown these types of cloth probably existing at this time.

Wild animals were exploited for their skins before the Neolithic, so I have shown these available from the earliest Neolithic. Evidence from the Iceman and the Hallstatt salt mines (see Chapters 6 & 9 for more details) show that wild animal skins continued to be exploited in later periods. Therefore, I suggest this was a source of raw materials for cloth from the Neolithic to Bronze Age.

Following a long tradition of the exploitation of wild animal skins, domestic animal skins would have provided a new, convenient source of raw materials for cloth. I suggest that the skins of domestic animals were probably used from the earliest availability of these animals. Their use is testified in evidence from later periods. I separate out wild from domestic animal skins, as although the skins could be processed in much the same way, the method of obtaining these skins in terms of the extended chaîne opératoire is substantially different.

By definition, cultivated flax and domestic animals cannot predate the origin of agriculture, therefore providing a *terminus post quem* for linen cloth and cloth of domestic animal skins. The earliest primary evidence of cloth of linen and tree bast dates to c. 4000 BC and is probably more a consequence of preservation conditions than the earliest examples that existed.

Based on evidence that wool is a quality selected by human breeding controls, rather than occurring in the wild, the horizon for wool as a raw material for cloth is believed to post-date the introduction of sheep as domesticates. The decline in evidence for linen cloth is associated with the increasing use of wool as a raw material, following the evidence of increased sheep in the faunal remains and decreased finds of linen in the Alpine lake dwellings (Rast-Eicher & Reinhard 1998:285, Winiger 1995 150-151, Sherratt 1981:282-283). Although lacking preserved cloth examples, wool was probably in common use as a raw material for cloth in the mid third millennium and contined to be used in subsequent periods. However, stray wool fibres from the earlier period suggest that wool may have been available earlier.

This chronology is only visible over a huge expanse of time: regional and chronological variation is expected. Examples of cloth with one thread system of wool and one of fibres of plant origin are known and suggest complexity in this model. Similarly with the species of animal used for skins, it is likely that there was variation in the relative quantity and preference for particular species.

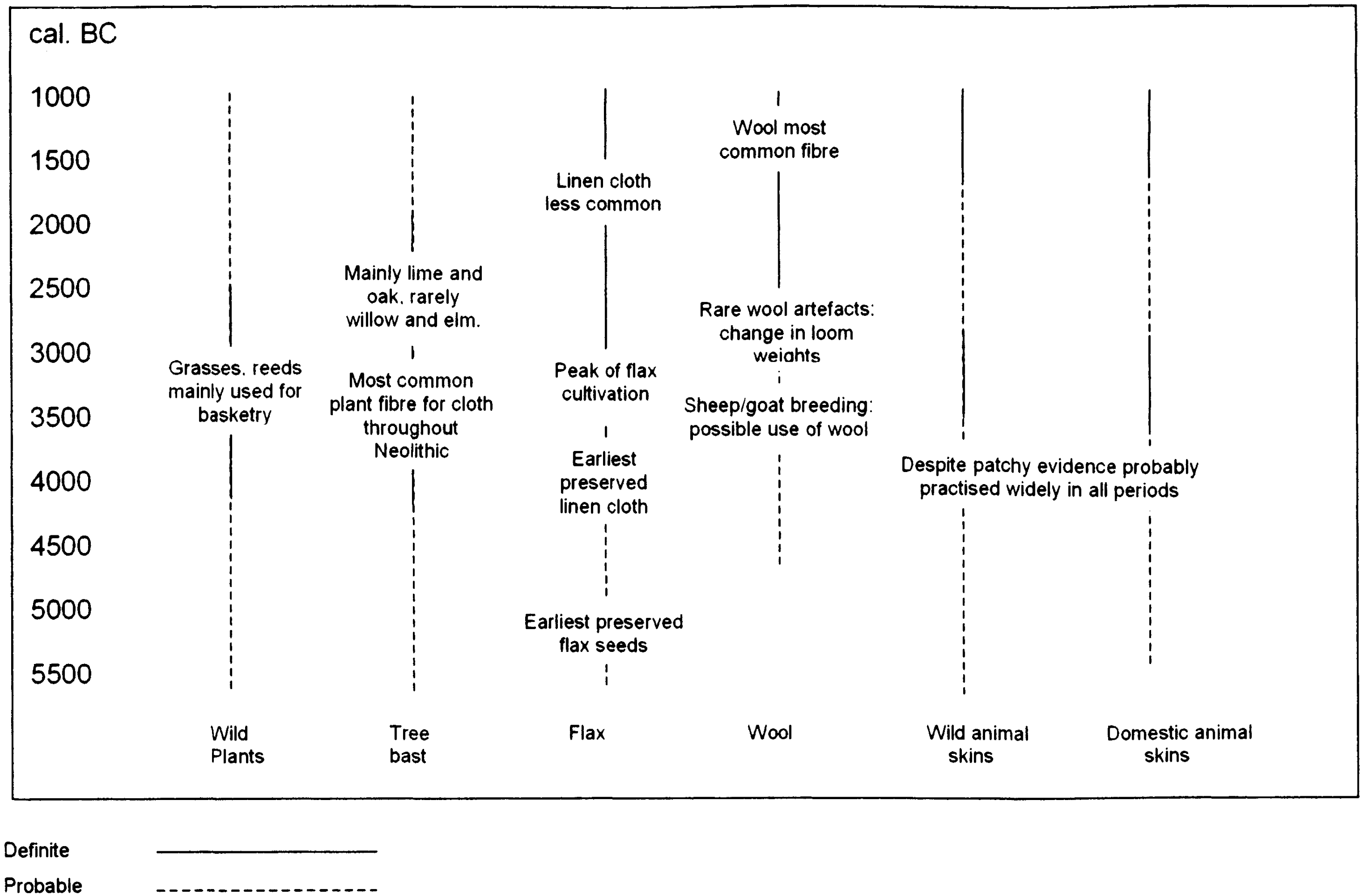


Table 4.1.1. Schematic diagram to show the chronology and coexistence of raw materials used for cloth in the Alpine region between 5500-1000 BC

4.2 The processing of raw materials

In this stage of the extended chaîne opératoire, the raw materials are processed in preparation for cloth construction. For plant fibres, this is the processing from whole plant material into fibres; for animal fibres this includes washing and sorting. The fibre elements, if they are long enough, may then be worked into cloth, otherwise they are spliced or spun into thread (see section 4.3). For skins, the inner fatty layer needs to be removed; the fur may be left on or removed.

Tree bast: from bark to fibres

Tree bast needs to be separated from the tree bark and then into fibres. The method varies according to species.

Methods of processing lime bast

Lime bast is the best understood tree bast fibre as there are historical accounts of the fibre preparation. According to research by Myking et al 2005, there were three main ways of processing lime bast which are seasonally linked to the procurement of raw materials (Myking, Hertzberg, & Skrøppa 2005), Figure 4.2.1 a-d.

The bast could be removed from the tree early in spring and separated immediately from the bark (Myking, Hertzberg, & Skrøppa 2005:68). In the most common process however, suitable branches and trees were felled in early summer and subjected to a water retting process in river or sea water for four to six weeks (See below in Methods of extracting flax fibres). During this time, the soft tissues of the cells decay, causing the layers of bast to separate into thin sheets of fibre (Myking, Hertzberg, & Skrøppa 2005:68, Médard 2005:100-101). The third method was to fell the branches and trees in winter and to place them in an enclosed oven with no chimney for a day, where the action of the warm smoke separated the bast from bark (Myking, Hertzberg, & Skrøppa 2005:68). The bast is then rubbed in the hands to separate the fibres (Körber-Grohne & Feldtkeller 1998:156-157).

Methods of processing oak and elm bast

The bast layers of elm can be removed and separated when they are damp without the need to ret (Médard 2005:100). I found my own experiments with tree bast confirmed this process: I successfully stripped elm fibres straight from the bark when seasoned branches were naturally damp from the dew (elm fibres see Figure 4.7.1.). In addition, I found that water retted elm bast became solid and unmanageable. Médard records that after retting, oak bast fibres were short and brittle, therefore poorly adapted to use in textiles (Médard 2005:101-102). In addition, she observes that under the microscope, oak bast fibres from her processing experiments were readily confused with elm bast; this brings into question the identification of oak bast fibres in prehistory (Médard 2005:101-102).

Seasonal choices

Choices between these methods may be apparent in relation to the product and fitting the process around other tasks. There was a preference for water retting in agricultural communities of northern Europe as this fitted with periods of less intensive agricultural work (Myking, Hertzberg, & Skrøppa 2005:69). Médard suggests that speed was of the essence to prevent fibre degradation in temperate climates, so summer was the best time to prepare the fibres which can dry in the sun and are then ready to work over the autumn, which is convenient as there is less outdoor activity (Médard 2000:73).

Properties of tree bast fibres

Each species has different properties. Lime bast processed by retting is more flexible but weaker than lime bast used fresh or heat treated (Myking, Hertzberg, & Skrøppa 2005:69). However, the longest lime fibres are obtained from retted bast (Médard 2000:73). Lime bast fibres are of finer quality near to the wood and coarser nearer to the bark (Körber-Grohne & Feldtkeller 1998:157). Elm bast fibres are long, soft and elastic, oak bast is coarser (Médard 2005:100-102) (Table 4.4.2).

Archaeological evidence

At Homstaad Hörnle IA, Lake Constance, Körber-Grohne and Feldtkeller observed that the annual layers of the tree bast remain together; this suggests that it was not water retted, but subject to heat treatment (Körber-Grohne & Feldtkeller 1998:154-162). Pfeifer and Oeggl's analysis of the tree bast threads of the Iceman show that some retained their annual layers, which they conclude shows they were used fresh, while in some of the fine threads the fibres were completely separated out, suggesting they were water retted (Pfeifer & Oeggl 2000:71). Several methods of processing may have existed simultaneously..

Bundles of rib bones or blackthorns that may have served to separate out fibres are known from a number of Neolithic sites (Figure 4.2.2.b&c). These are associated with flax heckling (Rast 1990a:119,Abb.2, Vogt 1937:47,Abb.72) or carding wool (Winiger 1981:148); they could have been used to separate tree bast fibres.

a)

b)

c)

Chaîne opératoire of tree bark to fibres:

Soak the strips of inner bark in water (*retting*)
↓
Leave for a period of time
↓
Check regularly to judge when retting is complete
↓
Remove from water
↓
Separate out individual layers
↓

Remove fresh bark
↓
Peel off fibres
↓
↓
Divide into suitable strips or individual fibres

Place felled branches or tree in an enclosed oven
↓
Separate bark from bast
↓
Rub to separate fibres

d)

Figure 4.2.1. Tree bast fibres: a) Lime bast fibres water retting (Photograph Susanna Harris). b) Separating individual layers of lime bast fibres after water retting (Photograph Susanna Harris). c) Retted lime bast layers split into narrow strips (Photograph Susanna Harris). d) Chaîne opératoire of tree bark to fibres.

Flax stems to fibres

The flax fibres need to be removed from the woody part of the stem. There are historical records of flax fibre processing from farming communities across Europe (for example: Durie 1979, Flad 1984, Kezich, Eulisse, & Mott 2002).

Methods of extracting flax fibres

Like tree bast, the fibres can be striped directly from the stem, but for fibres finer than 1mm, further processing is required (Körber-Grohne & Feldtkeller 1998:153). For this processing, first the seed capsules need to be removed from the dried stems (*rippling*) either by beating or combing (Durie 1979:2, Flad 1984:15-16). The seeds may be retained as they are rich in oil and edible by humans and animals (Kezich, Eulisse, & Mott 2002:68). After rippling the stems need retting. Retting is the partial rotting of the stems to separate the fibres from the woody stem, and to break down the unwanted parts of the cells. This could be carried out in two ways: either the stems of flax are submerged in river, pond or sea water (water retting) or they are laid on grassy fields and regularly turned, the action of the dew decaying the non-fibrous parts of the stem (dew retting) (Flad 1984:16, Hodges 1995:127). Dew retting takes three to five weeks (Flad 1984:16) and water retting takes approximately a week or more (Durie 1979:2-3). Historically, these processes were carried out in late summer or early autumn after the flax harvest (Durie 1979:2-3, Kezich, Eulisse, & Mott 2002:68).

Once the stems are retted, they are dried then beaten (*bracking*) to break the stems and bark which partially fall away; they are then scraped (*scutching*) to further remove the unwanted stem parts. Historically this involves a wooden sword-shaped tool (Flad 1984:19). These fibres are then combed (*heckled*) to separate the fibre bundles into finer fibres (Durie 1979:2-3, Flad 1984:16-22, Kezich, Eulisse, & Mott 2002:68). This process extracts the long fibres from the shorter waste (Kezich, Eulisse, & Mott 2002:69). At this point they are ready for spinning.

Archaeological evidence

A baulk of wood and a wooden mallet is enough to beat the flax stems (Durie 1979:3); there are examples in Neolithic lake dwellings, for example, those shown by Winiger as multipurpose tools, possibly also suitable for softening animal skins (Winiger 1995:136,Abb. 16-12-14). Wooden blades that could have been used for scraping (*scuthing*) are also known at sites with good organic preservation. An oak example was identified by Vogt from the early excavation at Robenhausen, Canton of Zurich (Figure 4.2.2.a): He considered this too thick to be a weaving sword, as he had interpreted it earlier (Vogt 1937:46-47, fig. 72,1). Its interpretation remains contested and has recently been published again as a weaving sword (Kapeller 2003:229). The tools identified as heckling tools from waterlogged Neolithic sites are bundles of pointed rib bones, black thorns or heckling boards with thorns attached (as mentioned above) (Rast 1990a;119, Vogt 1937:47,Abb.72).

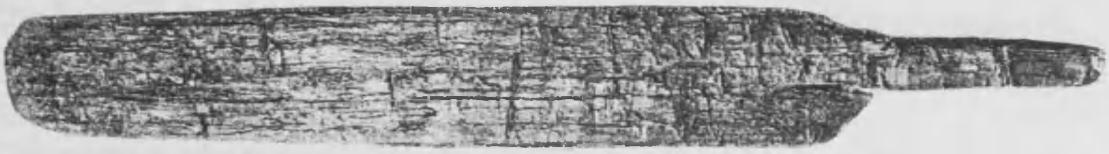
It is possible to detect some of these processes through microscopic examination of preserved fibres. Retted fibres consist only of fibres and fibre bundles, whereas non-retted flax fibres retain the epidermis (Körber-Grohne & Feldtkeller 1998:153). Retted, scutched and heckled fibres are observed at the Neolithic sites of Hornstaad and Wangen, Lake Constance; some were more effectively heckled than others (Körber-Grohne & Feldtkeller 1998:153) (see Chapter 5). There is evidence for flax fibres used directly from the stem, without retting. For example, the fibre bundles are still intact on a spun, spliced yarn that was excavated from the Late Neolithic site of Muntelier (Rast-Eicher 2005:119-121). This type of knowledge is only gained through microscopic examination of fibres, which is not always carried out.

Grasses to fibres

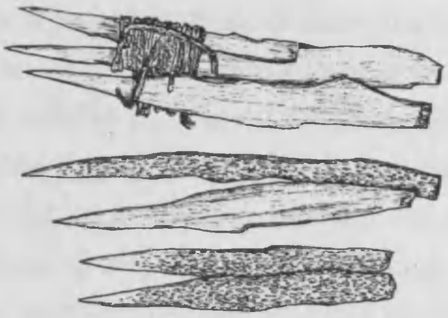
Grasses may be used whole or split into fibres.

The processing of grasses remains poorly understood (Médard 2000:69). Some processing must have occurred for the two ply grass fibres, diameter 0.8mm, 2Sz, found out of context at Delley-Portalban II, Switzerland (Médard 2000:250,planche 53/564) (DELL-005). By contrast grasses could be used practically intact, as for example the cape of the Iceman, c. 3300 BC (ICEM-010).

Like other plant fibres, grasses were probably harvested seasonally and selected according to age, size and texture. In an account of collecting canes in Australia, it was important that grasses were worked fresh before they became dry and brittle (Pedley 1992:25-26).



a)



b)

c)

Chaîne opératoire of processing flax stems for fibres

Seed bolls removed from the stems (*rippling*)

↓

Submerge dried stems in water, such as stream, sea, river and weigh or tie down (*water retting*)	Lay the stems on a grassy field (*dew retting*) ↓ Turn the stems occasionally

↓

Leave and check regularly to judge when retting is complete

↓

Dry the stems

↓

Beat the stems with a blunt object to break up the woody stem so that it falls away (*bracking*), this is best done on a sunny day

↓

Further remove the woody stems by scraping (*scutching*).

↓

Retain fibres

↓

Collect or discard the fibres that shed

↓

Further combing to obtain finer fibres

↓

Fibres ready for spinning / storing

d)

Fig.4.2.2. Preparing flax: a) Wooden tool, c. 68.5cm long from Robenhausen, possibly use in fibre processing to break and scrape plant fibres (Vogt 1937:47,Abb.72.1). b) Rib bones from Feldmeilen-Vorderfeld (Horgen layers), maximum length 15cm, interpreted as plant fibre combs / heckles (Winiger 1981:149:Taf.53). c) Bundle of blackthorns from Egolzwil, E3, c.6.5cm maximum length, interpreted as plant fibre combs / heckles (Rast 1990a:119,fig.2.2) or combs for wool fibres (Winiger 1981:148). d) Chaîne opératoire of flax processing.

From wool fleece to fibres

The fleece needs to be cleaned and the fibres separated out ready for spinning.

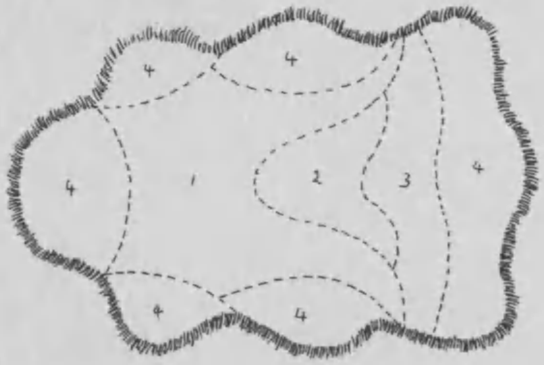
Methods of preparing animal fibres

The quality of a fleece varies according to the area of the body it comes from, Figure 4.2.3.a (Goodwin 2003:18); the wool may be worked together or sorted into grades. There are many methods of dealing with the natural grease and dirt of the fleece. It may be left greasy or can be washed by soaking in cold water then beaten (Picton & Mack 1999:24-25, Weir 1970:8), Figure 4.2.3.c. There are similar dry methods including beating with sticks or a bow instrument to separate the fibres (Hodges 1995:124, Picton & Mack 1999:30). To remove the knots, clean impurities and align the fibres so they are ready for spinning, the fibres may be pulled out (*teased*) by hand (Weir 1970:8) or combed (Picton & Mack 1999:25).

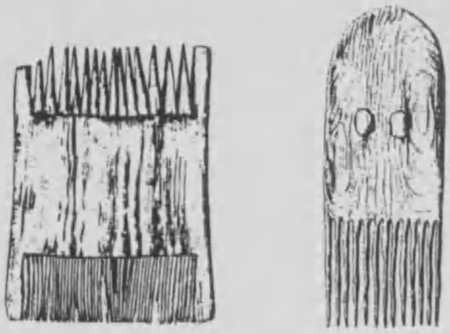
The order of these processes varies widely, as do the tools required; the whole process may be carried out without tools (washing and teasing out the fibres by hand), or may require a range of specialised tools (beaters, bows, combs). Evidence for these different processes is rather unclear.

Archaeological evidence

Combs possibly used for wool combing are known from a number of Neolithic and Bronze Age lake dwellings (Casini 1994a:111-112), Figure 4.2.3.b. There are representations of comb-shaped motifs on female figurines from central Europe dating to the Bronze Age and on the Copper Age stelae of the Valcamonica (Ossimo 4) and Valtellina (Caven3), Brescia (Casini 1994a:109-111). If these are accepted as combs the question still remains if they were used for wool or human hair. Casini argues on the basis of dating, that there could be a relationship between early wool use and combs (Casini 1994a:111-112). If this were the case, then there is an argument that wool combing is associated with women.



a)



b)

c)

Chaîne opératoire of sorting and cleaning wool:

Wool is picked over by hand to sort,
remove dirt and foreign bodies

↓

Wash in water, and beat to remove grease and dirt ↓

Specialist tools used to clean wool ↓

Remove knots from fibres

↓

Comb, card or otherwise align fibres

↓

Ready for spinning

d)

Figure 4.2.3. Preparing wool: a) Diagram of wool grades; 1=best, 4=poorest quality) on a modern fleece, tail end to the right (Drawing by Susanna Harris after Goodwin 2003:18). b) Wooden combs, possibly for wool processing from Concise (left) and Cortaillod (right), Switzerland (Drawing from Casini 1994a:111.fig.63, 2&4). c) Washing and beating wool (Drawing by Salvatore Notaro from a photograph in Picton & Mack 1999: 25). d) Chaîne opératoire of sorting and cleaning wool.

Christiansen proposes that the methods of removing fleeces and processing the wool would influence the way fibres became incorporated in the spun thread (Christiansen 2004:12-14). She suggest that rather than representing the evolution of the fleece (as suggested by Ryder see 4.1:sheep's wool), the fibres represent the process of selecting high quality fibres during the processing before spinning (Christiansen 2004:16). This may suggest that the processing of wool fibres became more refined during the Bronze Age, although the conflict between Christiansen's and Ryder's hypotheses show how difficult it is to interpret these details from the evidence available.

Animal skins: scraping and cleaning

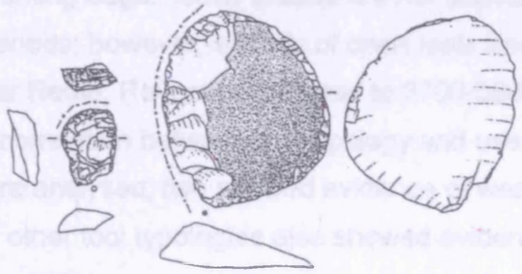
After skinning, the skins need to be trimmed and washed and the fatty layer is usually removed from the inner skin (*fleshing*) as this layer will putrefy and cause decay (Thomas 1983:1).

Washing, fleshing and removing the fur

The skin needs to be washed in water to remove the blood, dung and debris (Thomson 1998:4-5). If not to be cured immediately, the skin may be preserved by air-drying, cooling, salting or freezing to prevent decay (Kellogg 1984:26,36-38, Thomson 1998:4). In terms of preservation, both air-drying and freezing in the winter are genuine possibilities in the Alpine region that would leave no archaeological trace.

The fleshing process is applied to all skins, whether ultimately for rawhide, fur, leather, tanned or otherwise cured; the skin and the hair may also be removed at this stage (Hodges 1995:148, Kellogg 1984:49-51, 68-74, Richards 2004, Thomas 1983:3-4, Thomson 1998). References to current day, ethnographic and historical accounts show a number of ways of carrying out these stages. The fatty inner layer is removed by gently pulling and scraping. Skins may be soaked before they are fleshed (Oakes & Riewe 1996:35), worked fresh or after it has dried (Kellogg 1984:49). When fresh, small animal skins can be fleshed by peeling the layer off with the fingers (Kellogg 1984:50-51). The tools used for fleshing vary. Some state the need for sharp tools (Thomson 1998:3) or blunt scraping tools (Kellogg 1984:51, Oakes & Riewe 1996:35). There are numerous variations of removing the hair, such as shaving (Oakes & Riewe 1996:36-37), leaving the skins to start to decay slightly and soaking the skins in solutions of water, wood ash, dung or other (Kellogg 1984:69, Thomas 1983:3).

a)



b)

Chaîne opératoire of scraping and removing the hair from skins:

Wash the skin to remove blood and dung

↓

Dry, salt or freeze ↓ | Treat immediately ↓

Remove the under layer

↓

Remove the fur ↓

↓

Wash and dry

c)

Figure 4.2.4. Processing skins: a) Pulling and scraping the fatty inner layer from a deer skin during the authors experiment to fat and smoke than a deer skin, insert to show the undersides of skin (right) and the fatty layer (left) (Photograph Susanna Harris). b) Stone scrapers with use-wear marks associated with working skins (from Pawlik 1998:Taf.17). c) Chaîne opératoire of processing skins.

Skins can be dried out and used at this stage (raw hide), but they will lack the flexibility that is achieved through curing (Kellogg 1984:73).

Tools as evidence for the exploitation of skins

The most readily available evidence of this process comes from scraping tools. These tools are categorised as being sharp-edge tools with a long cutting edge, preferably without pointed corners or tips. Stone tool typologies classify flat tools with wide, curved, sharp-edges as scrapers. These are typically associated with a number of scraping tasks, such as skin or wood working; they are common throughout prehistoric periods and may have been hafted with wooden handles (Butler 2005:49-51).

Secure association of these tools with skin working, can be obtained from use wear analysis of the working edge. Such studies are not especially common in the Neolithic to Bronze Age periods; however, a study of chert tools from the Neolithic settlement of Schorrenried near Reute, Ravensburg, dated to 3700-3800 BC (Pawlik 1998) investigated the correlation between the typology and use. In this case, of the four scrapers that were analysed, two showed evidence of wear associated with working skins; in addition other tool typologies also showed evidence of use on skins (Pawlik 1998:190-192,tab. 205).

Scrape marks

The method of scraping is born out by the presence of scrape-marks resulting from this process on the flesh-side of the fur garments of the Iceman c. 3300 BC (Egg 1993:72-73, following observations by Groenman-van Waateringe & Goedecker-Ciolek 1992). Other methods or fleshing or removing the hair may have been practised, but this is difficult to trace.

4.3 Threads for cloth

Threads are long continuous strands of material, sometimes called yarns. Thicker threads may be called cord, string, rope or straps. Thread production is necessary for producing many cloth types as well as for tying, binding and sewing.

Threads cut from cloth

The first threads I want look at are the least common, and arguably may not have been used to make cloth; these are narrow strips cut from animal skins. This method is apparent in the Bronze Age Hallstatt Salt mines, where skins are cut into a range of different sized strips which are used for sewing and for a variety of tying purposes in the mines (Barth 1992). Barth notes, to maximise their length, the long strips were cut from skins in spiral shapes or fastened together at each end through corresponding splits (Barth 1992:123-125, Abb.2&3). They are used as thread to sew the cow-skin carry sacks (APPO-001, GRUN-002), wooden artefacts (CHRI-007) and the palms of the hand leathers (CHRI-008, CHRI-009). Such strips were also used to sew up the Iceman's pouch (ICEM-016) and quiver (ICEM-011), dating c.3300 cal.BC, Figures 6.3.a&b. This method of producing thread *from* cloth is the opposite to threads which are used to *make* cloth.

Un-spun fibre strips

Another group of threads are plant fibres that are long enough to be used to make cloth without spinning. In the Neolithic, un-spun tree bast fibre strips of various dimensions were used in cloth production. For example from Lattrigen Hauptstation-aussen, Berna Canton, Switzerland dated c.3200 BC there is a container constructed in plain weave using lime bast strips in both warp and weft measuring 6-10mm wide (LATT-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:240), Figure 4.3.2.a. This type of construction is border-line between cloth and basketry. At the same site there is a piece of twining with un-spun tree bast strips measuring 6mm wide in the warp, twined with spun thread measuring 3mm diameter in the weft (LATT-002) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:239), Figure 4.3.2.b. The cloth construction with wide strips in both directions may be fairly rigid, depending how many layers of fibres there are in the tree bast. Some are interpreted as mats, for example the plain weave bast strip constructs from Feldmeilen Vorderfeld (FELD-001) (Ruoff 1981:264,fig.20, Winiger 1981:161, Taf.62).

Constructions made from fine strips are more flexible. There is a small fragment of plain weave cloth using tree bast strips from Hornstaad Hornle IA.; it is catalogued as lightly z-spun with a thread diameter of 0.8-2mm. (Körber-Grohne & Feldtkeller 1998:175, cat.64, Taf.12.c.d.). On viewing in the archives at Hemmenhofen, Lake Constance in 2005, I found these could well be strips that had naturally twisted on drying. From my own experiments with tree bast in 2004 and 2005, I found that lime bast fibres were inclined to twist in a z direction as they dried. This is an interesting piece of cloth as it combines fine un-spun strips with a plain weave cloth construction and it seems similar to the raphia constructions of Zaire, Central Africa. Here un-spun raphia threads are woven on a single heddle loom, but rather than the warp and weft forming continuous elements, the warp and weft are distinct lengths of raphia that hang out as a fringe at the sides and bottom (Picton & Mack 1999:83-84). There are other fine tree bast strips include notably the two rings of tree bast thread from Molina di Ledro made of un-spun fibres c.1mm in diameter (MOLI-011 and MOLI-012), Figure 8.2.b, dating to the Early to Middle Bronze Age (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:148).

Plaited threads

These strips may be plaited into threads. The starting border for the twined cloth from Lattrigen Hauptstation (LATT-002) is made with a plaited thread, Figure 4.3.2.b. There are several examples of cloth made from plaited threads, for example, Figure 5.6.a.

Strips of fibres can be separated out by hand from the raw material. In Zaire raphia threads are split with a special comb-type tool (Picton & Mack 1999:35). In my own experiments with tree bast, I found that a narrow toothed comb was ideal for splitting tree bast fibres and obtained fibres over 1m long, which was as long as the original bark strips. I found this is a very quick method of thread production; processed tree bast fibres can be combed into separate strips in a matter of seconds.

Splicing

Splicing is a method of creating thread from long plant fibres. Long fibres are twisted together end-to-end into long strands. Two of these are then plied together; plying creates strength, as the spliced ends are made to fall in different places (Barber 1991:45-48). Recent research has shown that there are examples of un-retted, spliced linen thread on a spindle from the Late Neolithic site of Muntelier (Rast-Eicher 2005:119). The evidence for splicing depends on a detailed examination of the individual fibres and spinning technique and has rarely been detected in the Neolithic to Bronze Age.

Spun thread

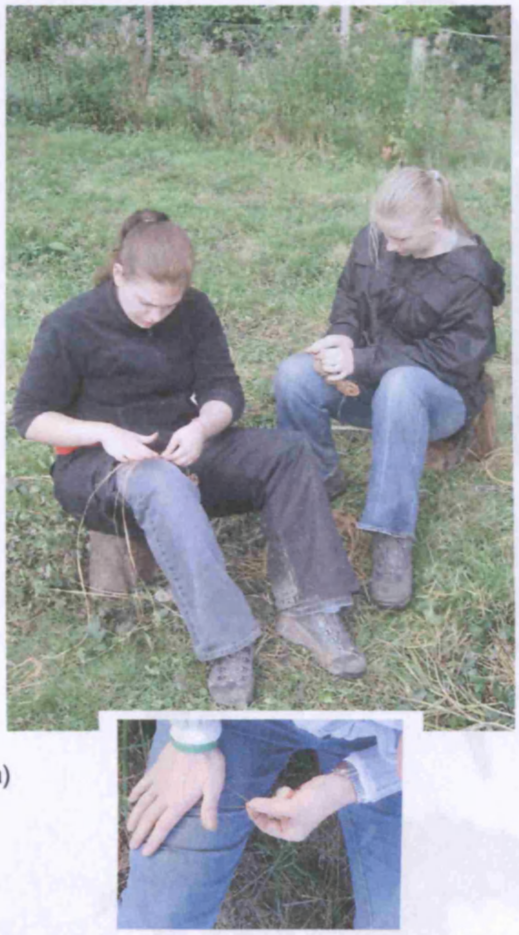
Spinning involves drawing out fibres and twisting them together into long, continuous threads (Barber 1991:52). Spun threads are the most common means of producing thread from fibres in the Neolithic to Bronze Age and there are two methods; one is the hand-spinning method, the other employs a spindle.

Hand spinning

Hand spinning involves rolling the prepared fibres on a surface, such as the thigh, to create a spun thread. As the thread is spun, new fibres are added in, to create a continuous thread. Two fibres can be spun and twisted together in one action to create a plied thread which is wound into a ball, Figure 4.3.1.a. Alternatively, two single fibres can be spun separately then plied together (MacKenzie 1991:75-81,fig.5). Requiring no equipment, this method is widespread in ethnographic and historical examples and often exists contemporaneously with other methods of spinning (Médard 2003:83).

Hand spinning is most suited to long fibres and was frequently used for spinning tree bast in the Neolithic (Médard 2003:83-85). As there is no equipment, this spinning method is assumed on the basis of the finished thread characteristics. From the evidence of the Neolithic lake dwellings, Médard distinguishes between the fine, z-spun threads (under 1mm diameter), that are usually of flax and the thicker s-spun threads (from 1-3mm diameter and above), usually of tree bast. Based on experiments, Médard found that the hand spinning method is most suitable for producing threads over 1mm in diameter (Médard 2003:85). On this basis, she proposes that the tree bast thread was probably hand spun and finer fibres (flax and wool) were spun with a spindle (Médard 2003:85). This means that hand spinning is mainly associated with tree bast threads. However, this is not exclusive there are examples of tree bast thread worked on spindles (see below).

From my experiments I found that an individual can be taught to hand spin an acceptable quality of thread in about 20 minutes. If spinning on the thigh, the spinner probably needs to sit down. It is a relaxing, sociable activity and can be practised anywhere. Records of hand spinning tree bast in Papua New Guinea documented that depending on the type of material approximately 10-20m can be produced in an hour, Table 4.3.1. (MacKenzie 1991;76).



a) b)

Figure 4.3.1. Hand spinning and drop spinning: a) Experiment with hand spinning lime bast thread, detail of the method of spinning (Photograph by Susanna Harris). b) Drop spinning (Drawing by Salvatore Notaro after photograph in Picton & Mack 1999:31).

Spinning method	***Fibre***	***Time***	***Length***	***Source***
Hand spinning	Tree bast fibres from *Ficus*	50-60mins	10m	20th Century Papua New Guinea, MacKenzie 1991:76
Hand spinning	Wool	40-60mins	20m	20th Century Papua New Guinea, MacKenzie 1991:76
Spinning with a spindle whorl	Flax	60mins	250m	19th Century,Germany Flad 1984:30

Table 4.3.1. Thread production times: Time required to produce thread using different spinning methods based on ethnographic and historical sources.

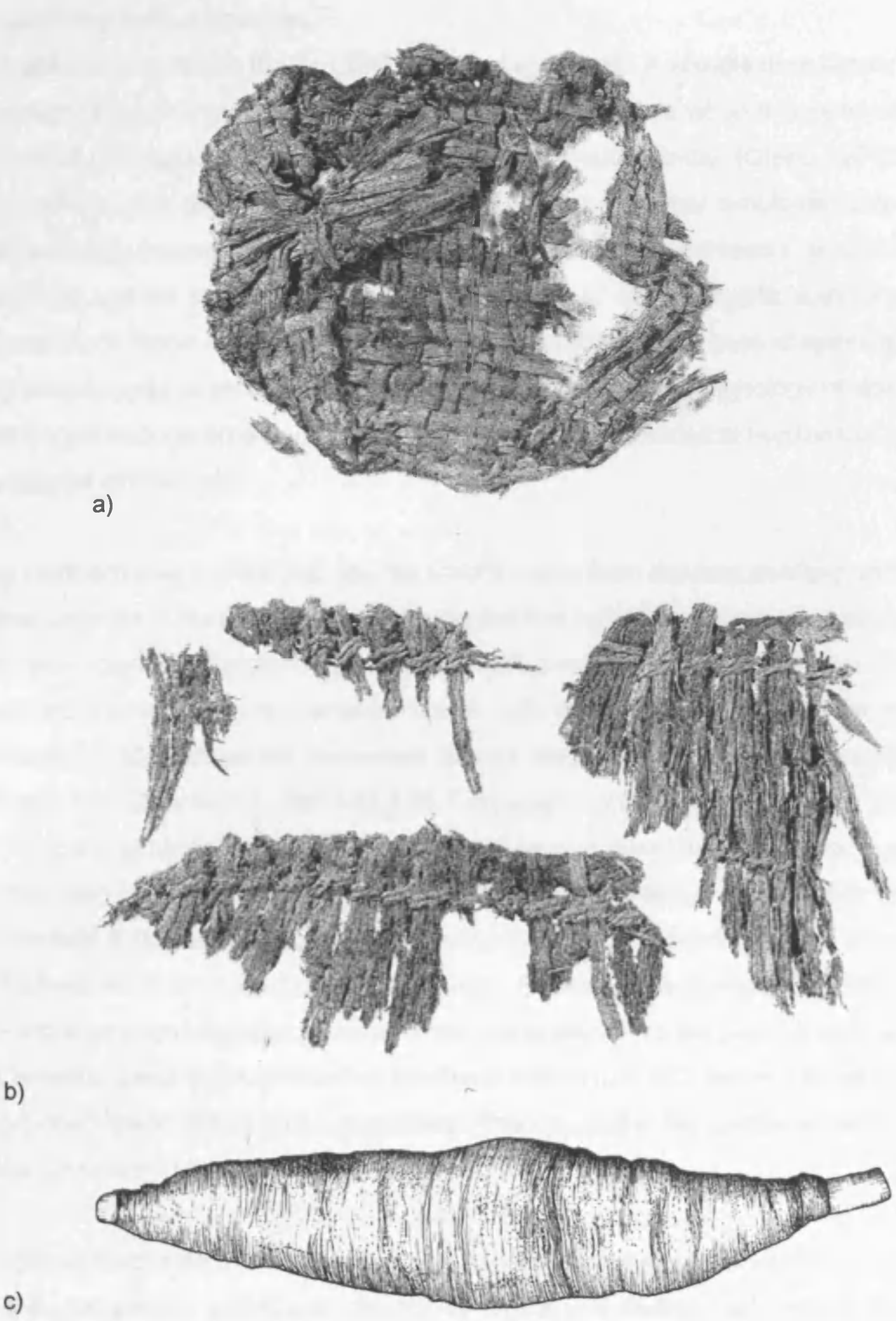


Figure 4.3.2. Thread types: a) Plain weave container measuring 17.5x22cm made with un-spun lime bast strips (LATT-001) (Photograph from Bazzanella et al. 2003b:240). b) Twined cloth with un-spun tree bast warp and plied weft, measurement 17x6.5cm, and plaited starting cord both from Lattrigen Hauptstation-aussen, Berna Canton (LATT-001) (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:239). c) Wooden spindle with fine tree bast thread from Delley-Portalban II , Canton of Fribourg, dated between 2752 -2462 BC, maximum length 18.9cm, width 4.1cm (DELL-002) (Drawing by F.Médard in Médard 2000:3,246).

Spinning with a spindle

A spindle is a device that is used for spinning thread. A spindle may simply consist of a straight stick or it may be weighed with a whorl; a spindle whorl is a symmetrical, centrally pierced object that is threaded onto a shaft (spindle) (Gleba 2004:3). The spindle is used to create a twisting motion while the spinner simultaneously feeds the thread with the prepared, drawn out fibres; once spun, the thread is wound around the spindle and the action is repeated (Barber 1991:42-43). Inorganic spindle whorls from ceramic or stone are the most common archaeological evidence of spinning, especially in the absence of preserved cloth or thread fragments. The typology of spindle whorls changes through time and can be used to follow chronological horizons of change and regional differences.

In northern Italy the earliest spindle whorls come from the lake dwelling settlements of the Lagozza culture in Varese, dated to the first half of the fourth millennium BC (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:99). They are small and flat ceramic whorls with lenticular or triangular profile, with a diameter between 5-7cm mm and weigh 30-40 g; some are decorated (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:101, Guerreschi 1966:142-184, Cornaggia Castiglioni 1955: 8-10). Similar whorls are found in Liguria, for example in the Lagozza culture levels of Arene Candide (Bernabò Brea 1946: TAV.XIV, TAV.L,2) and in the Veneto at the Rocca di Rivoli (Barfield & Bagolini 1976: fig50a,C21-27) as well as sites in Piemonte, Veronese, Padova and further south (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:101). In Switzerland, comparable spindle whorls are known from the Swiss Valais, and in Cortaillod sites of the first half of the fourth millennium BC (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003: 102). In southern France, similar flat spindle whorls are known in the Chassey Culture, but remain rare in other areas.

Spindle whorls are rare in Copper Age Italy (second half of the fourth millennium BC); while flat spindle whorls are common in central and eastern Switzerland (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003: 102). In southern Germany and around Lake Constance, flat, spherical and conical spindle whorls are known from lake dwelling sites dating to c. 3300 BC. Leuzinger notes the general absence of clay spindle whorls in the east-Swiss Pfyn culture sites, only becoming common in the Horgen culture period c. 3300 BC (Leuzinger 2002:120). Although these flat spindle whorls appear similar to the Lagozza di Besnate ones, they lack the earlier precursors and therefore are not considered related (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003: 102). Spindle whorls are common throughout the Bronze Age, made from animal bone, stone, clay and wood in a variety of forms and weights (Bernabò Brea et al. 2003:111).

Spindles for flax, wool and tree bast

Spinning with a spindle whorl was most commonly used for flax. Tree bast was also spun with a spindle whorl with a preserved spindle with thread measuring 0.4mm in diameter from Delley-Portalban II , Canton of Fribourg, dated between 2752 -2462 cal.BC (DELL-002) (Médard 2000:3,246). Although wool fibres are not preserved, the presence of small, light spindles is associated with wool spinning. In her spinning experiments on spinning with spindles weighted with Bronze Age spindle whorls, Grömer considers whorls more than 20g are necessary for spinning simple threads of flax, whorls lighter than this being more suitable for wool (Grömer 2005a:111). On this basis, the increase in lighter whorls from the Late Neolithic (early Copper Age) c.3300 cal.BC and into the Bronze Age is seen as evidence for spinning with wool (Rast-Eicher 2005:127)

Problems with the evidence

Spindles can be made without whorls so the absence of stone whorls does not mean that people were not spinning. At Wetzikon-Robenhausen, Switzerland there is woven cloth with threads less than 1mm in diameter, yet no spindle whorls. As mentioned above, Medard proposes that threads below 1mm are produced with a spindle (Médard 2003:85). Altorfer and Médard present several possible explanations for this: the thread was spun without a spindle, the spindles (and spindle whorls) have not survived or are not recognised, or the inhabitants imported the spun thread and instead specialised in weaving (Altorfer & Médard 2000:63-64). Therefore, even at sites with no preserved spindle whorls people may have been involved with production of cloth.

It is argued that spindle whorls could be mistaken for other items such as small wheels for model vehicles (Albert Bakker et al. 1999:788), or beads. However, based on ethnographic surveys of spindle whorls, spindles usually have a hole between 3-8mm wide, which accommodates the shaft of the spindle and the weight is unlikely to exceed 150g (Liu 1978, quoted in Barber 1991:52). Definite examples of spindles with spindle whorls are known from waterlogged excavations where the weight, shaft and thread clearly attest to this use, Figure 4.3.2.c.

Drop spinning

It is difficult to be sure about the exact technique of using a spindle, as historical and ethnographic examples show considerable variety in operation of this simple device (Médard 2003:84, Barber 1991:42-44). In her experiments referred to above, Grömer considers both drop-spinning, where the spindle runs freely, and a method where the spindle is supported in a bowl or on the ground as it spins (Grömer 2005a:109-110). The earliest representation of spinning in central Europe (several hundred years later) is on a funerary urn from the Hallstatt period from Sopron-Ödenburg, Hungary and shows a drop-spinning technique (as described by Médard 2003:84). Another example of drop spinning, as well as methods preparing the distaff (this is a stick that the raw fibres are wrapped around) and warp followed by weaving on a warp-weighted loom, is represented on a tintinnabulum from a woman's tomb at Arsenale Militare, Bologna, dating between the eighth and sixth century BC (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:201-202), Figure 8.3.a. Drop spinning seems likely at least for the Bronze Age.

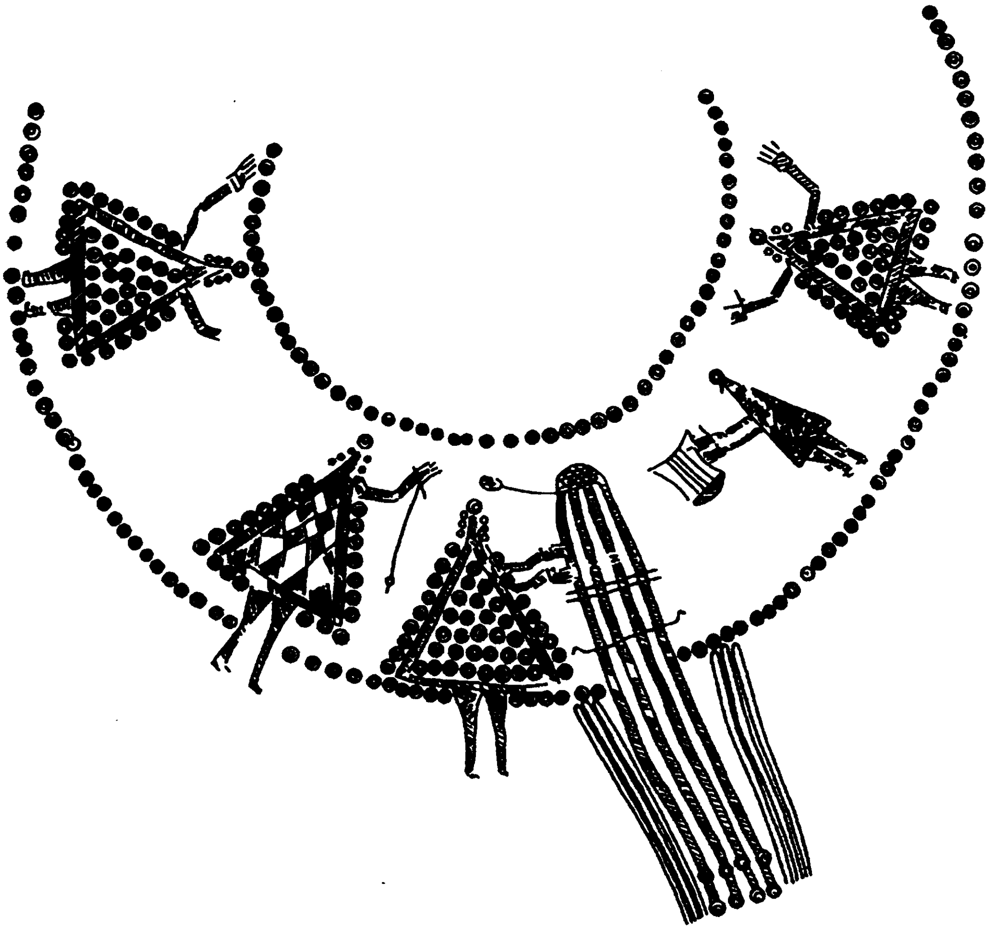
Plying and winding balls

After spinning, the simple thread would be wound on the spindle shaft, and would then need to be plied, a technique rather similar to spinning that twists two single threads together. The thread is then removed from the spindle and would need to be wound into balls. Balls of thread are found in the lake dwellings, for example MOLI-010, Figure.8.2.a. To remove the thread from the spindle to form a hank or ball probably required the use of a reel. The reel is a winding device, usually made of wood that is used to wind the thread from the spindle into a hank, which in turn could then be wound into a ball. No reels are preserved from the Neolithic to Bronze Age.

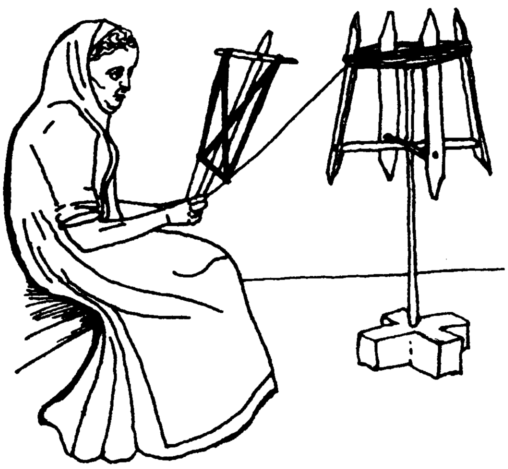
Schwarz suggests that one of the figures on the Iron Age vase from Sopron, Hungary is a small figure (child?) with a reel, Figure 4.3 3.a (Schwarz 1947:2133). This representation is often interpreted as a musical instrument to accompany the spinner and weaver (Barber 1991:294). Schwarz's interpretation of a reel worked by a child is interesting as winding onto a reel is a tedious and relatively unskilled task.

Issues of place and time related spinning

While drop spinning is often carried out sitting down, this does not need to be the case. Spinning with this method is a mobile activity with accounts of people walking and riding animals as they spin. In historical times, spinning was carried out by agricultural communities in the winter, when there was less work in the fields (Flad 1984:29).



a)



b)

Figure 4.3.3. Reeling thread: a) Representation of women on a vase from Sopron, Ödenburg, Hungary, Iron Age, Hallstatt culture. The woman in the centre is weaving on a loom, to her left is a woman drop spinning; the smaller figure to the right may be using a reel (Drawing from the Naturhistorisches Museum Vienna in Barber 1991:295,fig.13.3). b) Woman reeling thread; she holds a cross reel in her hands and is winding from a hank of thread on a yarn winder (Drawing by Susanna Harris after a photograph in Schwarz 1947:2131).

Spinning can be a social activity with records of people working in groups talking, playing music and telling stories (Flad 1984:30). In terms of quantity, a competent spinner could spin about 3600 m flax thread in one day (c.14 hours), (Flad 1984:30). That is about 250m of flax thread per hour, Table .4.3.1 In terms of time, thread production is a long process, in proportion taking much longer to produce the thread, than the cloth that is made out of it. Working on a museum construction of a woven cloth from Lüsherz, Lake Biel (LUSH-001) Riitta Sinkkonen-Davies expected that to spin the flax with a spindle whorl would take 10-20 times longer than weaving the cloth (pers.comm. Riitta Sinkkonen-Davies, December 2004).

Spinning and gender

Spinning is often associated with women in prehistory. One of the most influential works supporting this gender attribution originates from a series of papers by Murdock and collaborators during the 60's and 70's (particularly Murdock 1967, Murdock & Provost 1973). They made a statistical analysis of the sex division of labour of subsistence activities in a number of different cultures, based on cross-cultural sources. They used their results to show the frequency with which tasks were carried out by people of different gender. The results of this analysis show that spinning is carried out by women in 87% of the ninety-one societies studied (Murdock & Provost 1973:tab.1, quoted in Costin 1996:121-123). This research has been referred to in a number of works, notably by Andrew Sherratt in the social analysis of the Secondary Products Revolution, who uses it to sketch out various possible social changes relating to changes in technology (Sherratt 1981:297-299).

There are a number of criticisms of this analysis (Costin 1996:121-123, Owen 2005: 13-17), not least that in every category there are exceptions. However, other evidence indicates that women can be associated with spinning in the Bronze Age. The Homeric myths repeatedly associate spinning with women. The books are based in the Mediterranean and dated anachronistically to the Bronze Age; some suggest that they refer to the Mycenaean Bronze Age, c. 1600 1100 BC (Bennet 1997:511), others that they refer to the Dark Ages c.1100-700 BC (Dickinson 1986:35). Women are associated with spinning (and weaving) in the Iron Age (from c.800 BC) in central and Mediterranean Europe, as women are buried with spindles, and rare representations show women spinning (and weaving), for example, Figure 8.3.a. Although these associations are later, it is possible that strong gender traditions persisted over long periods of time, most convincingly in the Bronze Age.

4.4 Cloth Construction

The evidence for the construction of cloth comes from the examination of preserved cloth fragments and tools associated with the construction methods. For thread-based cloth the methods of interlacing, selvedges (edges), starting and finishing borders are particularly diagnostic. For skins, the method of curing is evident from analysis of the substances or treatment applied to the skins. Tools are diagnostic of certain construction types; particularly loom weights, although many, such as pegs or wooden looms, are made of perishable materials, which have not been preserved. The methods of cloth construction are understood through comparison with contemporary, historical and ethnographic practices and through experimental archaeology. The chronology of cloth types is understood through the presence of preserved remains of cloth, tools and associated evidence.

The properties of these cloth types are usually difficult to understand through the actual preserved remains, which are often small, discoloured and possibly altered by charring. Therefore, comparison is made with modern cloth types made with the same or similar materials and methods.

The construction of cloth types, notably woven textiles, is the most well researched aspects of cloth research in archaeology. Therefore, to keep these topics to a proportionate size, I follow the most common technical and material descriptions in detail and indicate areas with substantial diversity or dissent.

Twining

Twining involves a pair of active threads (usually the weft), which are twisted around a single passive thread (usually the warp) (Figure 4.4.1.a).

Variations in twining

Twining is the most common type of cloth found at Neolithic sites; at any one site there is often a range variations of this cloth type. Twined cloth can be made with gaps between the twined wefts (*open twining*) (Vogt's variant A Vogt 1937:12-13,Abb.14-17, Vogt's variant B, Vogt 1937:14-15,Taf.20-21), or packed tight (*closed twining*) (Vogt's variant C, Vogt 1937:15-18, Rast-Eicher 1997:307, Cardon 1998:18). Of these there are numerous variations depending on the diameter of the thread, the direction the active threads are twisted around the passive threads, or the number of rows worked together (Vogt's type C, variant B, Vogt 1937:14-15,Taf.20-21, see also Rast-Eicher 1997:307, Rast-Eicher 1992b:15-16, Cardon 1998:18). Another variation is the addition of tufts or tassels (*twining with pile*) added into the weft, either during or after twining (Vogt's variant D, type 1-4, Vogt 1937:20-32). These are illustrated in Appendix 2.

Archaeological evidence

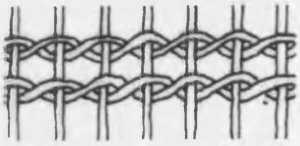
Such variation is apparent from the twined cloth excavated from the Pfyn and Horgen culture layers at Feldmeilen Vorderfeld (Winiger 1981:63-64,Taf.14, 166-170,Taf.64-67, Ruoff 1981:258). Examples from the Pfyn[5] layers range from open twining with fine threads, for example from , FELD-005 (Ruoff 1981:258, Winiger 1981:63,taf.14-4), to very dense twining with thick threads (FELD-006) (Winiger 1981:63,taf 14-2). Large pieces of twined cloth are known, for example a weft-twining cloth in lime-tree bast worked in open stitch slant S from Arbon-Bleiche 3, Switzerland, dated between 3384-3370 BC, which measures 59 by 60 cm with 18 preserved rows of twined wefts (excluding the starting border) at a regular distance of 3.5cm (ARBO-002) (Leuzinger 2002:132). From the same site there is a piece of twining with fine threads and close wefts (ARBO-008); the warp are s2Z 1.3mm x weft z spun 1.8mm diameter; the warps are 2mm apart, with 4 wefts per cm (Leuzinger 2002:132-4). There are a number of twined hats with pile (see section 4.6: hats). Flat sheets are more common, with a number of examples from Hornstaad Hörnle IA, dating c.3900 BC (HORN-006) (Körber-Grohne & Feldtkeller 1998:215) and Seekirch-Achwiesen, Baden-Württemberg, Germany dated c. 2800-2400 BC (SEEK-11, SEEK-12). One of these artefacts has an unusual starting row knotted through a loop (SEEK-011) (Feldtkeller 2004:64, taf.3.3). Although rare in the Bronze Age, there is a tiny piece of twining from the Early Bronze Age site of Lucone di Polpenazze, Brescia (LUCO-007) (Bazzanella & Mayr 1999:scheda 7).

Threads used for twining

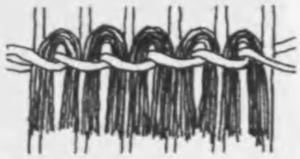
All the artefacts mentioned in the paragraph above have simple spun or plied thread in the warp and weft. However, cloth was also twined with un-spun strips in one thread system and spun thread in the other, for example four pieces of twining from Lattrigen Hauptstation-aussen, Berna Canton Switzerland are made with strips measuring 6mm in diameter in the warp and 3mm 2S in the weft (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:239).

[5] In Switzerland the Pfyn cultures dates between c.3900-3500 BC and the Horgen culture c.3000-2600 BC.

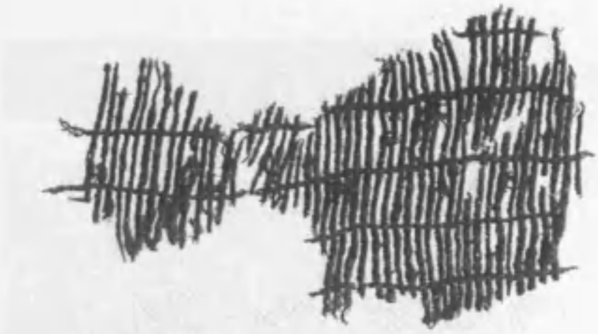
a)



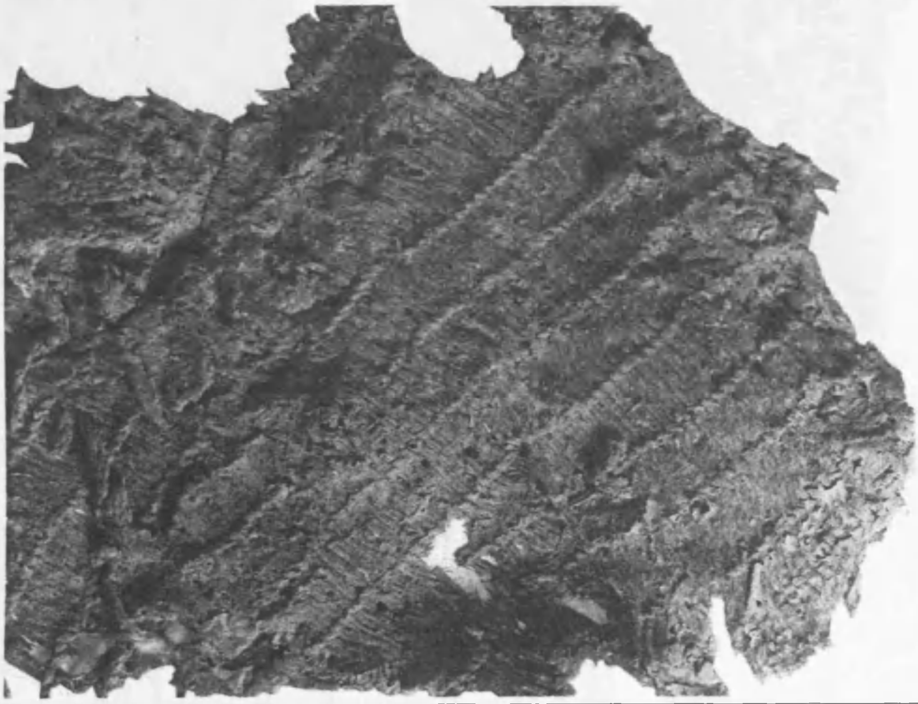
b)



c)



d)



e)

Chaîne opératoire of weft twining:

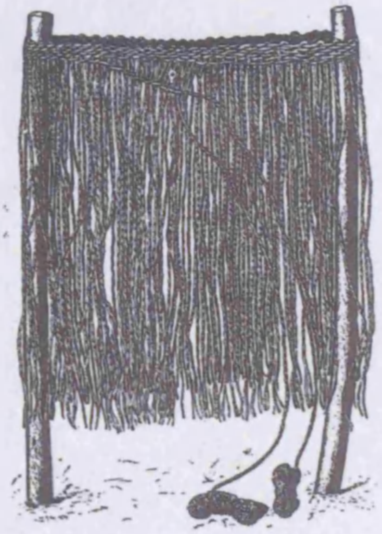
Take the prepared warps and warp up the loom / frame
↓
Tie weights to the end of the warps

Lay the prepared warps on the ground
↓
Secure the warps in position

Tie in a bundle or hold warps in the hands
↓

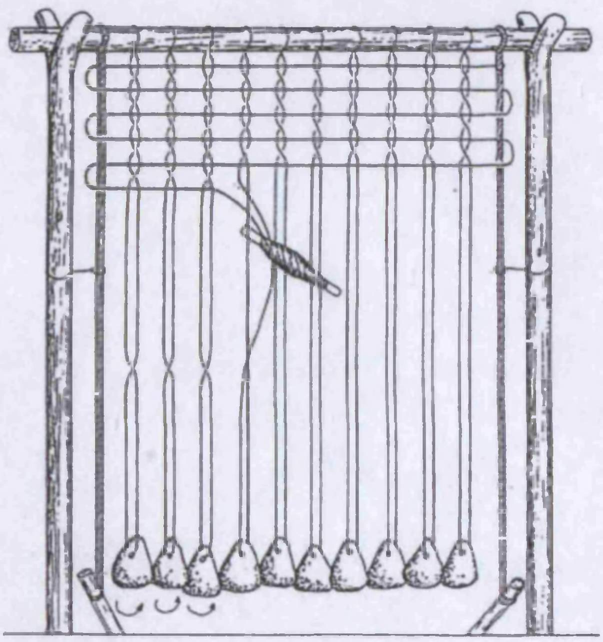
↓
Work in the first weft by twisting the two weft threads around the warps
↓
Continue working in weft to the desired length
↓
Tie off the weft and warp
↓
Remove the finished cloth from the frame / ground

Figure 4.4.1. Twined cloth: a) Open twining slant stitch S (Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.296). b) Open twining with pile, slant stitch Z (Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.296). c) Open twining with fine threads and visible gaps from Feldmeilen Vorderfeld, measuring 14cm x 8.5cm (FELD-008) (Ruoff 1981:258, Winiger 1981:63,taf.14-4). d) Open twining from Hornstaad Hornle IA cloth, dimensions 35x51cm (HORN-006) (Photograph from Körber-Grohne & Feldtkeller 1998:21,Taf.15).



a)

b)



c)

Figure 4.4.2. Examples of twining methods: a) Ojibway weaving frame, set up for weft twining (illustration in Broudy 1979:15,fig.1-6). b) Experiments conducted by the author to create a tree bast twined cloth with plaited warps and hand spun wefts using the weft twining technique. The starting cord was stretched between two trees and the two wefts were passed between the students (Photograph by Susanna Harris). c) Twining loom with weighted warps used to produce a warp twined cloth by rotating the weights (Diagram from Seiler-Baldinger 1991 reproduced in Winiger 1995:153,Abb.32.b1)

In other cases one set of threads is plaited, as for example from Hornstaad Hörnle IA, Lake Constance (Schlichtherle 1990:Taf.51,cat 1077) Figure 5.6.a, and a tubular container with plaited wefts and spun warps from Arbon-Bleiche 3 (Leuzinger 2002:131-132), Figure 4.6.3.b.

Raw materials for twining

Twined cloth was usually made from tree bast, particularly oak and lime (Reinhard 1992:51). There are also examples using grass or reed in the passive thread system and tree bast in the twined thread system, for example the Iceman's cape (grass and lime bast) (Egg 1993:80). In some cases, linen is used in the active thread system and tree bast in the passive, for example in the Pfyn layers of Robenhausen, or linen in both thread systems, such as an example from the Horgen layers of Zurich Seefled (Médard 2000:67).

Chronology

The practice of twining cloth was a common method of producing cloth in the Neolithic and Copper Age (in reference to the Italian chronology); the widespread presence of twining and consistency of construction throughout the Neolithic cultural groups suggests it was a well established method of making cloth, which probably had its origins in the Mesolithic (Winiger 1995:173). Winiger particularly associates the pointed bundles of rib-bones found in many of the lake dwellings (which I have discussed in section 4.2, Figure 4.2.2b) with tree bast processing (Winiger 1995:61). The presence of twining in the Bronze Age is difficult to chart accurately because of the poor preservation of cloth in the Bronze Age, however, twining as a means of cloth construction does not feature in the Bronze Age salt mines of Hallstatt.

Methods of twining

The broad principle of twining is that the threads of the passive system must be held in place while the active system is twisted around them. Just as much as there are numerous variations in the scale and density of twining, so are there a number of potential methods of twining cloth.

Weft twining

The evidence from starting borders shows that the warp threads were attached to a starting cord (ARBO-003, LATT-002, NIED-003, SEEK-012). The method of attaching the warps to the starting borders varies and may be seen as evidence for individual or village diversity and traditions (Feldtkeller 2004:57). This starting cord may have been pegged to the ground, or attached to a vertical or horizontal two-bar loom (Seiler-Baldinger 2003:55). Such a loom need not have been complex; it could have been strung between two posts, as was practised by the Ojibway in America (Broudy 1979:15,fig.1-6) (Figure 4.4.2.a). Reinhard suggested that stones found on archaeological sites that are usually termed net-sinkers may have been used as weights to produce twined cloth (Reinhard 1992:53-54). A recent discovery from Wetzikon-Robenhausen, Zurich, recovered a rough alignment of perforated weights that were lying on a bed of straw with a large piece of twined cloth, and fragments of wood, thought to be parts of the loom (Altorfer & Médard 2000:41). Although not helped by a complex stratigraphy, these finds are thoughtto represent the remains of a twined cloth under construction on a weighted loom, dating between 3800-3400 BC (Altorfer & Médard 2000:41,fig.7). In each of these examples, the method of producing twined cloth is to twist two wefts (*active thread system*) around the warps (*passive thread system*); this method is called twining with paired weft.

Issues of method

A weft twined cloth may be produced by an individual, but is it also possible for two people to work the weft. The pair pass the weft threads to each other from one side of the warp to the other. Patricia Wallis, a colleague from New Zealand, told me that the Maori sometimes practised this method of twining (Patricia Wallis, pers. comm.). I found this a convenient and sociable method of twining in the experiments that I set up in 2005 and 2006, Figure 4.4.2.b.

Warp twining

Another possibility is that instead of weft twining, the cloth may have been produced as warp twining, whereby the weft is the passive thread system and the warps are twisted around it. There are a number of kidney-shaped loom weights dating to c.4000-3500 BC, particularly associated with the Lagozza culture of northern Italy. These are made of lightly fired clay and seem to be associated with weaving, but the exact way they were used is not understood (Cornaggia Castiglioni 1955, Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:99-101, 104-105). Winiger argues that they may have been used for a twining loom(Winiger 1995:176-178). With a hole at either end to thread two warps, the kidney shape of the weight would create a natural space between the warps. This space is a natural shed for the weft to pass through. After each passing of the wefts, the weights would be turned. This creates the paired warp twisting around each weft.

Free working

With certain items there is no need for a loom or support and the fibres may be worked freely in the hands (Seiler-Baldinger 2003:57-58). In experiments Feldtkeller has produced twined hats with pile without a support and using a needle to add in the pile (Feldtkeller 2004:57-59). Unsupported techniques are possibly more suitable for small cloth pieces or more rigid constructions.

Properties and use of twined cloth

The wide variety of raw materials and construction methods affects the properties of cloth, making it difficult to generalise about the properties of twined cloth. The properties of fibres are shown in Table 4.4.2. Twining was used for many purposes. There is evidence for twined bags, (open twining EGOL-001, closed twining NIED-005), twined mats used in pot-making (impression on the base of a pot FIMO-002), as clothing (cape, ICEM-010, hats PEST-001, SEEK-13, SIPP-002), as sieves (FELD-009), as a knife cover (ICEM-015), and probably also for mats, roofing and wall coverings (mats possibly at Pestenaker) (Bartel & Schönfeld 2004:3-4, Bartel 2004:9, Banck 1994:178-179).

The combination of the water-resistant properties of tree bast and the structure of twining with pile points towards a water resistant product. Annemarie Feldtkeller suggested that fragments of twining with pile may have been used to make a rain resistant type of garment, such as historical 19th century European examples worn by shepherds and agricultural workers in Portugal and France (Feldtkeller 2004:60-62).

Weaving

Weaving involves two sets of threads intersecting at right angles passing under and over each other. Weaving is most commonly used by archaeologists to refer to woven textiles that are made with fine, spun thread in both warp and weft, to construct a dense, flexible cloth on a loom (*textiles or woven textiles*).

Archaeological evidence

Preserved woven textiles are known from the Neolithic lake dwellings, The oldest is from a Cortaillod layer of Zurich-Kleiner Hafner and is dated to c. 4100BC (Rast-Eicher 2005:121, Bazzanella, Mayr, & Rast-Eicher 2003d:88,fig.1). Other examples from early periods include Hornstaad Hornle IA, dating c.3900 (Körber-Grohne & Feldtkeller 1998), and Port-Stüdeli, c.3560 BC (Rast-Eicher 2003b:59-60). Woven textiles are known in all subsequent periods, including a fringed textile from the Early Bronze Age site of Lucone di Polpenazze, Brescia Italy dated c.2300-1500 BC (LUCO-001 to 006) Figure 4.4.3.c (Bazzanella & Mayr 1999:scheda 1-6) and Bronze Age Hallstatt salt mines (Grömer 2005b), Figure 9.3.a-c.

Neolithic textiles are usually made of plied linen threads in plain weave (Rast-Eicher 2005:124). There are rare examples of woven textiles made of tree bast (MYTH-001 this example also has pile inserts) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:219). In terms of quantity, woven textiles are less numerous than twined cloth in the preserved fragments of the Neolithic lake dwellings and the percentage of woven textiles out of the total cloth types preserved in different periods varies (Rast-Eicher 1997:312-313). As discussed earlier, wool is thought to have become an important raw material in the Late Neolithic / Copper Age and during the Bronze Age on the basis of numerous sheep and goat bones, the presence of lighter (6-80g) spindle whorls that would be more suited for wool along with lighter loom weights (Rast-Eicher 2005:127, Sherratt 1981:282-283). The absence of preserved wool textiles is due to the lack of *preservation in the alkaline conditions of the Neolithic Lake dwellings.*

Loom weights

In terms of weaving textiles, the Neolithic to Bronze Age has been associated with the warp-weighted loom. The warp-weighted loom consists of a wooden frame and heddles, and stone or clay weights, which are used to hold the warp thread under tension and frequently survive in the archaeological record. These weights are found on archaeological sites. In northern Italy weights associated with weaving are found throughout the Neolithic, but becoming more common in the Bronze Age (Bazzanella, Mayr, & Rast-Eicher 2003d:92). Their association with weaving is most convincing when they are found in rows, near to the walls of houses, as this closely relates to the method of using a warp-weighted loom. This is further supported by the types of starting borders of preserved cloth, which are particular to this type of loom (Rast-Eicher 2005:125). In some cases these weights are found in nearly all of the lake dwelling houses, leading to the idea that each family did its own weaving (Rast-Eicher 2005:122).

Fibre	*Properties*
Lime bast	Stronger than elm or oak bast, particularly if prepared without retting 47% stronger when wet Resistant to decay Low water absorption Limited swelling when wet Lightweight Retted lime bast is soft to handle Not particularly elastic Low resistance to wear Natural colour: light to medium golden brown
Oak bast	Short and brittle Natural colour: medium to dark brown
Elm bast	Especially long fibres Elastic Supple Natural colour: medium brown
Flax	Strong Good tensile strength 20% stronger when wet Good heat conductivity Good absorption Cool to the touch Rigid fibre Dull fibre but becomes more lustrous if beaten Stable shape and size following usual weaving process Good resistance to insects and micro organisms Only susceptible to mildew in extremely moist conditions Resists abrasion Resists chemicals Very flammable Natural colour: white, yellow, reddish, silver grey
Sheep's wool	Low to moderate strength Weaker when wet Good heat insulator Very susceptible to attack by moths Resistant to mildew Wool degrades and chars on heating Burns very slowly even in contact with a flame Soft to handle Highly absorbent Good stretch and recovery Absorbs shocks Abrasion resistant Readily dyed and good colourfastness Will felt if agitated in warm water Slow drying Fineness and structure will vary according to variety Natural colour: white, yellowish, reddish-brown, black

Table 4.4.2. Fibre properties (sources for lime bast: Myking, Hertzberg, & Skrøppa 2005:68-70, lime, elm and oak bast, Médard 2005:100-102, colour of tree bast source: Körber-Grohne & Feldtkeller 1998:156, Abb.16, and own experiments, sources for flax: Needles 1981:61-62, sources for flax and wool: Airoldi 2000:31-35, Kornreich 2005:11-17, Puliti 1987:11, 21-22, Wulfhorst 2001:10).

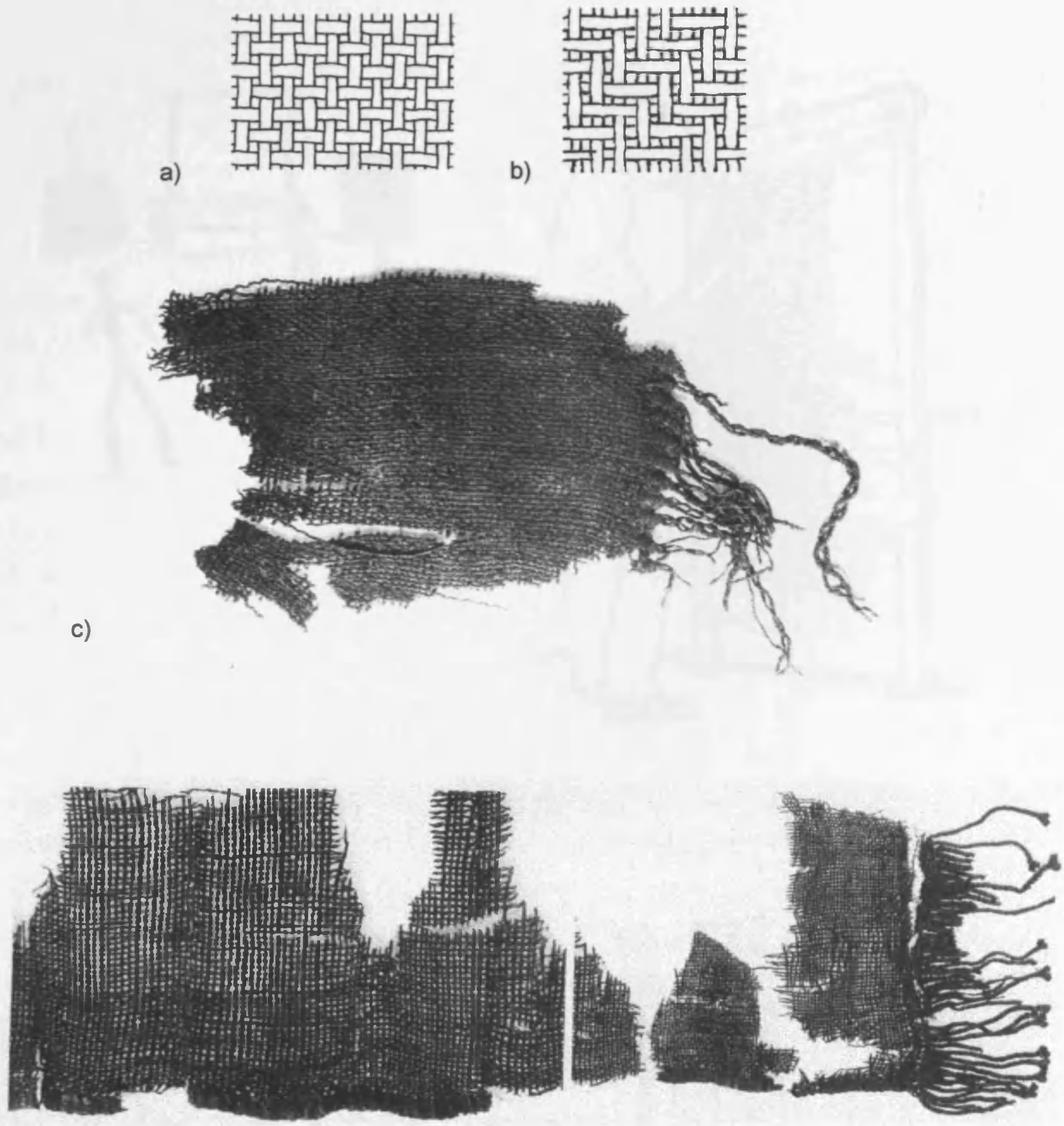
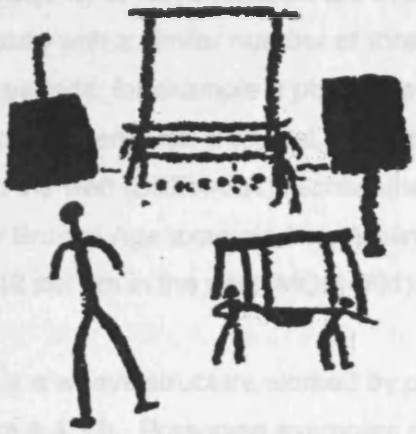


Figure 4.4.3. Woven cloth: a) Diagram of plain weave structure (Drawings by Susanna Harris after Rast-Eicher 1997:307,fig.290). b) Diagram of twill weave structure (Drawing by Susanna Harris after Seiler-Baldinger 1994:90,fig.158a). c) Plain weave with fringe from Lucone di Polpenazze, Italy, early Bronze Age, 65x14cm (LUCO-005) (Photograph from Bazzanella & Mayr 1999:20). d) Detail of a long strip of plain weave cloth with fringe from Utoquai, Zurich, c.3200-2800 BC, total length of preserved cloth 75x9cm, (UTOQ-001) (Photograph from Bazzanella et al. 2003:225).



a)

b)

c)

Figure 4.4.4. Weaving cloth: a) Engraving of a warp weighted loom and other figures including humans, from the Great Rock of Naquane, Capo di Ponte, Valcamonica, Italy. Dated to the Late Bronze Age c.1200 BC (Drawing from Anati 1994:159,fig.121). b) Weaving on a warp weighted loom (Drawing by Nick Bonner after photograph by the Laboratorio Didattico di Preistoria, Capo di Ponte). c) Weaving on backstrap loom (Drawing by Nick Bonner after a photograph in Seiler-Baldinger 1994:48,pl.9).

Weave types: plain weave, twill and plain weave with pile

The majority of woven textiles are in balanced plain weave; that is a plain weave structure with a similar number of threads per cm in warp and weft. This changes in later periods, for example a plain weave cloth from Seekirch-Achwiesen, Germany dated between 2860-2490 cal. BC, which has 14 threads per cm in warp and 8-10 per cm in the weft (SEEK-001) (Schlichtherle 2004a:41-45, Feldtkeller 2004:65), and the Early Bronze Age example from Molina di Ledro, with 16 threads per cm in the warp and 12 per cm in the weft (MOLI-001) (Bazzanella & Mayr 1995b:114-116).

Twill is a weave structure worked by passing the weft over two or more warp threads Figure 4.4.3.b. Preserved examples of twill weave are not known in the Neolithic or Copper Age and it is debatable when it became a widespread weave type. The Early Bronze Age lozenge decorated narrow-woven strip from Molina di Ledro (MOLI-001) is a type of twill weave (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:161). Based on this and on representational evidence, Rast-Eicher argues that twill weave was known from the end of the Early Bronze Age (Rast-Eicher 2005:128). More frequent preserved examples of twill weave are later, for example from the Bronze Age galleries of the Hallstatt salt mines (CHRIS-018) (Grömer 2005b:20), Figure 9.4.b. The presence of twill weave in the early to Middle Bronze Age therefore remains in question. As with twining construction techniques, there are a number of examples where pile can was added into plain weave; I have already mention the example from Mythenquai, Zurich (MYTH-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:219). Although not common, there are other examples including a cloth from Lake Paladru, Charavines, France c.2600 BC (Desrosiers 1989:132-133).

Chronology

In central Europe, the earliest presence of weaving (in the sense of woven textiles) is usually ascribed to the Early Neolithic (Rast-Eicher 2005:119). As there are no preserved cloth remains until those of the Alpine lake dwellings c.4000 BC, the earliest evidence of woven cloth in the central European and Alpine Neolithic cultures is attested through the introduction of flax as a domestic crop in combination with the presence of spindle whorls and loom weights (Barber 1991:ch.3, Bazzanella, Mayr, & Rast-Eicher 2003d:87, Rast-Eicher 2005:119). The exact nature of this as a technological change is uncertain. There is a suggestion that some kind of weaving existed in the Palaeolithic (Soffer 2004). This may be the case as weaving does not need complicated equipment or technology; although this does not deny that some shift in the practice of such a technique occurred in relation to the introduction of flax.

This debate is far from resolved. What is apparent in that whether the first woven textiles, or a technological development in terms of spinning and weaving methods related to the introduction of flax, woven cloth is present in the earliest preserved cloth remains from the Alpine lake dwellings.

Weaving on a warp-weighted loom

The techniques of working the warp-weighted loom, based on the use of these looms in Norway in the 1950s, were described in detail in Marta Hoffman's canonical book (Hoffmann 1964). This has been supplemented by numerous experiments and reconstructions (Bazzanella, Mayr, & Rast-Eicher 2003d:87, Schierer 1987, Schierer 2005a).

As with all looms the first task is setting up the warp, which involves wrapping the warp threads in sequence around series of pegs or posts (Hoffmann 1964:40), and this is then tied, cut and attached to the loom. The warp is after this stage tied to the loom weights, making sure that they balance evenly while maintaining a separate shed for the forward and back threads. When in place, the heddle or heddles (term defined in the Glossary) can be attached and the sheds are tied to keep them ordered (Hoffmann 1964:40-43) and then the weaving can begin. The weft is passed from one side to another between the shed, alternating the shed each row by shifting the heddle. A tool such as a wooden weaving knife, weaving sword, comb or even a finger, is used to push the weft upwards and beat it in so that it lies evenly against the previous weft, continuing like this until the cloth is finished. To fasten the cloth, the warp end needs to be knotted or braided or otherwise finished (Hoffmann 1964:44-45).

The warp-weighted loom is particularly suitable for wide pieces of cloth, while not especially useful for long pieces of cloth (Bazzanella, Mayr, & Rast-Eicher 2003d:92). The presence of long, narrow woven cloth therefore suggests another type of loom may have been used. One possibility is the body-tension or back-strap loom.

The back strap loom

The back strap loom operates by fastening one end of the warps to a fixed object (post, peg, tree etc.), these warps are then ordered around a system of horizontal rods and the other end of the warps are fastened around the weavers lower back. A heddle can be used to adjust the shed, while the weaver, moving back and forth, adjusts the tension (Bazzanella, Mayr, & Rast-Eicher 2003d:92, Seiler-Baldinger 1994:81-82). The only evidence for this kind of loom would be a number of sticks, which are difficult to identify. Winiger has suggested that some wooden sticks were possibly used for this purpose (Winiger 1995:180). Other evidence may include the short weaving knives from the Pfyn culture (Winiger 1995:160,fig.37,4-5) or short heddle fragments from the Cortaillod culture (Winiger 1995:161,fig.38,3-5, Bazzanella, Belli, & Mayr 2003a:278).

There is a representation of a back-strap loom in use in terracotta from Mesopotamia dating to the early second millennium BC; showing that such a loom existed at this time, albeit far away (Bazzanella, Belli, & Mayr 2003a:278). Bazzanella and Mayr copied the narrow woven strip with lozenges from Molina di Ledro and suggest that this could have been worked on a back strap loom, the pattern being woven in by hand rather than with separate heddles (Bazzanella, Belli, & Mayr 2003a). Unlike the warp-weighted loom which is relatively immobile once in place, the back-strap loom is readily portable.

Properties of woven textiles

Woven textiles are smooth, flat and flexible. Twill, pile, and other variations in the weave structure would have changed the properties in subtle ways. Woven cloth may be subject to fraying on raw edges; wool cloth may be pounded or rubbed to felt the surface (fulling), making the cloth stronger and resistant to fraying. The properties of fibres are shown in Table 4.4.2; these affect the qualities of the cloth. Textiles can be used for many purposes including clothing, containers, equipment, bedding and furnishings.

Other plain weave cloth types

It is not only woven textiles that can be worked in plain or twill weave; an interesting group of artefacts are un-spun strips of tree bast that are worked in plain weave. These are usually described as basketry or matting. I have already mentioned a plain weave basket measuring 17.5 by 22cmfrom Lattrigen Hauptstation-aussen, Berna, Canton (LATT-001) (Figure 4.3.2.a) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:240). There are a number of other examples of similar constructions, for examples from Arbon-Bleiche 3 (ARBO-005) (Leuzinger 2002, pp. 115 – 134). These are rather rigid constructions and are borderline between cloth and basketry.

Other methods of weaving

The back strap and warp weighted loom are most commonly discussed in relation to the study period. However, looms can be made from any sort of frame device and there are numerous examples. These include large looms without weights where the warp threads are simply wrapped around the frame or bow looms where the tension is created through holding the wood under tension (for a number of examples Broudy 1979). While there is no clear evidence for these looms, they would be difficult to detect archaeologically, so their use cannot be excluded.

Knotted netting

Knotted netting is made with a single thread worked in sequential rows fastened with knots.

Archaeological evidence of knotted netting

Knotted netting is commonly found in the Neolithic lake dwelling settlements, although becoming less common in the later Neolithic (Rast-Eicher 1997:312-313) and with a general lack of evidence in the Bronze Age. For example, in the Zurich area, knotted nets are present in cultures attributed to the Cortaillod, Pfyn, Horgen and Corded Ware cultures, which span c.4000-2400 BC (Rast-Eicher 1992b:16, Abb.6.).

The scale and raw material of net types varies between nets with the same construction technique, altering the qualities of the finished netting. For example, at Zurich Kleiner Hafner, there is an example a linen net, constructed with thread c.2mm in diameter and 1cm mesh width (measured along the thread between the knots) (Suter 1987:266,Taf.20.2) and a net made of oak bast threads c.1mm in diameter and a mesh width of 1cm-1.6cm (Suter 1987:137, 266, Taf.20.3) (Figure 4.4.5.d). These both belong to the Early Cortaillod culture levels of the site, dating c.4000 cal.BC. There are examples of nets with much wider meshes. From Hornstaad Hornle IA, for example, there is a fine linen net (threads diameter 0.4-0.6mm) with meshes 3.9-4.2cm wide (HORN-036) (Schlichtherle 1990:194,Taf.52), Figure 5.5.b. Knotted nets may be made with a mixiture of raw materials, for example flax nets with tree bast starting cords were identified at Hornstaad Hörnle IA (HORN-017, HORN-018, HORN-019) (Körber-Grohne & Feldtkeller 1998:143,Tab.2).

Knotted netting is usually thought to have been used for fishing nets (for example, Körber-Grohne 1987:11), and a general decrease in quantity of netting throughout the

Neolithic has been interpreted as a change in fishing strategies (Rast-Eicher 1995:172) However, knotted nets may have been used for clothing and bags as known from ethnographic and historical examples (as acknowledged in Vogt 1937:36). For example, the net found with the Iceman could have been used for catching birds or as a carry net (Spindler 1995:118-119, Egg 1993:70).

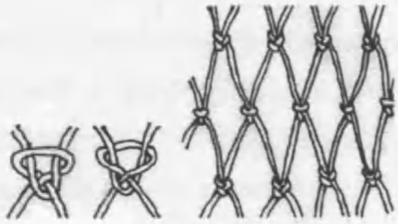
The method of knotting nets

Netting techniques usually begin from a row worked onto a taut starting cord or rod, with each subsequent row knotting onto the previous one (Geraint Jenkins 1974:71). Some kind of bobbin or needle is necessary to hold the long active thread. Vogt identified a possible netting-needle of deer horn with a lateral eye from Scahffis, Bern Canton, (Vogt 1937:47.fig.72.3). A small rod, acting as a spacer, is useful to regulate the size of the mesh (Geraint Jenkins 1974:71). Rows may be worked back and forth or in the round (Rast-Eicher 1997:305, Seiler-Baldinger 1991:13ff, Vogt 1937:33ff). Rows worked in the round or side to side can be identified by examining the sequence of knots. Knots will all be worked the same way(and therefore face the same way) if the net is worked in the round. The knots will appear in alternating rows of front and back facing if knotted back and forth (Körber-Grohne & Feldtkeller 1998:136). The back and front of knots and alternating rows are shown in Figure 4.4.5.b. To shape the net, the mesh may be decreased or increased (Geraint Jenkins 1974:73).

Properties of knotted netting

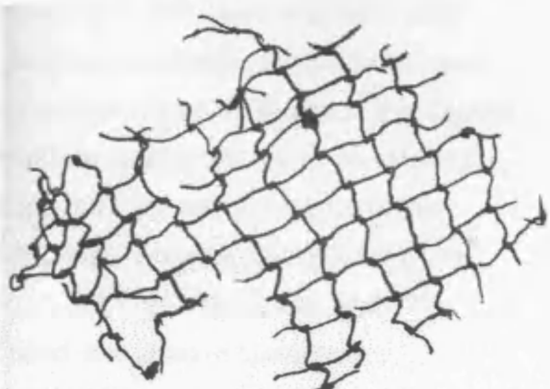
Knotted netting is light, flexible and strong; although less elastic than its knotless relation. The openness of the net depends on the size ratio of mesh and thread. The sturdy, light and open characteristics of knotted nets make them good for trapping animals (including fish and birds) especially as nets are readily camouflaged. As flax and lime bast are stronger when wet, these would be ideally suited to fishing nets (Table 4.4.2). Nets may tear then need repairing (Figure 4.4.5.c) and nets in contact with water are liable to decay (Geraint Jenkins 1974:79-80). Historically, the mesh size of fishing nets depended on the method of fishing and the species of fish people wanted to catch (Geraint Jenkins 1974:70). Knotted nets are useful as airy, light containers and covers.

a)



b)

c)



d)

The chaîne opératoire of knotting nets

Allow sufficient thread

↓

Wind thread around needle or shuttle (if using)

↓

Work first row of netting on to the starting cord rod or frame

↓

Work sequential rows back and forth ↓ | Work sequential rows in the round ↓

Increase and decrease as necessary

↓

Work until the desired size

↓

Tie off the final stitch

e)

Figure. 4.4.5. Knotted nets: a) Knotted net with lake-dwelling knot, known as *Pfahlbauknoten* in German (Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.284.). b) fishing net knots in alternating directions, knot detail shown front and back (Drawing by Susanna Harris after Körber-Grohne & Feldtkeller 1998:136,Abb.1b). c) Mending nets (Drawing by Susanna Harris after a photograph in Geraint Jenkins 1974). d)Net with fine threads from Zurich Kleiner Hafner, Zurich Canton, mesh size measured between knots c.14mm (Drawing from Suter 1987:300,fig.3). e) Chaîne opératoire of knotting nets.

Knotless netting

Knotless netting is created with a single thread of interconnecting loops which is worked in sequential rows, it may be worked with single (Figure.4.4.6.a) or multiple twists (Figure.4.4.6.b) (Rast-Eicher 1997:305, Vogt 1937:33-35). The loops may cross over or under each other; this is described as an S or Z direction.

Archaeological evidence of knotless netting

From the excavation in Zurich, knotless netting is known in the Cortaillod and Egolzwil cultures c. 4000 BC, but not present (or not preserved) in later periods (Rast-Eicher 1992b:15-16,Abb.6). At Lake Paladru, France, knotless netting continues to be used into the first half of the third millennium BC in excavation layers attributed to the Corded Ware culture (Cardon 1998:19). Variations of knotless netting are found co-existing, for example, there are two types of knotless netting from the Horgen layers of the Feldmeilen Vorderfeld, Zurich Canton, Switzerland dated between 3239-3023 cal.BC (FELD-001, FELD-012) (Figure 4.4.6.c&d) (Winiger 1981:190-191,taf.76.1&3). The thread of FELD-001 is *identified as tree bast, Z plied and 2mm in diameter*, (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:222). FELD-012 has an upper edge which has been drawn together, suggesting that was originally held with a draw-string; Winiger suggests it was a bag or container (Winiger 1981:190).

As with so many cloth types, knotless netting is rare in the Bronze Age, although there is a fine, close-meshed example in linen from Molina di Ledro, Italy. In this example the thread is just 0.6mm thick and the meshes are 3mm x 1.5mm and there is a thicker area which may suggest mending or a join; such a fine net has been interpreted as *hairnet or a bag* (Bazzanella & Mayr 1995b:121).

The method of knotless netting

In terms of production techniques, from experimental analysis, I have found the techniques that women use to make knotless looped bags, called *bilums* in Papua New Guinea, the most applicable (MacKenzie 1991, Thomas 1995:117-118). The open looping technique described by Mackenzie (MacKenzie 1991:209-216) produces a cloth similar to the archaeological types I am concerned with.

The technique of open looping involves using a stiff but pliable spacer strip to wrap the loops around; this forms a row and creates even sized loops. The thread may be looped in and out using a needle or by doubling up the working end to make it stiff enough to pass through each loop (MacKenzie 1991:65). After the beginning row, subsequent rows are worked into the bottom of the previous loop in rounds, or back and forth until the desired length.

As this technique involves pulling the un-worked thread through the loop, the thread cannot be too long, as it would tangle; Mackenzie suggests the ideal thread is five metres long (MacKenzie 1991:210). Therefore as the rows are looped, the thread runs out. When there is not enough thread left, another piece of thread needs to be knotted on, or new fibres can be spun into the end, as is done in Papua New Guinea. In this practice, the process of knotless netting therefore involves the alternation between looping and spinning new fibres into thread on the thigh (MacKenzie 1991:210).

This method contrasts to other methods of constructing thread-based cloth, where spinning thread is complete before the cloth construction begins. However, it is possible that there were techniques to make knotless netting with long continuous threads wrapped around a bobin, as in the examples of knotted netting (see below). This may well be true for examples such as the fine knotless netting from Molina di Ledro (MOLI-009) Figure 8.5.c.

Although the *bilum* stitch is looped differently from the examples above, the technique of using spacer strips, needle and spinning new thread as it runs out, is readily applied to create the types of Neolithic and Bronze Age knotless netting. For example, the knotless net from Feldmeilen (FELD-012), Figure 4.4.6.d, has no visible knots, so continuous thread production seems likely. Conversely, I found that techniques without spacer strips are impractical, although historical records in northern Europe show this is possible with thicker wool thread with smaller loops, and a more complex looping stitch (Nordland 1961:26,figs.12-18).

Properties of knotless netting

The knotless netting from the Neolithic to Bronze Age is open mesh and therefore is light, flexible and elastic. Depending on the scale and type of fibre, it may be dense or loose and therefore more or less elastic. In addition, loops with two or more twists are more rigid and have larger meshes (Rast-Eicher 1997:315). The elasticity and open nature of this cloth type makes it ideal for straining solids from liquids (for example Nordland 1961:46), as light and expandable bags and as stretchy covers such as hairnets.

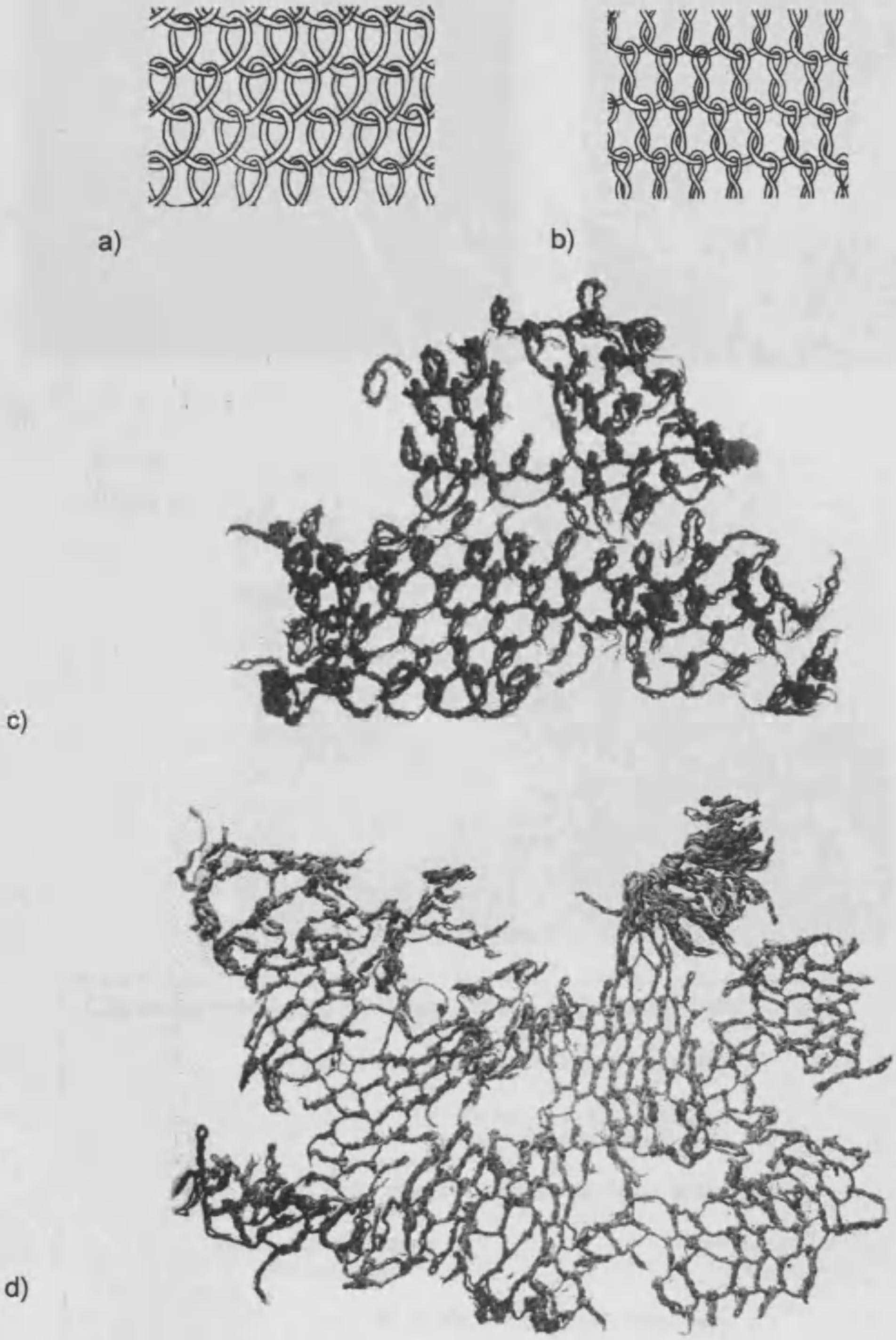


Figure. 4.4.6. Knotless netting: a) Diagram of simple looping with s-crossing (Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.281.). b) Diagram of twisted looping with s-crossing (Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.282.). c) Knotless netting from Feldmeilen Vorderfeld; 17x12cm, tree bast, 2Z, thread diameter 2mm, Horgen culture (FELD-001) (Winiger 1981:191,taf 76-1). d) Knotless netting, 37x28cm, the top edge is drawn together, possibly a bag, Feldmeilen Vorderfeld (FELD-012) (Photograph from Winiger 1981:190-191,taf.76.3).

a) b)

c)

Chaîne opératoire of knotless netting with spacer and needle

Thread needle with single, long thread
↓
Create a knot in the thread
and tie onto spacer strip
↓
Work a row of looped stitches along the spacer strip
↓
Work sequential rows back and forth | Work sequential rows in the round
↓
As thread runs out spin more each
↓
Increase and decrease as necessary
↓
Work until the desired size
↓
Tie off the final stitch

d)

Figure. 4.4.7. Methods of knotless netting: a, b & c) Photographs of an experiment to produce knotless netting using tree bast thread, a needle and two plastic spacer bars; work based on an experiment by the author in 2006 (Photograph by Susanna Harris). d) Chaîne opératoire of knotless netting with spacer and needle.

Curing animal skins

Animal skins need to be treated to make them soft and flexible otherwise as they dry they become hard and crispy.

Archaeological evidence

Bone or stone scrapers may be associated with curing skins, as with the earlier stages of skin processing, Figure.4.4.8.a. Otherwise, evidence comes from the analysis of preserved skins.

Two types of pollen were found on the Iceman's skin clothing. One type was normal pollen, the other was shrunk and discoloured (Groenman-van Waateringe 1995:67). The first type probably became attached when the garment was worn. The second type may have been attached to the animal when it was alive and become deformed during the curing method. Groenman-van Waateringe suggest that the shrinking and discolouration of the pollen may be the result of a heat treatment, such as a fat and smoke curing method (Groenman-van Waateringe 1995:69). However, experiments have not completely recreated this effect (Groenman-van Waateringe 1995:67-68).

Ryder analysed a number of Bronze Age and Iron Age skins from the Hallstatt salt mines (Ryder 1993). From his observations, the skins do not appear to be vegetable tanned, but possibly oil-tanned or rawhide (Ryder 1993:106). It seems unlikely that skins were tanned with tannin substances from the Neolithic to Bronze Age. Skins cured with tannins (leather) are much more likely to be preserved in waterlogged deposits, therefore their absence suggests they did not exist at this time (Groenman-van Waateringe 1995:69, Spindler 1995:135-6). However, chemical analysis of residues in a pot with from the Bronze Age lake dwelling of Fiavé, Trentino, showed traces of tannins and degraded leather. Along with acorns which are a source of tannin, this suggests the pot was employed for tanning processes (Evans 1984:1098).

Methods of curing skins

There are many ways to cure skins involving a combination of stretching and scraping, rubbing in fats or other substances and treating with smoke or heat. As it is not clear which treatment was applied to skins from the Neolithic to Bronze Age, I will outline several possible methods.

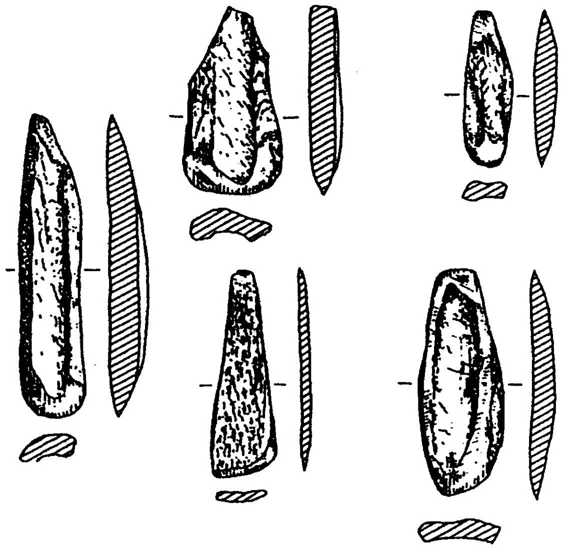
This brief account describes how Australian aborigines cured skins. The skins were stretched onto bark sheets, ashes were rubbed on to absorb the fat and they were allowed to dry near a small fire. Once dried, the skins were made more flexible by scraping and scoring with a shell, bone point or stone flake; fat was rubbed into the surface of the skins to make them waterproof (Mulvaney & Kamminga 1999:90).

Canadian Inuit communities use a variety of methods to cure animal skins; some of these practices continue to the present day (Oakes & Riewe 1996). After the skins are prepared (see section 4.2) they are stretched on a wooden frame or pegged to the ground, Figure 4.4.8.b&c. When the skin is dry, it is washed and dried again. Following this the skins may be wrung, twisted, chewed or scraped to make them soft and pliable. In addition, the surface may be rubbed with salt or fat, or the skin may be soaked again. These processes may be carried out over a number of days. However, if the temperature is above freezing the skins will start to decay, creating some urgency in this process. (Oakes & Riewe 1996:34-38). There are many variations of these processes practiced throughout by these communities.

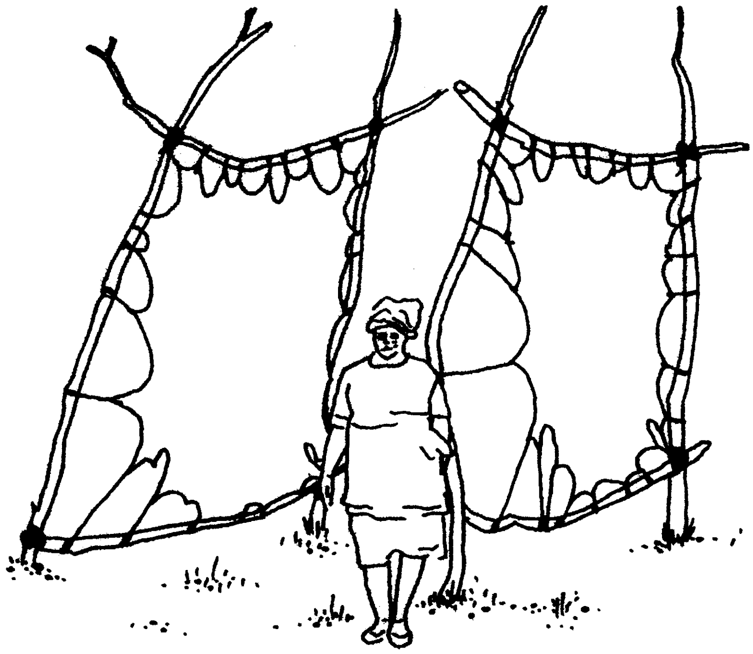
Another method is oil and smoke curing; as practised traditionally by North American Indians (Binford 1972, Kellogg 1984:90-92, Richards 2004). After the skins are prepared by soaking over one to two days to remove the hair and fat, they are rubbed with a mixture of water and fat that comes mainly from the animal's brain. These are left to soak in over night. The following day the skins are scraped, pulled and stretched to make them soft, and then smoked over a fire for several (3-5) days (Kellogg 1984:90-92). From this account, the whole process should be complete in about a week. There are a number of variations on this process.

Time, cooperation and quantity

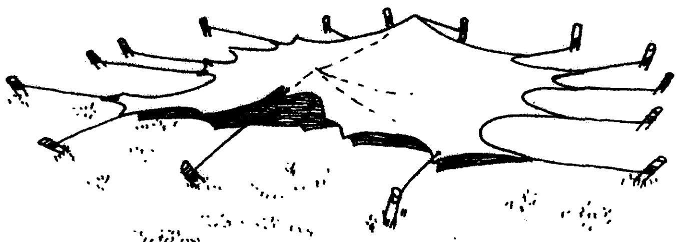
Although these curing methods are relatively quick it is worth bearing in mind that a large number of individual skins may be needed for large items. Table 4.4.1 shows the estimated number of skins needed to make different items using a small animal such as a rabbit or possum. The larger the skin, the less number of skins required. However, skins from large animals (such as bear or cow-skins) are difficult to handle and may be worked on by a group, or may be cut into pieces so individuals can work on sections (Kellog 1984:29-30, Oakes & Riewe 1996:37). Compared with curing using fat, smoke and scraping methods, tanning with vegetable tannins (such as oak bark) is a much slower process, taking months of soaking in tannin solution (Kellogg 1984:84).



a)

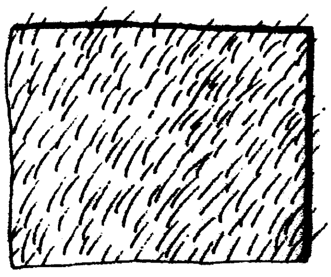
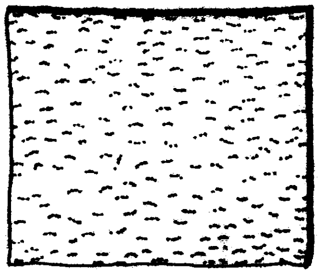


b)



c)

Figure 4.4.8. Scraping and stretching skins: a) Bone scrapers, possibly used for curing skins from Vinelz "alte Station", Bielersee, Switzerland, dating c.2700 BC, no scale given (Drawing from Winiger 1995:135). b) Stretching skins on wooden racks (Drawing by Susanna Harris after a photograph in Douglas 1956). c) Stretching a skin pegged to the ground (Drawing by Susanna Harris after a photograph in Douglas 1956).

a)  b) 

c)

Chaîne opératoire of fat and smoke curing skins:

Remove fur is not wanted
↓
Rub fatty solution into the skin
↓
Allow the preserving substance to be absorbed
↓
Wring, rub, chew, pull, stretch or otherwise
work the skin until it is soft and pliable.
↓
Prepare the fire pit.
↓
Hang the skins on a frame above the
fire so that they are in the smoke.
↓
Watch and control the fire and smoke over
several days so that the skins are evenly cured.

Figure 4.4.9. Curing skins: a & b) Diagram of fur and skin (Drawings by Susanna Harris).
c) Chaîne opératoire of fat and smoke curing skins.

Item to make	***Species and number of skins required***	***Source***
Full length coat	40-50 rabbit skins[1]	Kellogg 1984:142
Jacket	16-24 rabbit skins	
Blanket 150x120cm	25-25 rabbit skins	
Gloves or footwear	2 –4 rabbit skins	
Cloak 230x170cm	81 possum skins	Mulvaney & Kamminga 1999:90
Carry sack from Hallstatt (for example APPO-001, GRUN-003)	l-2 cow skins makes three sacks	Barth 1992:136,Abb.4

Table 4.4.1. The number of skins needed to make various items. Although rabbits and possums are not species known to be used for skins in the Alpine region from the Neolithic to Bronze Age, these figures give an indication of the number of small animals that may be needed for different size items.

[1] Rabbits measure about 35-45cm from head to tail (Abram 2004:69); possums are about the same size.

Species	*Properties*
Bear skin	Tough Hardwearing
Mature cow skin	Durable and even 4-6mm thick Thick Coarse, straight hairs
Calf skin	Thickness increasing with age: at 1 month. 1mm, at 12 months 2.5mm
Horse skin	Similar weight and thickness to cow skin Very durable Coarse grain
Sheep without fleece	Thin Very strong
Sheep with fleece	Soft Flexible
Hairy sheep	Hair like goat. Thin, compact skin
Goatskin	Very thin Fine grain Compact grain Between 1-3mm thick
Kidskin (young goat)	Very thin Strong Soft Pliable
Domestic pig skin	Tough and durable The hair follicles may pierce the skin making it weak
Deerskin	Strong Soft Supple
Wolf fur	Fur does not freeze when damp
Snake skin	Vary in thickness depending when they were last shed

Table 4.4.3. Qualities of animal skins (sources for bear, wolf skin: Charles 1997:257, 263, sources for cow, horse, goat, pig, deer, sheep, kid: Kellogg 1984:30, 96, 108-109), Cow and calf, goat, sheep (Haines 1991:1-2).

Properties of skins

Cured skins and furs range from soft and pliable to firm and thick depending on the qualities of the skin and way it is treated. The qualities of skins depend on the species; some of these shown in Table 4.4.3. Big mammals such as bear, cows and horse have large, thick and heavy skins (Kellog 1984:29). Small mammals have small, thin and delicate skins, becoming thicker with age (Kellogg 1984:20). Skins are strong and resist wear and tearing. Due to their impermeable nature, skins are good for containing or resisting water, sun, wind or other substances. Furs are insulating, cushioning, textured and colourful. Curing methods will affect the colour and finish of the skin (Kellogg 1984:92).

Chronology of cloth types

The following summary represented in Table 4.4.4. is based on the evidence discussed above.

A wide diversity of thread-based cloth types are known from around 4000 BC when the earliest preserved cloth types are found in the lake dwellings. These include twined cloth types, woven textiles, knotted netting and knotless netting. Twined cloth (usually made of tree bast) is the most common cloth types in the lake dwellings and may well have been an established method of making cloth in the Mesolithic. Although some type of woven cloth may have existed before the Neolithic, woven textiles worked with fine spun thread and loom (usually linen) probably appeared with the introduction of farming. Evidence of cloth is scarce in the Bronze Age, and probably represents an increased use of wool for woven cloth, which seems to be born out in the amount of wool in cloth in the Bronze Age Hallstatt salt mines and later periods. Twining does not seem to be as important in the Bronze Age. Skins and furs seem to be important in all periods, with large quantities of skins found when preservation conditions allow.

There are probably a number of cloth types that remain completely lost: throughout several millennia there is a lack of preservation of wool and skins: individually or in combination these could have been used to weave, twine, knot or net a number of unique cloth types. As with the raw materials, the number of different cloth types is actually quite limited and shows consistency.

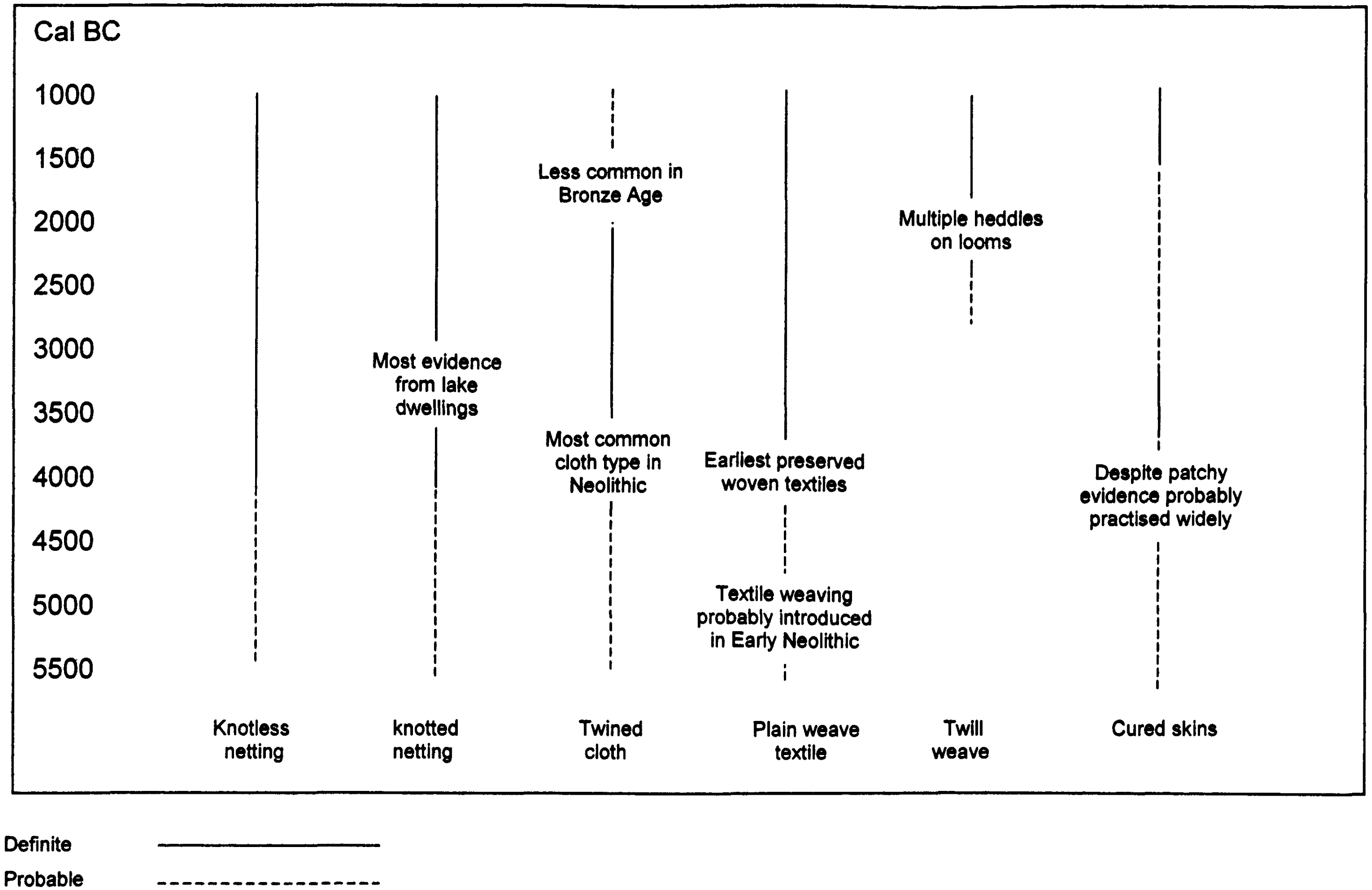


Table 4.4.4. Schematic diagram to show the chronology and coexistence of cloth types in the Alpine region between 5500-1000 BC

Cloth construction and gender

Weaving has frequently been associated with women in prehistory. As with spinning, most of the direct evidence comes from the Iron Age, including rare sources of representational evidence (Figure 8.3.a & Figure 4.3.3.b) and the presence of spindles and bobbins related to weaving (for example, Barber 1991:294, Barfield 1998:152-153). Again, as with spinning, whether the same gender division existed in earlier periods is debated.

In Murdock and Provost's work on the gendered division of labour, they note a number of gender distinctions in cloth construction activities (Murdock & Provost 1973:207,tab.). In the societies they studied, net making was nearly three times more often carried out by men than women; the preparation of skins and manufacture of leather products were equally as likely to be carried out by men as women while mat making and weaving on a loom were approximately twice as often carried out by women than men (Murdock & Provost 1973:207,tab.1). Arguably, these results do not necessarily enlighten the situation from the Neolithic to Bronze Age, but there are some points worth bearing in mind. As Costin argues, the gender division of labour in craft production (therefore including cloth construction) is strongly marked; that is to say it is common for craft industries to be exclusively worked by males or females and these may be kept distinct through physical and ideological boundaries (Costin 1996:123). Therefore, it is rare that men and women work in the same craft production, and when they do, they use different technologies, make different products or work for different purposes (Costin 1996:121-123).

While this might not make the actual gender attribution of these tasks in prehistory much clearer, it does suggest that the responsibility of the construction of co-existing cloth types may well have been the preserve of a particular gender groups. This is significant considering the co-existence of different loom types and brings into question the possibility that while women may have dominated the use of one loom type; men may have worked on another.

4.5 The construction of artefacts

While there is usually a lot of emphasis on the process of making cloth, only in a few cases is cloth used exactly as it was made. Often cloth is adapted by cutting and sewing or by attaching fastenings and ties. Sometimes, cloth is produced to shape so that construction of artefact and cloth are one and the same process.

Wrapping and fastening

Wrapped cloth artefacts are worked by opening the cloth out, either placing the content onto the cloth, or bringing the cloth to the contents then wrapping the cloth around it; this may then be tied, fastened or left to hang. Wrapped cloth artefacts may be fastened with ties, pins, buttons or other attachment. Nets are a type of wrapped artefact: floats and weights are attached and the net works by wrapping around the fish (FELD-003), Figure 4.8.3.c. The Iceman's clothes including grass cloak and striped garment were fastened by wrapping and tying (Goedecker-Ciolek 1993:109-110). The proliferation of bronze pins as garment fastenings in the Bronze Age is associated with a predominantly wrapped garment style.

Sewing

Sewing can be used to join pieces together, for hems and edges, to reinforce and to fasten on buttons and other paraphernalia. All cloth types can be sewn.

Archaeological evidence

The edge of a close twined bag made from oak bast from Mozartstrasse, Zurich Canton, Switzerland, dated c. 2700 BC, is turned over and sewn down and has a sewn loop (buttonhole?) on one edge (MOZA-002) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:217). There is a ribbed border sewn on a piece of plain woven linen textile from Zurich-Kanalisation Seefeld, Zurich Canton, Switzerland, dated c.2700 BC (KANA-002) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:214). There is stitching over the surface of a plain weave linen cloth of Lucone di Polpenazze, Brescia, dated to the Early Bronze Age (LUCO-006); this may be an area of repair or reinforcement (Bazzanella & Mayr 1999, scheda 6). It is similar to reinforcement stitching on a Copper Age tunic from Lorca, Murcia, Spain (Alfaro 1992: 26, fig. 8). Pieces of cloth are stitched on to the ends of the narrow woven linen strip from Molina di Ledro, dating to the Early Bronze Age; the sewing thread is wool (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:162). At the same site there are examples of stitching that appear to be decorative, one to sew on seed beads (MOLI-006), the other possibly embroidery (MOLI-008). These are discussed further in Chapter 8.

All the skin clothing and equipment found with the Copper Age Iceman was sewn. Some are sewn with sinew, others with spun plant fibre thread and others with skin strips (see Chapter 6). There are a number of examples of sewing on skin and woven wool artefacts in the Bronze Age Hallstatt salt mines (see Chapter 9).

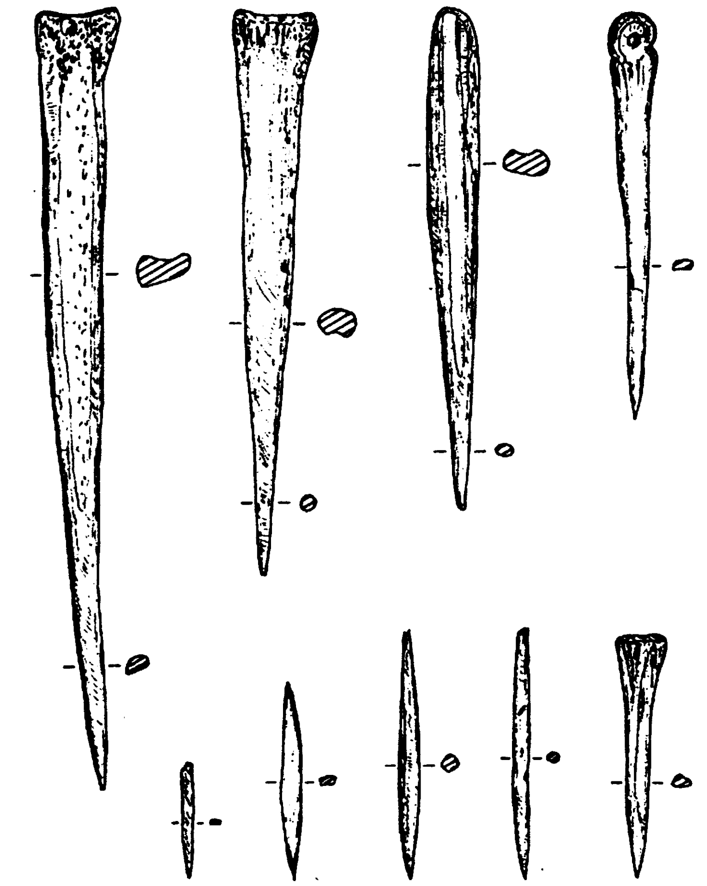
Needles used for sewing are rarely found on archaeological sites. Skins probably required the use of an awl to pierce a hole. Pointed bones that could have been used for awls are common in the Neolithic lake dwellings (Winiger 1995:135). This relates well to the results of use wear analysis on the points of bone tools from Square Mouth Pottery culture levels of Arene Candide, Liguria; of six artefacts studied, two awls were used to work fresh skins and one on dried skins (Maggi, Starnini, & Voytek 1997:518). Copper awls were possibly too soft for this purpose (Pearce 2000:70). At the Bronze Age cemetery of Singen, Constance Region, southern Germany there are a number of female skeletons buried with awls (Harding 2000:80). If taken as a symbol of women's roles in life, this suggests that sewing was a gendered activity in the society these women belonged to.

Methods of cutting and sewing

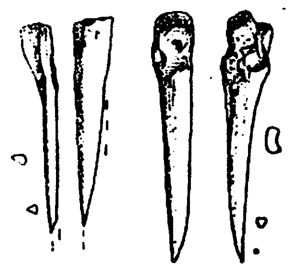
Cutting and sewing cloth artefacts involves measuring, shaping and fitting. Oakes and Riewe describe the process of making skin boots as practised by Inuit women in the 1980's in North America (Oakes & Riewe 1996:50). The seamstress measures the person's foot by eye or using hand measurement. These are projected onto the cloth with a pattern or reference points and then cut out (Oakes & Riewe 1996:51-56). Once cut out the pieces are sewn together and adjusted throughout the process so they fit properly. Similar processes are described in making clothing in 20th century Britain (Buckley 1999:61).

Making to shape

Some cloth is produced exactly to the shape it is required. This is most commonly found in small artefacts made with the twining technique such as the tree bast hats with pile (discussed below) and the net for the Iceman's shoes (Wood 1999); this is discussed in Chapter 6.



a)



b)

Chaîne opératoire of constructing cloth artefacts:	
Estimate your cloth resource ↓ Measure and make pattern ↓ Project pattern onto cloth ↓ Cut out the pieces ↓ Thread needle ↓ Match the joining edges and sew together	Estimate your cloth resource ↓ Open out the cloth ↓ Wrap the cloth around the object or body ↓ Fasten, tie or hang

Figure 4.5.1. Constructing cloth artefacts: a) Pointed bone tools from the Horgen culture levels of Feldmeilen Vorderfeld. Tool on the left measures c.25cm in length (Drawing from Winiger 1981:p.145,Taf.51 1-16). b) Pointed bone tools from Arene Candide; point on the left has wear evidence of working dry skins and measures c. 3.7cm in length; the point on the right has wear evidence of working fresh skins and measures c.4.5cm in length; (Drawing by E.Starnini in Maggi et al. 1997:536, fig.16.4 & p.537, fig. 17.11). c)Chaîne operatoire of making artefacts.

4.6 Cloth artefacts

A cursory glance through any photo documentary book across the world will include an abundance of cloth artefacts. Cloth can be used for clothing and bags, to cover dwellings, floors or walls, as bedding, containers with various contents, or to construct equipment such as saddles, sieves, quivers, knife sheaths and more. These cloth artefacts contain, cover and identify.

Cloth for clothing

Clothing refers to the individual garments cut from cloth wherease a costume is an assemblage of clothing, ornaments and fittings (Sørensen 1997:96-97,fig.2). I shall discuss clothing here and costume in secton 4.8. Clothing is put onto the body and attached by fastening, wrapping or tying. In the study region there is evidence of hats and headscarves, cloaks, tunics, leggings and belts..

Hats

There are a number of artefacts interpreted as hats made from tree bast, twined with pile from early third millennium BC contexts. Three come from Hornstaad Hornle IA, c.3900 BC and single finds from Wangen-Hinterhorn, c.3800-3600 BC (Figure 5.8.b), Sipplingen-Osthafen c.3300 BC and Seekirch-Achwiesen c.2900-2600 BC (Feldtkeller 2004:57-59,Abb.5 & Feldtkeller & Schlichtherle 1987:75-78, Dunning & Rast-Eicher 1992:72). There are two fur hats, with one from the Copper Age Iceman (Goedecker-Ciolek 1993:109) (Figure 6.2.c), another from the Bronze Age Hallstatt salt mines (GRUN-004) (Barth & Lobisser 2002:15), Figure 9.4.a. The patterned area on the head area of the stele 15 from Sion, Petit Chasseur (Feldtkeller & Schlichtherle 1987:75,fig.3), and on the head area of stelae Arco IV, appear to represent cloth head wear (Pedrotti 1995:50), Figure 7.4.c.

Cloaks

Although only fragments survive, tree bast twining constructions with pile are interpreted as a type of cloak or coat on the basis of their size and furry texture (Dunning & Rast-Eicher 1992:72, Rast 1995:150). Another example is the grass and lime bast twined artefact interpreted as a cape found with the Copper Age Iceman c.3300 BC (ICEM-010) (Egg 1993:80) and representations of cloaks on the stelae from Arco (II, III,IV, V) (Figure 4.1.4.b and Figure 4.6.1.a&b) and Lagundo (A,B,D) and possibly also the fringed rectangles of the Valcamonica rock engravings (Pedrotti 1998:301), Figure 4.7.3.c&d. There were probably wool examples of cloaks (and other items of clothing) as there were in northern Europe in the Bronze Age (Broholm & Hald 1940, Broholm & Hald 1948), Figure 4.8.2.a.

Tunics

Other upper body garments include the representation of what are interpreted as tunics on the stelae of the Alpine region (Pedrotti 1998:302). Outside the Alpine region, tunics are also known from the burial of Cueva Sagrada I, Lorca, Spain, dating to c. 2200 BC (Alfaro 1992:20-24). Other upper body garments appear to be wrapped like shawls, for example on Arco IV (Pedrotti 1998:302), Figure 4.6.1.b.

Belts

Belts are represented on the stelae and anthropomorphic engravings of the Alpine region (Pedrotti 1998:301-2, Pedrotti 2000a:138,fig.14), Figure 7.2.b&c. These may be associated with a number of examples of narrow strips of plain-woven cloth, such as those from Molina di Ledro, Trentino (MOLI-001, MOLI-002) (Bazzanella & Mayr 1995b:114-118). The Iceman wore a calf-skin belt (Groenman-van Waateringe 1993:126,Egg 1993:50) which was used to attach both the leggings and loincloth (Egg 1993:50), Figure 6.2.a.

Shoes

There are a number of tree bast shoes from the Neolithic lake dwellings, including two examples from Allensbach and one from Sipplingen, Lake Constance (Feldtkeller & Schlichtherle 1987:80-84). They are made of tree bast strips woven in plain weave (Körber-Grohne & Feldtkeller 1998:147). Another type of shoe is the net and skin shoes of the Iceman (Egg 1993:70); these are discussed further in Chapter 6. No shoes are known from the Bronze Age Hallstatt salt mines, although numerous examples are known from the Iron Age contexts (Hans Reschreiter pers.comm.).

Skirts and leggings

There are some suggestion of fringed skirts represented on the Copper Age stelae, for example the first phase of engraving on stele 27 of Sion, Petit Chasseur (Winiger 1995:128), or Aosta, Valle d'Aosta stele number 13 (Zidda 1998b:166). The lower half of the so-called tunics on the stelae may represent skirts (Feldtkeller & Schlichtherle 1987:75). Leggings are known from the Iceman, (ICEM-006) (see Chapter 6), but besides this example, are not attested until Iron Age examples from Vedretta di Ries, Bolzano, Italy (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:180, Bazzanella, Dal Rí, Maspero, & Tomedi 2005, Bazzanella, M. 2005).

a)

b)

Figure 4.6.1. Representations of clothing: a) Three views of Arco II, Trentino, Italy, 1.7m high. The back view (centre) is engraved with strips, the sides show slanting lines; these motifs have been interpreted as cloak with fringe. The multiple line motif around the centre is interpreted as a belt (Photograph by E. Munerati in De Marinis 1999:147,fig.2), b) Three views of engraved stele from Arco IV, Trentino, Italy, 86cm high. The figure represents a woman with headdress and striped cloak on her back. She has a stripped upper garment with circular dots on the lower edge (Photograph by E. Munerati in Pedrotti 1995:51,fig.10).

Fastenings

In the absence of cloth, clothing styles and technologies may be suggested from the durable remains of fastenings. Earlier research made a distinction between a traditions of skins, sewing toggles and buttons versus a tradition of single-piece wrap around garments, textile weaves and pin fastenings (Clark & Piggott 1970:306). The argument that the buttons of the Bell Beaker horizon were associated with tailored skin jackets and Bronze Age pin fastenings with textile clothing in various styles fastened with one or two pins (Clark & Piggott 1970:307). However, this view is contested as buttons may be used on thread-based cloth and textiles can used for tailored garments.

Clothing and issues of time, place, cloth type and social identify

Clothing is put on and taken off the body, Figure 4.6.2. At this point it may be stored, thrown away or given away. Like other material culture, clothing is used and discarded according to social choices. However, as material culture worn so close to the body it is particularly personal. The combination of forms, shapes, pattern and colours of cloth are readily associated with roles of gender, ethnicity, age and status of the people who made and use them. This is discussed in more detail in Chapter 7. The evidence shows the range of cloth types that may be used for clothing.

Chaîne opératoire of clothing use:

Select item of clothing
↓
Put on the body
↓
Wrap, tie or fasten as necessary
↓
Select other items of clothing to put on
↓
Add jewellery, equipment,
Hair ornaments etc.
↓
Wear
↓
take off
↓
Clean, care for, repair
↓
Store

Figure 4.6.2. Chaîne opératoire of clothing use.

Cloth as containers

Containers are artefacts used to enclose and hold. Containers may be used to store, transport or retain the contents. They may be re-used repeatedly, or buried in the ground with the contents of a hoard.

Archaeological evidence

There are a number of examples of cloth containers. There is a twined bag from Egolzwil 3, Canton Lucerne dated c.4000 BC that contains stone beads and flint flakes (EGOL-001) (Wyss 1990:131). There is a tubular container in twining with plaited wefts, from Arbon-Bleiche 3, Thurgau, that appears to be some sort of container, dated c. 3300 BC (ARBO-004), Figure 4.6.b (Leuzinger 2002:115-134). The remains of a drawstring at the upper edge of a piece of knotless netting from Feldmeilen Vorderfeld, is interpreted as the upper edge of a bag (FELD-012) (Winiger 1981:190-191)), Figure 4.4.6.d.

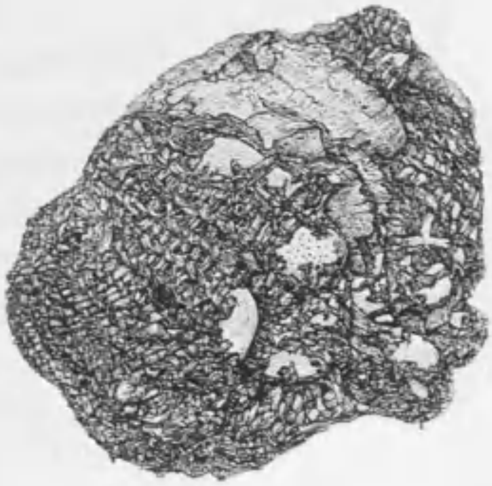
From Hornstaad Hornle IA, there is a small plain-weave linen draw string pouch (HORN-037) (Körber-Grohne & Feldtkeller 1998:170), Figure 5.7.a. The known examples of pouches include the calf-skin belt-pouch used to carry a number of small artefacts and the fur arrow quiver worn by the Iceman (ICEM-016, ICEM-011) (Groenman-van Waateringe 1993:126, Egg 1993:49-50).

Cloth as tools or parts of tools

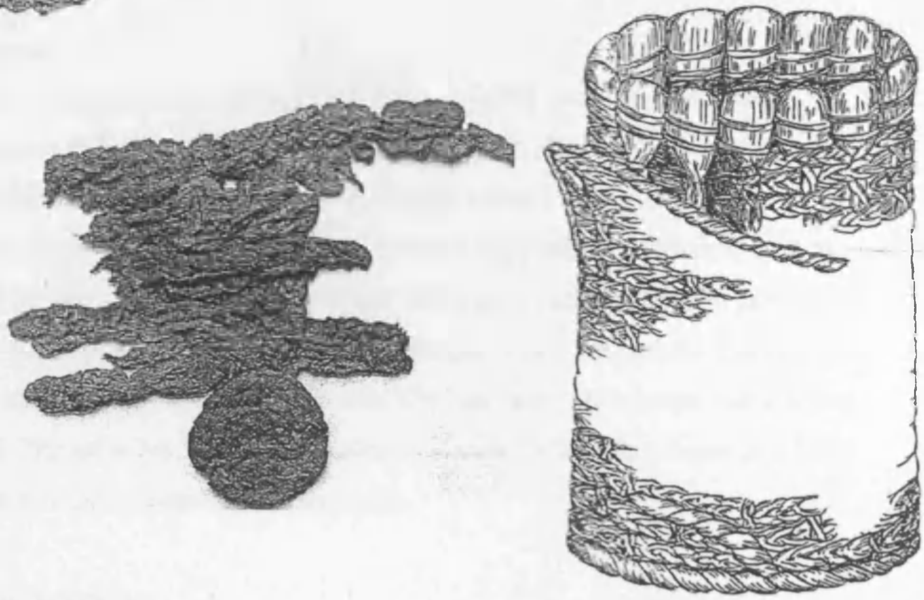
Cloth artefacts would have served as equipment and tools, or parts of these items.

Knife sheaths

There are representations interpreted as knife sheaths on the stelae from the Valtellina, northern Italy (Anati 1968:25-28, Casini et al. 1994a:154), Figure 4.6.4.a. The remains of skin attached to a copper dagger from via T. Buddio, Alba, Piemonte, Italy (BUDD-001) on display in the Alba museum is interpreted as a sheath. The most complete example is the twined tree bast knife sheath from the Iceman (Pfeifer & Oeggl 2000). Stone and metal cutting tools, such as knives or daggers are common and although sheaths are rarely preserved, they would have been integral parts of these tools, used to protect both the blade and the person handling it.



a)



b)

c)

Chaîne opératoire of container use:		
Select container ↓ Put item(s) in container ↓ Carry container to another place ↓ Take item(s) out	Select container ↓ Put item(s) in container ↓ Store or transport to another place ↓ Take item(s) out ↓ Use item(s) ↓ Put item(s) back in or replace with different contents	Select container ↓ Put item(s) in container ↓ Store item(s) in container

Figure 4.6.3. Cloth containers: a) Twined, pear shaped bag, top of bag missing, contains 30 stone beads, a number of shells and flint flakes, conserved length 13cm from Egolzwil 3, Wauwilermoos, Switzerland c. 4000 BC (EGOL-001) (Drawing from Wyss 1990: 131). b) Tubular container (left) and reconstruction diagram (right) from Arbon-Bleiche 3, Thurgau Canton, Switzerland. Reconstructed as a container it measures c.13cm high with a diameter of 7.5cm (ARBO-004) (Photograph and drawing from Leuzinger 2002: 131-132).
c) Chaîne opératoire of containers.

Hand protection

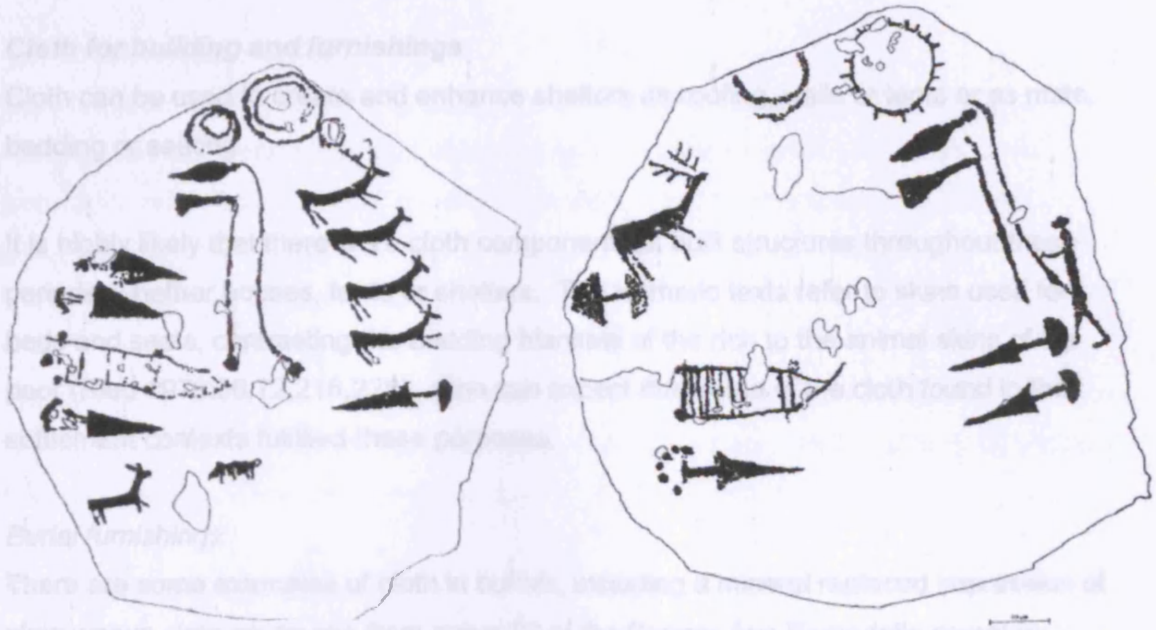
The role of cloth to protect the body is seen in other examples. A flint knife from Sipplingen, Lake Constance area dating to the Horgen culture has a piece of plain woven cloth attached to the top of the tool with birch pitch acting as a handgrip (SIPP-001) (Schlichtherle & Wahlster 1986:70-74). The so-called hand leathers from the Middle Bronze Age Hallstatt salt mines are other examples of cloth used to protect the hands, thought to be used when handling ropes (CHRI-010,CHRI-005, CHRI-008) (see Chapter 9).

Nets, traps and sieves

There are numerous knotted nets, particularly from the lake dwellings that are associated with fishing (Körber-Grohne & Feldtkeller 1998:171). Nets could also be used for catching birds and other mammals (Spindler 1995:118). Other cloth constructions could have been used as traps, Winiger suggests that the roll of close weft twining from Feldmeilen Vorderfeld, Meilen, Canton of Zurich dated c. 3200 BC (FELD-004) could have been part of a fish trap (Winiger 1981:160,taf.60-2 and p.188, abb.41). Another twined cloth artefact from this site has been interpreted as a sieve (Winiger 1981:166,170,taf 67-3, other examples in Banck 1994:179); there are other sieves known from the Lake dwelling settlements.

Containers, tools and gender

Containers and tools probably had gender associations. If hunting with a bow and arrow was largely a male gendered task, then an arrow quiver may have been associated strongly with men. If organising the household food stores was a female gendered task, then food storage containers may have been associated with women.



a)

Chaîne opératoire of the use of a knife sheath and a sieve	
Take the knife out of the sheath ↓ Use the knife ↓ Return the knife to the sheath	Put the grain in the sieve ↓ Shake sieve ↓ Sort grain and waste ↓ Empty the sieve ↓ Repeat process

b)

c)

Figure 4.6.4. Cloth artefacts for protection: a) Rock engravings interpreted as representations of dagger sheaths; the sheath is directly above the bottom left dagger on each composition, from Caven, Valtellina, Northern Italy, (left) (drawing from Anati 1968:25-28) , (right) height 110cm (drawing from Casini et al. 1994:154, fig.92). b) Chaîne opératoire of a knife sheath and a sieve. c) Stone tool with birch pitch and textile hand grip, only the impression of plain weave textiles remaining, from Sipplingen, Lake Constance, Horgen culture, (Photograph from Schlichtherle & Wahlster 1986: 70-74).

Cloth for building and furnishings

Cloth can be used to create and enhance shelters as roofing, walls or tents or as mats, bedding or seating.

It is highly likely that there were cloth components of built structures throughout these periods, whether houses, tents or shelters. The Homeric texts refer to skins used for beds and seats, contrasting the bedding blankets of the rich to the animal skins of the poor (Rieu 1976:36,72,216,228). One can expect that some of the cloth found in the settlement contexts fulfilled these purposes.

Burial furnishings

There are some examples of cloth in burials, including a mineral replaced impression of plain weave cloth on an axe from grave 83 of the Copper Age Remedello cemetery (REME-001) (Acanfora 1956: 355, fig.9) and five small scraps of charred plain-weave linen cloth in a secondary deposit from the cist burials of Sion, Petit-Chasseur, Swiss (PET-001) (Bocksberger 1976a:86), Figure 7.10.b.

Cloth re-use and repairs

All types of cloth wear. They may lose their shape, fur or colour, tear, stretch or simply fall apart. Worn out cloth may be made into other artefacts or used as rags. Evidence for cloth re-use is discussed in Chapter 9. An example of repairing is discussed above in section 4.5: an example of sewing in relation to the Iceman's leggings in Chapter 6. Repairs and re-use are significant in extending the useful life of cloth.

Chronology

Although there is only a limited number of cloth containers and tools, this is an issue of preservation: the actual number was probably immense and related to specialist as well as general use. The types of cloth containers and tools probably changed over time and in different areas, with the focus on: economic activities such as hunting, fighting or travelling in the mountains (quivers and backpacks); or agricultural tasks (grain sacks, harvesting sheets or bags); as well as changing social structures for containers used in ceremonies and special events.

4.7 Decorative techniques

Decorative techniques applied to cloth primarily alter the visual appearance of cloth, but may also affect the properties of cloth such as texture or smell. As evidence for decorative techniques on cloth is mainly derived from cloth fragments, this creates a bias in the preservation as more thread-based cloth is preserved than skins. Representations of cloth are another source of evidence.

The alteration of the visual appearance of cloth is often used symbolically, with appropriate colours, textures and patterns for men and women, regional groups, social roles and events. This is discussed further in Chapter 7 and 8.

Natural colours and textures

Before moving into artificial colouring and embellishment it is worth considering how the natural colours and textures of cloth can be used to create texture, contrast and colour difference.

Tree bast fibres from lime, oak and elm are all different shades of brown, yellow and orange (Körber-Grohne & Feldtkeller 1998:156, fig.16), and were potentially sources of visual effects and contrasts. The use of bast thread with contrasting colours is recorded in an un-charred, twined cloth with pile from the Late Neolithic, Pfyn culture lake dwelling of Wangen, Lake Constance, dated between 3824-3586 BC (Körber-Grohne & Feldtkeller 1998:133,176, taf.19a), I have not illustrated this find as the colours are not apparent in the black and white photo. The addition of pile to the surface of cloth, mostly to the surface of twined tree bast, but with some plain weave examples, has been discussed as a construction technique (section 4.4), however, as it is a type of fur imitation (Feldtkeller 2004:57), it could have been applied for the textured effect.

Similarly, flax fibres vary in colour from white to light grey, depending how they are processed. The natural colour of goat and sheep's wool ranges from black, grey and brown to white. Hundt documented the natural colour of wool fibres from the Grünerwerk Bronze Age salt mines, which included pure white and light yellow white to dark brown (Hundt 1960:148). Contrasting natural colours can be used to create visual contrast through stripes, embroidery or supplementary threads, although there is very little evidence of this from the Neolithic to Bronze Age.

Figure 4.7.1. The natural colour of plant fibres. Clockwise from bottom left: elm bast fibres and elm bast cord, lime bast fibres twined with cotton string, plain woven linen cloth with flax fibres on top, bundle of lime bast fibres (far right), lime bast two ply thread, loop of oak bast fibres (centre). All from experiments by Susanna Harris (Photograph, Susanna Harris).

Skins are naturally coloured and textured. The use of alternating light and dark goatskins worked in stripes of the Iceman's upper garment (ICEM-005) (Figure 6.3), shows the potential of skins to be sewn in decorative patterns. The variation of colour in fur is evident in the skins from the Bronze Age Hallstatt mines where colours range from light to dark with shades of cream, yellow-brown and brown (CHRI-001, CHRI-005) (discussed in Chapter 9).

Colouring cloth by printing or dyeing

Colour pigments are fragile and unlikely to be preserved on cloth, however there is evidence for possible printing stamps,dyeing and the application of colour pigments on other surfaces.

Printing

Printing involves the application of colour to the surface of cloth. One of the earliest clues to cloth decoration in the Neolithic are the stamp-shaped *pintaderas* found in assemblages from Middle Neolithic Square Mouthed Pottery I and II sites in northern Italy (Bagolini 1992:295). These baked clay objects with incised patterns on one side and a knob on the back are usually interpreted as body stamps (for example Whitehouse 1992:82-85), but equally could have been used on other surfaces, such as cloth (Barber 1991:175). To print cloth, a pigment paste would be applied to the stamp surface and applied to the cloth. Examples of the patterns from the *pintaderas* are shown in Figure 4.7.2.a.

Dyeing

Dyeing involves the immersion of fibres, thread or cloth in a solution of coloured pigments with the aim to colour them. The evidence for dyeing is combined with evidence of weaving patterns (see below). When Vogt analysed the weave structure of various examples of Neolithic cloth, he proposed that the complex patterns would only have been visible if they were produced with coloured threads, although due to the charred nature of the cloth these colours are no longer visible (Vogt 1937:74). Such patterns are found on two artefacts in plain weave with twill, which are supplementary weft stripes, discussed below, from Robenhausen, Switzerland (ROBE-008), (Vogt 1937:52-53, abb.84-85) and (ROBE-017) (Vogt 1937:71, abb.108-109), Figure 4.7.3.a. Although the dating is uncertain, they probably dated to the Pfyn culture, c.3650 BC (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:231).

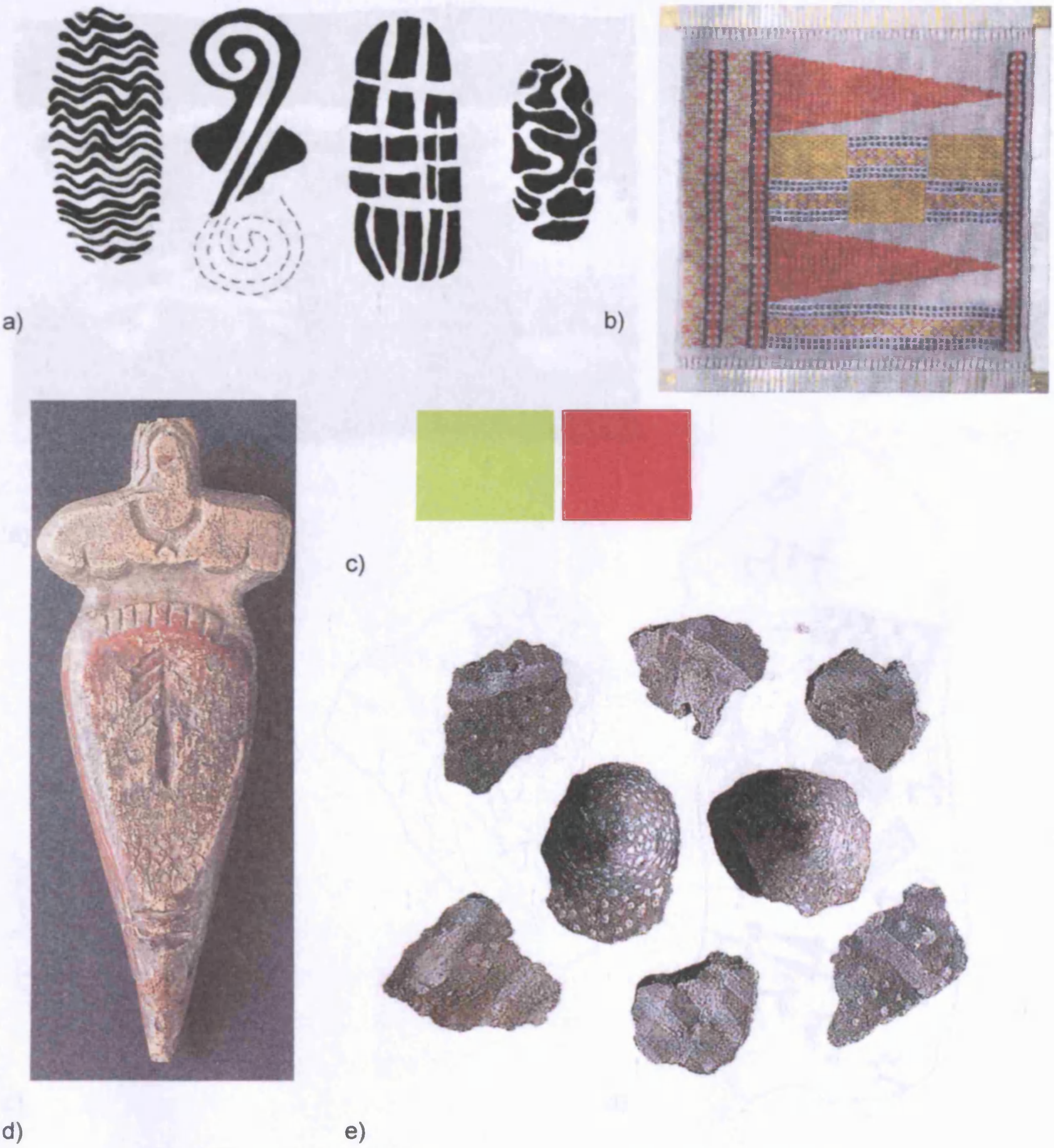


Figure 4.7.2. Decorative techniques: a) Impression of patterns as printed from the surface of pintaderas, from left to right: Isolino di Varese, La Vela Trento, Arene Candide (x2), (Drawing by Susanna Harris after photographs of the base incisions of *pintaderas* in Whitehouse 1992:83,fig.4.11). b) Museum reconstruction of the woven cloth with supplementary wefts from Irgenhausen, Pfäffikon, Canton of Zurich, IRGE-001, 22x16cm, linen; the colours are not those identified by the chemical analysis (T. Aste, in Bazzanella & Mayr 1995a:129,fig.2). c) Approximate dye colours of *Cornus mas* and *Rubia tinctorum* (after Bazzanella & Mayr 1995a:131-137). d) Female figuring with red ochre (from Pedrotti 2000a:138,fig.14), e) White painted patterns on clay wall pieces from Ludwigshafen-Seehalde, Pfyn culture (Photograph from Fatzer & Leuzinger 2004:89).

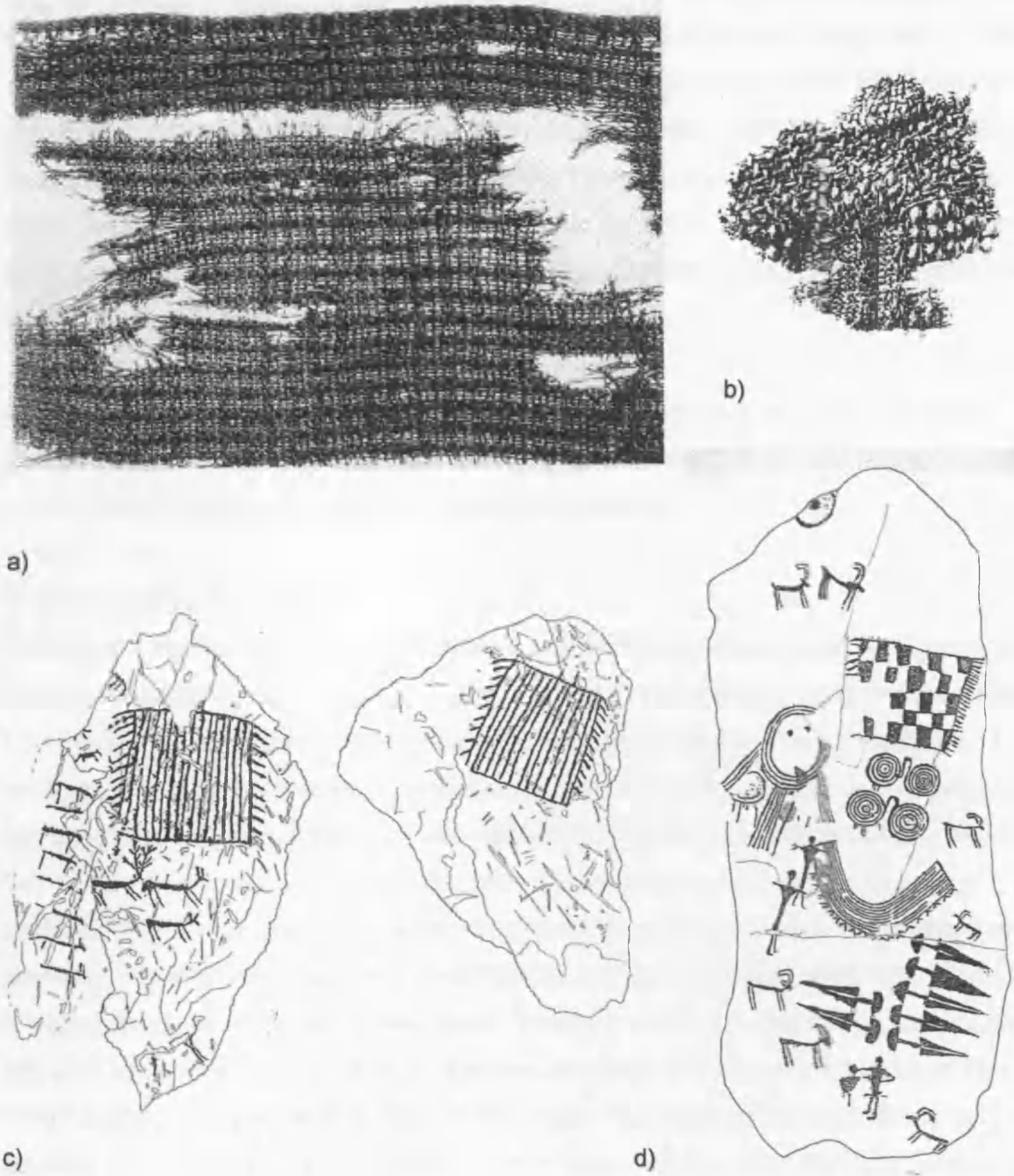


Figure 4.7.3. Decorated cloth: a) Plain weave linen cloth with stripes from Robenhausen, Switzerland, 16.5x8cm; stripes in weft created by rows of twill over 3 warp fibres, ROBE-008 (Photograph from Vogt 1937:52-53, abb.84-85). b) Two piece of plain weave cloth joined with a section of knotted netting, with seed beads of *Lithospermum purpureo-coeruleum* sewn on in rows through two holes made in the seeds, 4.2x3.8cm, Murten, Fribourg Canton, Switzerland, MURT-001 (Photograph from Vogt 1937:37,Abb.62). c) Tracing of a rock engraving including two fringed rectangles with stripes on two engraved faces of a stone boulder from Ossimo, Valcamonica, Italy; maximum size of boulder 135cm high and 78cm wide (Drawing from Casini et al. 1994b:178,fig.109). d) Tracing of a rock engraving including a fringed rectangle with cheques; engraved face of a boulder from Borno, Valcamonica, Italy;dimensions of surface c.200x80cm (Drawing from Casini, De Marinis, Fedele, Fossati, & Odone 1994b:193,fig.124).

The technique of adding supplementary wefts can be used for complex patterns, for example the unique patterned cloth from Irgenhausen (IRGE-001) (Vogt 1937:76-90). shows a reconstruction of this cloth, Figure 4.7.2.b. The colours were identified by chemical analysis as blue, red, purple and yellow (Brunello 1973:10-15, also quoted in Rast-Eicher & Reinhard 1998:288). This cloth has recently been radiocarbon dated to 1685-1493 cal.BC (Rast-Eicher 1995:173); Early to Middle Bronze Age. There is only one piece of dyed cloth from the Bronze Age Hallstatt salt mines (CHRI-018) (Grömer 2005b:20).

This tiny piece of olive coloured, woollen cloth in twill weave is from the Christian-Tuschwerk mine is dated to the Late Bronze Age Urnfield Culture; the dye was applied to the cloth rather than the threads (Grömer 2005b:20).

Botanical evidence for dyes

There are a number of plants and minerals that could have been used for colouring cloth in the Late Neolithic to Bronze Age. For example, in the first occupation of the Late Neolithic site, c. 2668-2580 of Charavines, Lake Paladru, France there are unusual proportions of madder (*Rubia sp.*) pollen. This plant can be used to produce a red dye, Figure 4.7.2.c. There are also dwarf elder seeds (*Sambucus ebulus*) which can be used to produce a purple juice which could have been used for dyeing or painting. The berries are not suitable for food because they are poisonous (Bocquet & Berretrot 1989:123, Bocquet et al. 1987:33-54, quoted in Cardon 1998:3-5). There are a large number of cornelian cherry seeds (*Cornus mas)* and elder seeds (*Sambucus nigra)* in some levels of the Bronze Age lake dwelling of Molina di Ledro (Dalla Fior 1940, quoted by Bazzanella & Mayr 1995a:130). The wood of the cornelian cherry can be used for brown, olive and yellow colours (Figure 4.7.2.c), and the elder berries and leaves can be used for lilac, green and black while the bark can be used for a yellow or green (Bazzanella & Mayr 1995a:132). The presence of these plants, especially non-edible species on settlements hint at dyeing.

Colour pigments

Evidence of cloth decoration is found on less perishable surfaces than cloth. For example, ochre was found in the Early Neolithic burials at Arene Candide, Liguria (del Lucchese 1997:607-608) and red ochre was applied the female figurine from the Riparo Gaban, Trentino, dating betwee the Early and Middle Neolithic (Pedrotti 2000a:136-138), Figure 4.7.2.d. White lime paint patterns (dots and criss-crosses) have been found on wall fragments from Ludwigshafen lake dwelling settlement, Lake

Constance dating to c.3900 BC (Fatzer & Leuzinger 2004:89, Schlichtherle 1997:14), Figure 4.7.2.e. In northern Italy, coloured minerals were excavated from the base of the Copper Age engraved stelae at Cemmo, (Anati 1976:37, fig. 27) and Ossimo Anvòia in the Valcamonica, Brescia (Fedele 1995 :50). The use of coloured pigments may have been common, however, the extent to which they were applied to cloth is unknown.

Methods of collecting pigments and dyeing

Berries, leaves, roots and bark for pigments may have been seasonally available and place specific according to their habitat or origins. Ochre is found in some areas of the Alps. Pigments may be stored and often need to be prepared before use; rare dyes could have been traded. For dyeing, the fibres, thread or cloth may have been dipped in a mordant solution. A mordant is a chemical (such as those in urine and yeast) that encourages the dye pigment to attach to the cloth and increase its fastness (Goodwin 2003:20-28). The dye analysis of the Iron Age Hallstatt textiles dated between c.800-400 BC showed the presence of copper and iron ions. These may have been mordants obtained from dipping the cloth in urine or yeast (Hartl & Hofmann-de Keijzer 2005:92-94). A similar technique may have been applied in the Bronze Age.

Historically dyeing involves lots of water, watertight containers, pigments, a drying area as well as gloves, stirrers, dye storage containers and a supply of heat from a fire (Cannon & Cannon 1994:11). The fibres, thread or whole cloth may be immersed in the dye solution for a suitable period of time, then taken out to dry. The process of dyeing may use toxic, unpleasant or smelly substances, and is liable to dye other items (hands, skin, surfaces) that come into contact with the process. The permanence of dyes probably varied.

Surface embellishment

The surface of cloth can be embroidered or embellished with beads or small items.

Embroidery

There is evidence of embroidery on a piece of plain-woven linen cloth from the Early Bronze Age lake dwelling of Molina di Ledro (MOLI-008). The stitches form a strip 20mm wide and running along one length of the fragment (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:170-171), Figure 8.5.b. A fragment of cloth from Feldmeilen shows stitching holes, which may be evidence of stitching decoration with a fibre that was not preserved, possibly wool (Ruoff 1981:256). Spindler argues that the stitching on the calf-skin belt-bag of the Copper Age Iceman used to reinforce the construction was also decorative (ICEM-016) (Spindler 1995:106-108). Embroidery and fancy stitching techniques could be worked on any type of cloth; it is unclear the extent to which embroidery was practised.

Beads

There are several examples of seed beads attached to the surface of cloth, for example from the Neolithic lake dwelling settlement of Murten, Switzerland, (MURT-001) (Vogt 1937:37,abb.62&64, Barber 1991:140) and another from the Bronze Age lake dwelling of Molina di Ledro (MOLI-006) (Battaglia 1943:51-52, pl. 20.2a). Rast-Eicher argues that the small Glies-type buttons from the Middle Neolithic were for decorative effect (Rast 1995:149). Although it is rare to find beads attached to cloth, pierced beads are known from Neolithic sites. Schlichtherle identified a number of pierced *Prunus spinosa* seeds from Sipplingen and Hornstaad lake dwellings on Lake Constance and *Taxus baccata* seeds from Greifensee. He suggests the similar pierced form of these seeds could show that such a practice was more common than the rare examples attached to cloth indicate (Schlichtherle 1988:202,abb.4).

Beads could be sewn onto any cloth or woven directly into cloth. Embroidery can be worked on all cloth types using a needle and thread; skins may have been worked with an awl. Comparatively easy to put down and pick up, sewing requires a source of light and a place to sit.

Weave patterns

Patterns can be worked directly into the structure of woven cloth by adding extra thread (supplementary wefts), by changing the order of passing the weft over the warp (twill) or a combination of these methods. I have discussed the evidence of patterns created with supplementary wefts above in relation to dyeing.

Twill

Twill is worked by passing the weft over two or more warp threads in a systematic manner to create a pattern. Rast-Eicher argues that twill weave was known from the end of the Neolithic based on the evidence of representations of looms with multiple heddles in the Valcamonica, which can be used to create this effect (Zimmerman 1988:26-38 in Rast-Eicher 2005), Figure 4.4.4.a. In addition, she argues the complex patterns on the engraved stelae of Sion, Swiss Valais and Aosta, Italy are likely evidence of twill technique and date to the Beaker culture of 2400-2200 BC (Rast-Eicher 2005:128), Figures 7.2-7.6. She dates this very precisely to the Early Bronze

Age on the basis of the stelae and Valcamonica rock engravings. However the Valcamonica engravings are notoriously hard to date, Anati quotes the date as c.1200 BC (Anati 1994:159). Therefore this is are not a secure way to date other artefacts or horizons of technical development. A type of twill weave is the Early Bronze Age lozenge decorated narrow-woven strip from Molina di Ledro (MOLI-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:161). More frequently preserved examples of twill weave are dated much later, for example from the Bronze Age galleries of the Hallstatt salt mines (CHRIS-018) (Grömer 2005b:20), Figure 9.4.b. Twill weave affects the structure of the cloth: wool twills are more elastic that plain weave wools.

Selvedges, starting and finishing borders

Fancy selvedges, starting and finishing borders, also offer an opportunity for decorating woven cloth. Starting borders and selvedges were sometimes made with ribbed effects, with an example at Robenhausen (Vogt 1937:49-50, Barber 1991:134). Evidence from the analysis of the cloth construction shows that starting borders and selvedges may have been controlled separately from the plain-weave body of the cloth (ROBE-012) (Vogt 1937:50-51, Barber 1991:135). Sometimes fringes were knotted in bunches, some quite simple (ROBE-012) (Vogt 1937:52-55, Barber 1991:135) and Utoquai, Canton of Zurich (UTOQ-001) (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:224-225) or the Early Bronze Age examples from Lucone di Polpenazze, Brescia (LUCO-001, 004,005) (Bazzanella & Mayr 1999). Some were elaborate and probably coloured (ROBE-010, LUSH-001) (Vogt 1937:55-65, Barber 1991:136-137).

Adding weave patterns

Decoration in the weave needs to be carried out as the cloth is woven; the weaver controls these effects. The starting borders may have been made separately as a means of organising the warp; Marta Hoffmann recorded Scandinavian weavers making similar types of starting border in the 1960's (Hoffmann 1964:64-67). Selvedges would need to be worked at the beginning and end of each passing of the weft. The closing border would finish it off; an elaborate means of preventing the cloth from unravelling. Weaving patterns require more skill and time than plain weaving. However, these patterns could be added in by hand and do not necessitate complex loom devices (Vogt 1937:75, Bazzanella, Belli, & Mayr 2003a:277).

This decoration is also a source of creativity. Barber captures this in her book "Women's Work: the first 2000 years" (Barber 1994). When referring to the Neolithic lake villages of central Europe, she states: "Above all else, these weavers loved fancy borders. (...) Then having neatly framed the cloth on three sides, these weavers threw all their ingenuity into devising a bottom border" (Barber 1994:92-93).

Animal skin: scoring, cutting and embossing

Skins can be decorated with a number of techniques; adding fringes, cutting into the surface, embossing and colouring with paint or dye.

There are examples of tiny fringes around the edge of the thumbhole of several of the hand leathers from the Christian Tuschwerk galleries at Hallstatt (CHRI-008, CHRI-009, CHRI-020). Skins may well have been embossed, as are some metal artefacts, for example the silver pectoral from a Copper Age burial at Villafranca Veronese, Verona, Italy (Casini et al. 1994a:217). Jensen proposes that the embossed, punched and linear patterning on Late Bronze Age sheet metal armour, helmets and shields is reminiscent of leather ornamentation (Jensen 1999: related catalogue entries number 147-153, pp.251-253). Looking further afield there is a Late Neolithic or Early Bronze Age sheep-skin dagger sheath from Wiepenkathen, northern Germany (Clark 1937:178-179) which has a herringbone pattern scored onto the surface. A similar artefact is represented on the Copper Age stelae of Aosta (Zidda 1998a:170-3).

Cloth decoration in representation

Cloth representations include a number of decorative effects. I have already mentioned the source of representations in relation to the evidence for clothing in section 4.6.

The patterned and coloured decoration on the Neolithic figurines from Riparo Gaban, Trentino may be interpreted as decoration on costumes (Bazzanella 1999:196-197). There are a number of different types of decoration on the clothing of the Copper Age stelae from the Alpine region. The body areas of the stelae from Sion, Petit Chasseur, Switzerland are covered with patterns including zigzags, lozenges, rows of dots, checks and triangles, see Figure 7.8. This is discussed in detail in Chapter 7. Similar representations were engraved on the stelae from the funerary site of Aosta, Valle d'Aosta, Italy (De Marinis 1995b, Mezzena 1998). I have referred to the striped decoration on the stelae from Arco, Trentino, Italy in section 4.6 above, Figure 4.6.1. There are strips engraved on the fringed rectangles, of the Valcamonica and Valtellina, Brescia, Italy. These fringed rectangular shapes with fringes, appear typical of woven cloth (Harris 2004:56-60). The decorative patterns in these representations contrast to the mainly plain cloth artefacts that are found at settlement sites. It may suggest that these costumes were more decorative than ordinary cloth. Similarly, the metal ornaments and arms represented on the stelae may show they were ceremonial attire and may have held symbolic meaning (Casini 1994c:95).

In the Bronze Age there are a number of female figurines from central Europe which appear to represent clothed figures that are decorated with a spirals, zigzags, dots, triangles and other geometric patterns (examples given in Barber 1994:142, Feldtkeller & Schlichtherle 1987:75, Casini 1994a:110, Harding 2000:373). Even excluding motifs thought to represent ornaments, there remain a number of patterns that appear to be associated with cloth.

4.8 Cloth Assemblages

Experiencing cloth as part of assemblages that is, in groups and combinations, is the most usual way in which we come into contact with cloth in our own or other societies. Whether cloth is part of a house interior, a costume, a wedding dowry, equipment for agriculture, work, leisure, festivals, as burial furnishings, or items of trade, cloth in society is bound to how it is experienced in these contexts. Therefore to understand the social context of cloth is to recognise these assemblages and how they are used and perceived.

Recognising these assemblages is problematic from the Neolithic to Bronze Age as cloth assemblages are rarely intact. The few assemblages that are preserved do not represent the diversity of cloth assemblages that must have existed. Despite this, it is necessary to engage with this stage of the chaîne opératoire, which is the culmination of choices made throughout the extended chaîne opératoire. These assemblages take us full circle, as such equipment, costume, housing and trade items enable and inspire people to create or acquire the cloth and cloth artefacts that have been described in the previous chapters.

To investigate cloth assemblages, I have split this into three subject areas: costume and wardrobe, equipment for activities and occasions, cloth for trade and gifts. This chapter is more speculative in some sections, as a means to broaden the argument from the few cloth assemblages that remain to fill the gaps where the many long-lost cloth artefacts would have been.

Costumes and wardrobes

A costume is an assemblage of clothing, ornaments and fittings (Sørensen 1997:96-97,fig.2). Costumes can be adapted or made to suit the particular circumstances, occasions, gender, age and social roles. As people may own more than one costume, it is necessary to think about the store of clothing that these components are selected from. For want of a better word, I call this a wardrobe. Whether a wardrobe with a small number of available garments or from a large array, the significance of wardrobe is to consider that a single costume need only be part of a larger assemblage available to an individual.

Costumes in the Neolithic

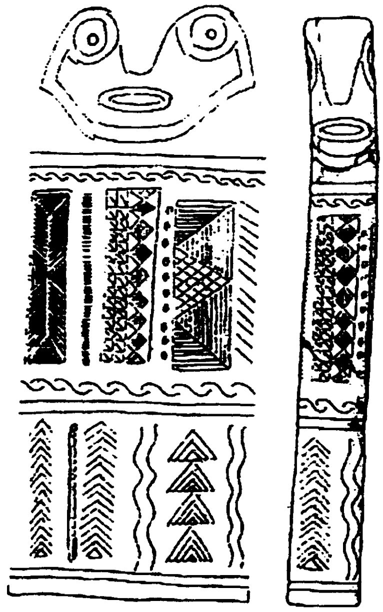
As discussed in section 4.6:hats, there are a number of tree bast hats worked in twining with pile, tree bast sandals and larger pieces of tree bast cloth, which may have been wrapped garments. These contemporary garments may have been worn together, (Dunning & Rast-Eicher 1992:72, Rast 1995:150, figs 95&96, Schlichtherle 1997:9,Abb.4), Figure 4.8.1.a. The patterned and coloured decoration on the Neolithic figurines from Riparo Gaban, Trentino, discussed in section 4.7 may indicate a costume (Bazzanella 1999:196-197) (Figure 4.7.2.d. and Figure 4.8.1.b.). Looking further afield, decorated figurines dating from the Neolithic to Bronze Age from central and eastern Europe point towards costumes with v-shaped necklines, with patterned and ornamented belts, upper garments and skirt (referred to in Dunning & Rast-Eicher 1992:74, Rast 1990b:124,abb.3, Harding 2000:373,fig.11.3), Figure 4.8.1.c&d.

Costumes in the Copper Age and Bronze Age

The Copper Age Iceman is wearing a costume that includes an upper garment, leggings, loincloth, belt, cape, shoes and hat in a variety of skins and plant fibre cloth types (ICEM-001-018), Figure 6.1. The Iceman's costume is obviously associated with a man; unfortunately there is no comparable female costume. The representations of individuals on the Copper Age and Early Bronze Age stelae of the Alpine region include combinations of cloak, tunic, belt (Pedrotti 1998) and shawls (Casini 1994b:106), they appear to be gender differentiated costumes (see Chapter 7, Figures 7.2-7.7;).

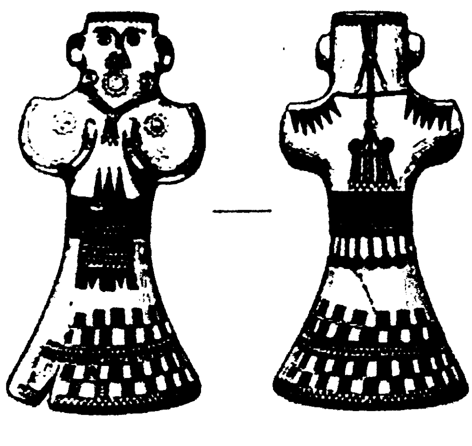
Costume and gender

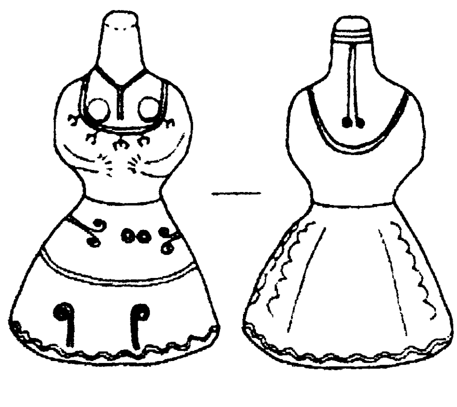
Although there is poor evidence of gender in costume in the Neolithic of the Alpine region, Mesolithic or Neolithic rock paintings of clothing from the Spanish Levant show hats, skirts, leggings and possibly aprons or loincloths, which appear to be differentiated according to gender: men wearing leggings, and women knee length skirts (Winiger 1995:123,Abb.6.). Research of the position of pins and ornaments on the body in burials by Wels-Weyrauch of female costumes in southern Germany suggests that women were distinguished by two different costumes while men worn only one type (Wels-Weyrauch 1989, quoted by Sørensen 1997:99). Complete costumes are preserved in the Bronze Age Danish oak coffin burials including gender differentiated costumes of woven woollen tunics, tops, capes and string skirt (Broholm & Hald 1940, Broholm & Hald 1948). Male figurines dating to the Bronze Age from Sardinia are shown wearing flat hats, tunics, skirts and cloak (Harding 2000:369-371,fig.11.1) Figure 4.8.2.b.



b)

a)

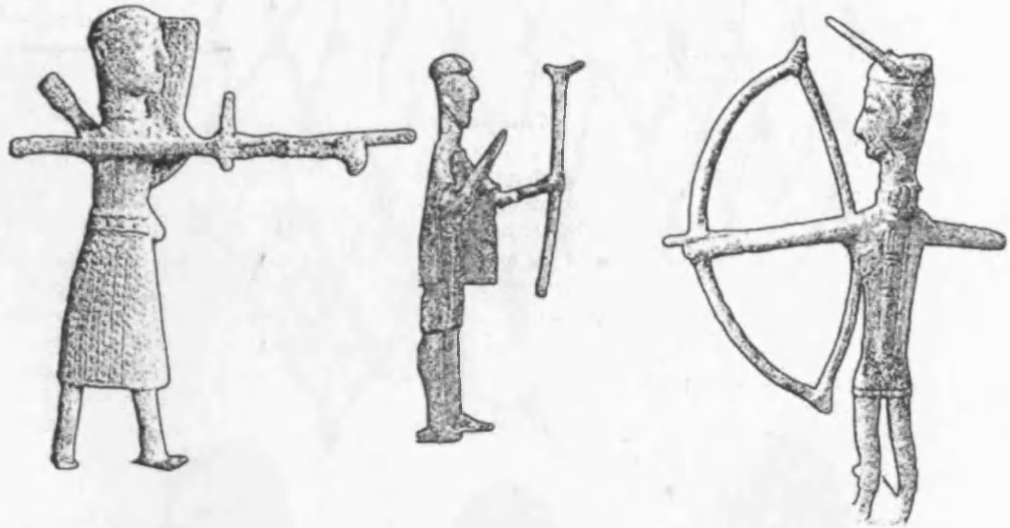




c) d)

Figure 4.8.1. Costumes: a) Reconstruction of a man wearing a hat, cloak and shoes from tree bast (Drawing from Schlichtherle 1997:9,fig.4). b) Human femur (right) engraved in the round (left) from Riparo Gaban, Trento. As the engraved face makes it appears anthropomorphic, the decorations may indicate clothing (drawing from Bazzanella 1999:197,fig.8). c&d) Bronze Age figurines from Kličevac, Smederevo and Gaj, Banat, Serbia (Drawings from Schumacher-Matthäus 1985 in Harding 2000:373,fig.11.3).

a)



b)

Figure 4.8.2. Costumes: a) Bronze Age costumes from the Danish oak coffin burials. Man's costume (left) from Muldbjerg and woman's costume (right) from Egtved (Photographs from the National Museum of Copenhagen in Harding 2000:371,fig.11.2). b) Sardinian bronze figurines wearing costumes including tunic cloak, hats and skirts (Drawing in Harding 2000 :370,fig.11.1).

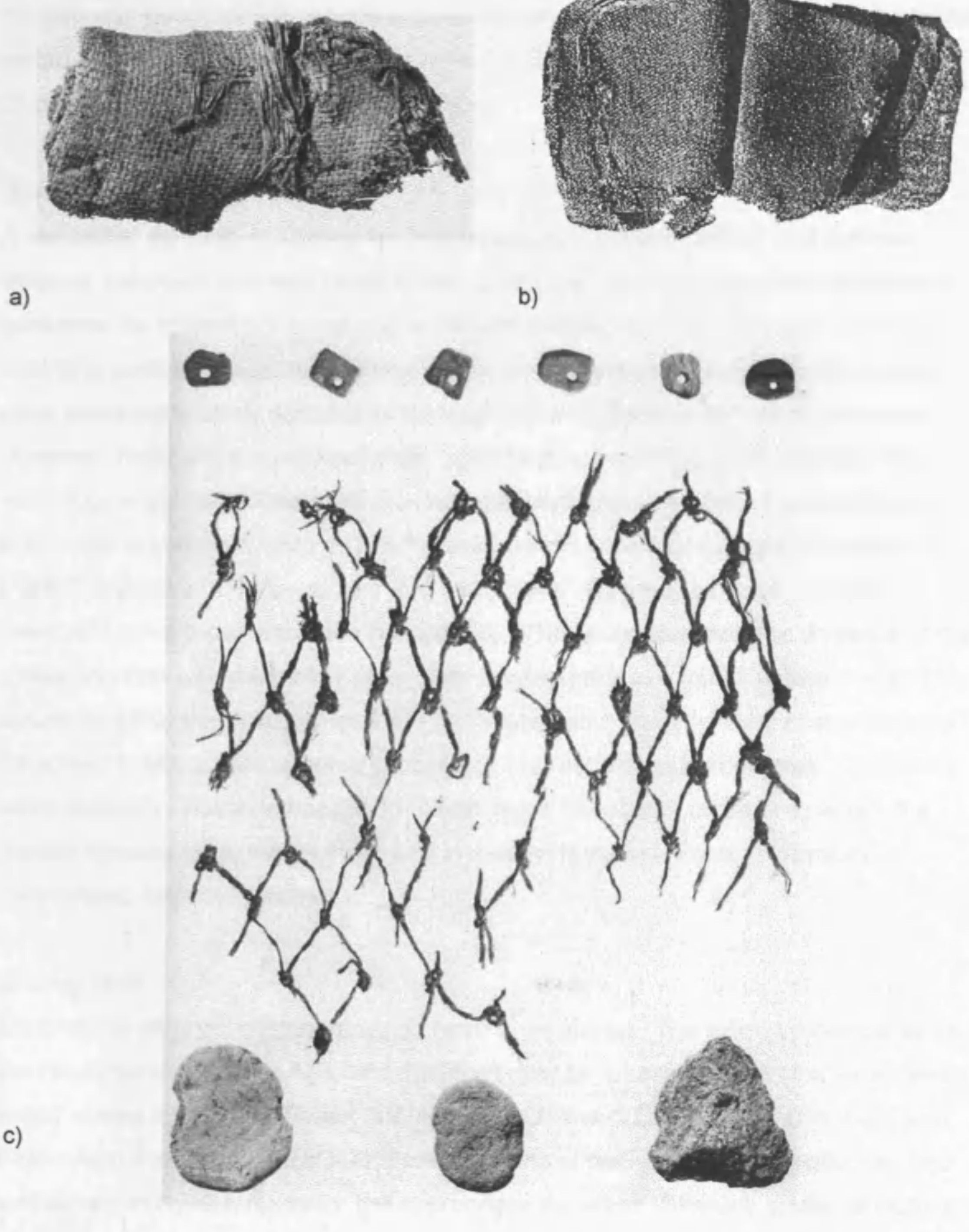


Figure 4.8.3. Cloth assemblages: a) Rolled and tied bundles of plain weave linen cloth from Twann, Berna Canton, Switzerland, dimensions unrolled 65cm x7.7cm wide (TWAN-001) (Photograph from Bazzanella et al. 2003b:242). b) Layers of preserved cloth from Molina di Ledro, Trento, Italy, dimensions 13 x 15cm (Photograph from Battaglia 1943: 52). c) Fishing net with floats shown above and weights below (FELD-003) (Photograph from Winiger 1981:189,taf.75).

Regional costumes

The idea of regional costumes in the Copper Age is most evident from the stelae, as the different geographical groups appear visually different. Compare for example the stelae from Arco, Trentino, Italy (Figure 4.6.1.a&b) with the costumes of Sion, Petit Chasseur, Swiss Valais (Figure 7.2-7.6).

Wardrobes

A wardrobe, as such, is implied when archaeologists debate winter and summer clothing, raincoats and hats (Rast-Eicher 2005:124), promoting the idea of different costumes for individuals according to climatic conditions. The Iceman's costume including padded shoes, fur upper garment and leggings with water resistant grass cape seem particularly adapted to the cold and wet of a high altitude environment. However, there are a number of cloth types he is not wearing, such as those made of wool, flax or oak bast fibres, yet are known in contemporary sites. For example woven linen cloth is known at such as Arbon-Bleiche 3 on Lake Constance (3384-3370 BC) (ARBO-6, ARBO-009) (Leuzinger 2002:115-134). This may indicate a costume selected from a wider wardrobe (Chapter 6). The decorative patterns on some of the stelae contrast with the mainly plain cloth artefacts that are found at settlement sites, suggesting that these costumes were more decorative than ordinary costumes (see Chapter 7). Many choices were probably in play in relation to costumes. Costumes were probably chosen in relation to the occasion (meetings, ceremony, work), the person (gender, age, status, role) and in relation to cultural context (ethnicity, chronology, regional groups).

Storing cloth

Clothing for different costumes would have to be stored. The rolled-up narrow strips of the Neolithic and Bronze Age lake dwellings may be a case in point. For example the rolled woven strips from Twann (TWAN-001), Molina di Ledro (MOLI-001, 002) and Feldmeilen Vorderfeld (FELD-007) may be parts of clothing that were rolled up, tied and stored in houses ready for the appropriate occasion. Similarly stacks of cloth, such as the twenty three pieces of woven textile found in a lump at Valle delle Paiole, Brescia (PAIO-001) and examples from Molina di Ledro (Figure 4.8.3.b) may represent cloth artefacts that were originally folded for storage. These rolled, folded and tied cloth artefacts hint at cloth storage, which is important in the search of understanding the way cloth assemblages were used, whether for costumes, or other purposes.

Equipment for activities and occasions

In the section on artefacts as tools and equipment, building elements and furnishings, I discussed the use of individual artefacts. Now it is necessary to envisage these as part of a larger assemblage of tools or accessories.

Cloth assemblages associated with food procurement

Fishing equipment in the Neolithic lake dwellings included not only nets but also weights and floats (Winiger 1981:189,taf.75) (Figure 4.8.3.c). In the same way, arrow quivers, containers, nets, and weapon covers are aspects of a hunting or fighting assemblage. This is particularly evident in the artefacts associated with the Iceman, including a quiver, belt-pouch and suitable clothing (Egg 1993, Spindler 1995). Therefore cloth is part of hunting, fighting and fishing assemblages.

Crops needed harvesting, some of which may have required cloth containers, sheets or sacks, as was the case historically in northern Italy, where big woven sheets were used for collecting the hay harvest (Kezich, Eulisse, & Mott 2002:5-7). All sorts of containers would have been useful in food production whether for collecting food from the forest or agricultural crops. At least some of these would have been cloth, although wood and basketry were probably also important. Therefore cloth is an integral part of food procurement assemblages.

Cloth assemblages in food processing

Sieves with twined tree bast mesh have already been discussed (see above). Liquid processing, such as cheese making or brewing, probably needed cloth equipment, especially for liquids. Norland identifies historical examples in northern Europe of knotless netting hair strainers used for cheese making. He proposes that similar strainers may have been needed to line the Bronze Age pierced ceramic containers which are associated with cheese making (Nordland 1961:18). This indicates the possible role of cloth in material culture assemblages used to carry out these processes.

Cloth in production

Impressions on the base of Neolithic pots at Fimo-Molino Casarotto, Vicenza, Italy (FIMO-002-003) (Bagolini et al. 1973:201,fig.31), show how cloth was sometimes used in some processes of pottery production to rest wet pots on before they were fired. These impressions, including one example that appears to be twining (FIMO-002) are sometimes classified as mats and here the boundary between flexible and rigid materials is unclear and perhaps not particularly meaningful in this context. Another use of cloth is as components of bellows, used in pyrotechnical activities (Kezich, Eulisse, & Mott 2002:57), such as metal smelting (Harding 2000:220-221). There are no surviving cloth parts but ceramic *tuyères* (bellow nozzles) dating to the Bronze Age are known in the Alpine region, for example at Molina di Ledro (Rageth 1974:175-176,Taf.91). In the Bronze Age Hallstatt salt mines, cloth was use for containers, straps to tie and bind artefacts and as hand-leathers to protect the hands during rough work (Barth 1994:28-29, Reschreiter 2005:13, Grömer 2005b:20); these are discussed in detail in Chapter 9. Other hot or abrasive processes, such as cooking or metal ore sourcing, may have used cloth equipment to protect the hands and body.

Cloth and weaponry

Another area where cloth, particularly animal skins, is recognised is in the context of weaponry, fighting and defence. Daggers in burials are often found around the waist area (Harding 2000:275). If they were worn on the body they were probably protected by a sheath, which also served to attach it to a belt. In the Bronze Age swords are common and again, may well have been protected by a sheath. In the northern European rock art dating to the Bronze Age, male figures wear sheathed swords at the waist (Harding 2000:271). Sheaths, scabbards, belts and quivers enabled weapons to be worn on the body ready to be used.

Just as important is the protection of the body from these weapons. Surviving armour is of sheet bronze and is therefore the most commonly discussed, but leather and wood versions are assumed (Harding 2000:285-291). As discussed above, Jensen proposes that the embossed, punched and linear patterning on Late Bronze Age sheet metal armour, helmets and shields was reminiscent of leather ornamentation (Jensen 1999: related catalogue entries 147-153, pp.251-253).

Cloth, animal traction and harnesses

During the Bronze Age horse harnesses are known via the preserved cheek pieces, which must have been connected by straps, often thought to be skin straps. Bronze Age examples of these non-cloth harness pieces are known from Castione dei Marchesi, Fidenza, Italy (Harding 2000:169-172). Equipment for traction animals, such as ploughs, probably required cloth components, as did historical examples (Kezich, Eulisse, & Mott 2002:14). Although skin straps are often anticipated for these connecting areas, world-wide examples show that thread-based cloth is often used for muzzles, girths and straps (Collingwood 1987:44-45&60-63).

Cloth assemblages and ceremony

There is little evidence for cloth assemblages associated with ceremonial events. The use of cloth in burials has been referred to above (section 4.6: Cloth for building and furnishing). Paraphernalia for special occasions probably existed, but is difficult to detect. This may have included shrouds for the dead, musical instruments, masks and costumes.

Cloth and the home

Dwellings of all sorts would have contained assemblages of cloth artefacts for bedding, seating, wall coverings, doors and other divisions of space or comfort. The quantity and type of cloth in homes probably varied considerably.

Cloth, trade and exchange

There is everything to believe that cloth, readily transportable and desirable, was one of the many items traded and exchanged. Early texts show the importance of cloth for trade and exchange in Minoan and Mesopotamian Bronze Age societies. Ethnographic accounts state the importance of cloth in trade and exchange transactions, whether over long distances or between smaller social network groups.

The Alpine region was involved with some means of trade or exchange with other areas. This movement of goods can be researched by tracing the origin of raw materials; when an artefact made of raw material from outside the area it must have been brought there by another means. Stone sources are especially useful for this (Hoffstadt & Maier 1999:31). However, there are few avenues to investigate this. The raw materials that are known in the Alpine region for cloth were all available in this area. Even if some societies did not have access to some of these resources, so far research methods have not been able to detect this. Another means of detecting trade and exchange may be through evidence of specialisation in villages or societies. This was discussed in section 4.3: spinning with a spindle whorl. However, there is no strong evidence for this from the Neolithic to Bronze Age. Rather than specialisation, the division of labour within households or among families might have been more important.

Chronology, societies and cloth assemblages

The quantity of cloth, as well as types of cloth and cloth assemblage probably varied substantially between different societies. For example, the role of cloth is particularly important in mobile societies as it is readily transported, comparatively light weight and does not break. Mobile hunter gatherer societies use a high percentage of cloth material culture. This is the case with documented hunter-gatherer groups, where perishables such as cloth may make up to 95% of the material culture (Soffer 2000:59). By contrast, in societies where mobility is not so important, cloth may have been a less important material. For example, in the Museo degli Usi e Costumi della Gente Trentina, Trentino, Italy, a museum dedicated to agricultural societies of the region in the 19th-20th century, cloth artefacts were used in nearly all the assemblages of production and ceremony, yet wood was the predominant material. The significance of this is difficult to quantify in relation to the many societies of the Neolithic to Bronze Age with varying elements of mobility, sedentism, agriculture, exchange and the use of wild resources. However, it does bring to attention that there are potentially very different demands for the amount of cloth and type of cloth and cloth artefacts in societies, which may have changed in time and place.

This chapter as a resource

In this chapter I have collated a large amount of evidence relating to the extended chaîne opératoire of cloth from the Neolithic to Bronze Age. In each section, there are many issues that could be expanded and discussed in depth. However, to investigate the social context of cloth requires that this evidence is put into the context of specific societies; that is, the cloth types that co-existed and the cloth cultures that were practised. Therefore, I see this chapter as a resource to investigate the social context of cloth in individual case studies, as I shall present in the next five chapters.

PART III

THE CASE STUDIES

CHAPTER 5

Time and place structures in the production and use of cloth at Hornstaad Hörnle IA, Lake Constance, c. 3900 BC

In the previous data chapter, I presented the archaeological evidence for the extended chaîne opératoire and developed social contextual themes in relation to this evidence. In this chapter, as the first of five case studies, my strategy is to employ this research to investigate the social context of cloth at individual archaeological sites. I have selected each of the case studies to cover the widest possible range of evidence and develop these in order as to discuss the many aspects of the social context of cloth. By choosing individual sites as a basis for the case studies, I am deliberately adding a contextual, place and time specific, dimension to my argumentation. This strategy enables me to add depth and detail to the analysis of the extended chaîne opératoire, which is essential to bringing out the human dimension of this research. I will then use conclusions from the case studies to return to a more wide-ranging discussion of cloth from the Neolithic to Bronze Age in the Alpine region in Chapter 10.

In this first case study, I have chosen Hornstaad Hörnle on Lake Constance, one of the earliest sites with preserved cloth in the Neolithic. The site has been meticulously excavated, dated and researched. There are preserved remains of a variety of cloth types made from plant fibres, along with evidence for the procurement and processing of fibres for cloth. This provides detailed evidence, both for chronology, seasonality and continuity over a set period of time and also for the location of activities associated with the acquisition of raw materials, processing of fibres, construction and use of cloth in the village and surrounding landscape. On this basis, I have chosen to develop the themes of time and place in relation to the chaîne opératoire of cloth from the acquisition of raw materials to the assemblages of cloth use.

Investigating time and place in social context

Issues of time and place are intimately related to the way people create and interact with material culture and are a formative avenue of research in this thesis. Before starting the analysis of the site, I will first consider time and place as aspects of social context in more depth through ethnographic and historical examples.

In 1971, Marie Jeanne Adams wrote a short article on "Work Patterns and Symbolic Structures in a Village Culture, East Sumba, Indonesia" (Adams 1971), based on ethnographic fieldwork on the island of Sumba in 1969. In this paper she describes how the time schedules of producing ceremonial cloth, including the annual seasonal cycle of agricultural work, the length of time to produce a cloth (up to four years), and occurrence of life-cycle events, are intricately related to metaphors of male and female, mythology, and processes of social life, including the meeting of young people, pregnancy and the negotiation of in-law relationships.

Another short article on textiles, "Learning to Weave in Chinchero" (Franquemont & Franquemont 1987), relating the authors' fieldwork in the 1970s, explores how structures of time and place strongly influence the process of learning to weave in the community of Chinchero, Peru (ibid, 55). They outline a number of stages in learning to weave; these are not prescribed, but are stages that roughly correspond to a female's upbringing and, if carried out, lead to a full knowledge of weaving.

The stages are: at first the young girl learns to spin at home with her mother. Then, through time looking after sheep away from home, she learns to weave with her peers (and presumably also learns how to care for the source of the wool, the sheep). When too old for this she returns to work in the village where she learns the next stage of weaving, from another woman, putting the learning into practice when setting up her own home (by weaving bedding, clothing and other items). with a woman's duties as mother and wife, there is little time to weave as she is bound to the demands of agriculture and trading textiles in the market, but once the children leave she has time to spend at home at the loom, and in old age may significantly develop these skills, until eyesight or dexterity fails and she again returns to spinning.

The authors highlight how this method of informal training is highly effective, yet readily broken if another time / place cycle intervenes. Therefore, a girl who goes to school will miss the early stages and never pick up these skills, or a childless woman may not be allowed to use a certain loom. Although not written as an article on time / place cycles, their work shows the significance of the coincidence of timing and place in allowing skills to develop and the right teacher / student relationships to be made; at home, in the village or watching the sheep.

In many ways, both of these papers anticipate post-processual approaches in archaeology. Adams' paper does so more explicitly as a goal, but Franquemont and Franquemont do so through their detailed narrative and observations. Ingold's discussion of taskscape is relevant here. He discusses the significance of temporality (time and timing) and the pattern of dwelling in the landscape (artefact, movement, place) (Ingold 1993: 511). It is this view of people interacting in contexts of time and place that is inherently social:

> "The temporality of the taskscape is social, then, not because society provides an external frame against which particular tasks find independent measure, but because people, in performance of their tasks, also attend to one another. Looking back, we can see that Durkheim's error was to divorce the sphere of people's mutual involvement from that of their everyday practical activity in the world, leaving the latter to be carried out by individuals in hermetic isolation" (Ingold 1993:518).

This is what Adams and Franquemont and Franquemont illustrate so well in their analysis of time and place structures: it is these structures inherent in the production of cloth that are intrinsic elements to wider aspects of social life: people meeting (peers, lovers, teacher and pupil), the problems of conflicting cycles (other agricultural tasks, school, child-rearing), ceremonies to mark stages in time (harvest, the presentation of a marriage / funeral cloth), as well as the relevance of stories and myths associated with oral interpretations of these events. While such symbolic significance of time and place structures can rarely be accessed in prehistory, the comparison of different structures, both between contemporary cloth types and in long-term chronological change, can be.

It is this development of the social nature of time and place, and related constructs in archaeology and the recognition of these as structures, that I want to develop in this chapter. With a case study of the extended chaîne opératoire of cloth, including flax and tree bast acquisition, fibre processing and construction (twined cloth, netting, plain weave) and use at the lake dwelling village of Hornstaad Hörnle 1A, Baden Württemberg, Germany, I shall discuss time and place in relation to the location of tasks in the village and wider landscape, and the temporal aspects of these extended chaînes opératoires, whether daily, seasonal or over a number of years. Through this analysis, I believe it is possible to show that comparative cloth types are not merely different technical solutions to problems, but are part of the way that people's lives are created and made meaningful, and can be recognised as such, even though the abstract symbolic connotations of such structures remains intangible.

The archaeological context of Hornstaad Hörnle IA

Hornstaad Hörnle IA is a lake dwelling settlement, situated on the Hori Peninsula of the Untersee on Lake Constance, Figure 5.1. Approximately 3900m² was systematically excavated by Helmut Schlichtherle between 1973-1980, and since 1983 the excavation has been part of the "*Schwerpunkt programms*" (Dieckmann 1987:28, Dieckmann 1991:84-86). The village was located in the shallow water zone on the lake shore, an area that is flooded in summer but is relatively dry during winter (Maier 2001:12). The settlement is one of the oldest known lake dwelling settlements in the north Alpine foreland: dated by dendrochonology, it was occupied between 3917-3905 BC, belonging to the local Recent Neolithic[6] and gives its name to the Hornstaad culture (Billamboz 1998, quoted in Maier 2001:12). These precise dates, show the short life-span of the village, which contrasts to the wide time ranges obtained by Radiocarbon dating and therefore makes it an ideal site for the examination of issues of time.

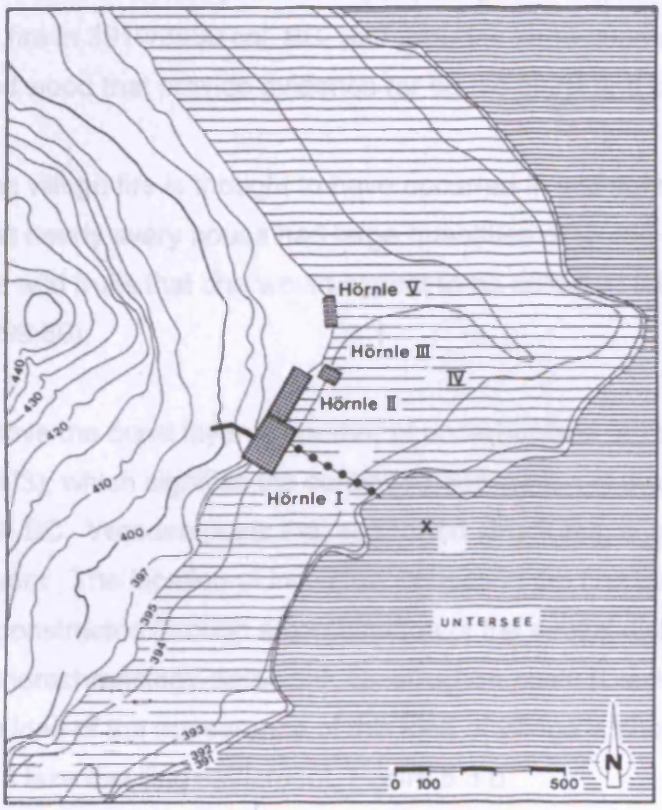
Hornstaad Hornle IA is one of a number of settlements and occupation phases on the peninsula. It is the lowest levels of a site called Hornstaad Hornle I. Stratigraphic layers AH1-3 (Figure 5.2.a) are considered together as cultural layer "A" and the excavation is "I", hence the name of the earliest village occupation phase is Hornstaad Hörnle IA (Dieckmann 1991:87-89, Maier 1999:88, Billamboz 1998). IA is covered by a substantial layer of lake chalk, covered by a later occupation layer (AH4), which corresponds to a Pfyn culture settlement that is beyond the scope of this paper[7] (see Dieckmann 1991:87 and Schlichtherle 1990:35, 41-47, Maier 1999:88, Billamboz 1998). Fifty metres to the north is another lake dwelling settlement, called Hornstaad Hörnle II, which is 30 years later: this and a number of other sites are shown on the site map (quoted in Maier 2001:13), Figure 5.1.a.

The first phase of occupation, Hornstaad Hornle IA, beginning around 3917 cal BC, is marked as AH1 in Figure 5.2a, and consists of a thin sand and organic layer containing uncarbonised waste material, especially wild fruit and threshing remains, and faeces from the lake dwelling settlement.

---

[6] Jungneolithikum / Recent Neolithic (Schlichtherle 2004b: 28, 4300 – 3500 BC).

[7] Hornstaad Hörnle IB, Pfyn settlement is dated between 3586-3507 BC (Billamboz 1998 quoted in Maier 2001:12)



a)

b)

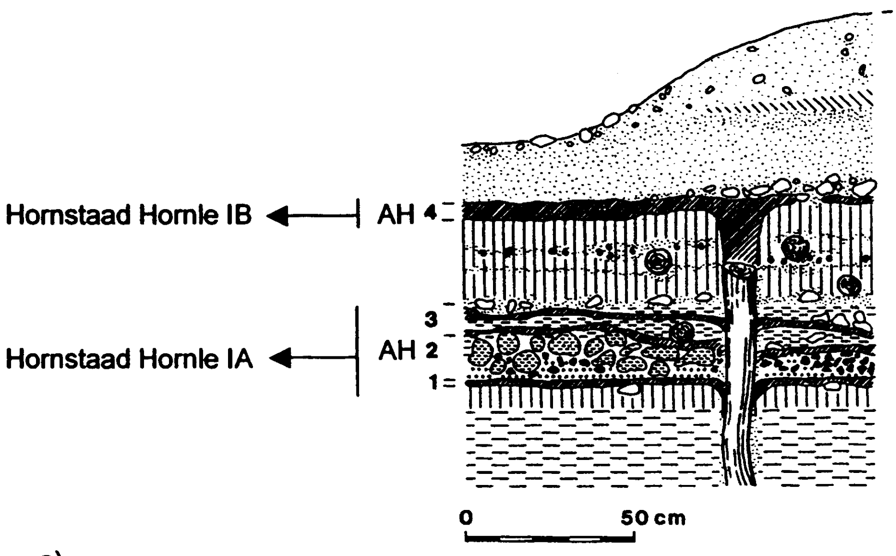
Figure 5.1 a) Location map of Hornstaad Hörnle showing site I to IV. This case study concerns only level A of Hornstaad Hörnle I, Lake Constance. The main lake area is marked with close parallel lines, shallow water zone with wider horizontal lines, and excavated areas marked with rectangles filled with dots, the dry land to the left is shown with contour lines (Map from Dieckmann 1991:85,Abb.1). b) The site of Hornstaad-Hörnle, Lake Constance photographed in 2005 (Photograph by Susanna Harris).

This was covered by a burnt layer (AH2) which represents the destruction of the village by fire in 3910/3909 cal. BC, and includes large quantities of carbonised grain, loam and wood that provide evidence for house plans and contents.

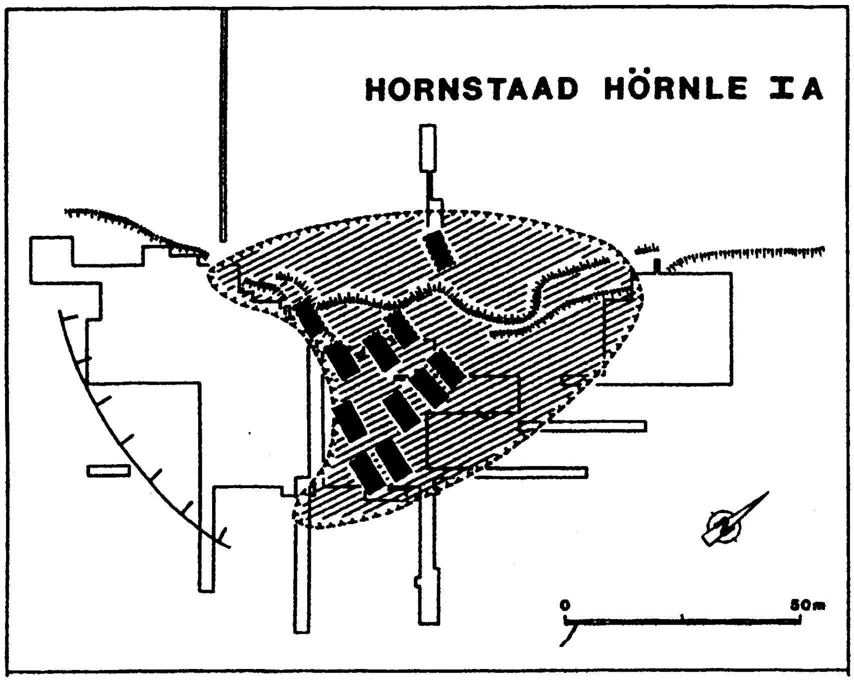
The village fire is thought to have occurred in late summer or early autumn on the basis that nearly every house had large quantities of stored un-threshed cereals and few of the wild fruits that one would expect to be collected later in the autumn (Maier 1999:89).

Above the burnt layer is another of uncarbonised organic waste material and loam (AH3), which signifies the continued occupation of the site from 3909 cal. BC to 3905 cal. BC. Wooden posts that supported structures, such as houses, are present in all layers. The location of individual houses in the first building phase has been reconstructed through a combination of the spatial distribution of the house daub and dendrochronology-dated oak construction posts (Dieckmann 1991:92-93), Figure 5.3.a. An idea of the appearance of this kind of village is shown in the museum reconstruction of a lake dwelling settlement, Figure 5.3.b.

The waterlogged and charred conditions aided the preservation of textiles and basketry of plant fibres (tree bast, linen, grasses). Cloth of skins or animal fibres would not be preserved in these conditions, as the alkaline deposits do not support the preservation of these materials. There is still not a complete analysis of the textile finds, but there are two extensive analyses (Schlichtherle 1990:124-131 & Körber-Grohne & Feldtkeller 1998). The first is a catalogue of finds from the earlier excavations within a monograph of the site, concentrating mainly on the analysis of construction types; the later is the work of botanical and textile specialists with comprehensive analysis of raw materials, processing treatments and construction types. A number of stages in the extended chaîne opératoire of cloth processing and construction can be identified from these publications. In addition, there is also a spatial analysis of the nets and net-weights in relation to houses (Dieckmann 1991: 95-96).

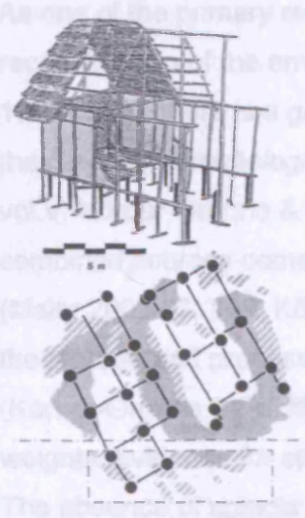


a)



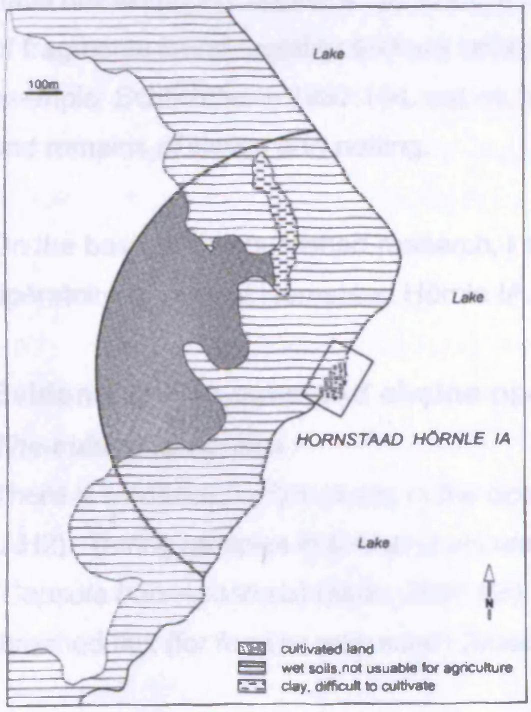
b)

Figure 5.2 a) Excavation profile of Hornstaad Hörnle 1 showing layers AH1-3 which constitute the first occupation period (A) and AH4, the later Pfyn settlement (B) (Diagram from Dieckmann 1991:88,Abb.3). b) Plan of the houses of Hornstaad Hörnle IA. The excavated areas are outlined, the extent of the archaeological deposit A is marked by diagonal parallel lines, the position of the houses are shown with black rectangles (Diagram from Dieckmann 1991:86, Abb.2).



a)

b)



c)

Figure 5.3 a) Lower diagram shows the correlation between the place of the oak posts (black dots) and the distribution of fallen daub (grey area), used to identify the position of individual built structures. The upper diagram shows a reconstruction of the structure (Diagram from Dieckmann 1991:92,Abb.5). b) Museum reconstruction of Neolithic lake-dwelling houses with palisade, based on excavations at Sipplingen, dating to c. 3500 BC. Unteruhldingen, Lake-Dwelling Museum, Lake Constance (Photograph by Susanna Harris), c) Model based on environmental data of the cultivatable land near to Hornstaad Hörnle IA. The cultivated land is shaded dark, the wet soils unsuitable for agriculture are shown with horizontal lines, a small area of clay is shown with short horizontal dashes (Diagram from Maier 1999:89,fig.3).

As one of the primary research goals of the excavation of Hornstaad Hörnle was the reconstruction of the environment and economy (Maier 2001:13, Schlichtherle 1990:150ff), there is a great deal of high quality research available, mainly published in the *Siedlungsarchäologie im Alpenvorland* series, Stuttgart (vol.I. Schlichtherle 1990, vol.V. Körber-Grohne & Feldtkeller 1998, vol.VI. Maier 2001, Vogt 2001). From these combined sources comes evidence for the cultivation of flax and collection of tree bast (Maier 2001:67, 139, Körber-Grohne & Feldtkeller 1998:157-158), as well as aspects of the storage and processing of these raw materials to prepare and extract the fibres (Körber-Grohne & Feldtkeller 1998:137, 148-155). With no spindle whorls or loom weights, evidence for spinning and weaving comes from the cloth finds themselves. The absence of spindle whorls and looms weights does not necessarily mean people were not producing thread and cloth; there are a number or reasons for this which I have discussed in Chapter 4. In terms of complete cloth artefacts, there are a number of fragments found together that are believed to come from the same piece (for example: Schlichtherle 1990:194, cat.no.1082-1100) as well as a twined hat with pile, and remains of sieves and netting.

On the basis of this published research, I shall outline the evidence for the chaîne opératoire of cloth at Hornstaad Hörnle IA.

Evidence of the extended chaîne opératoire at Hornstaad Hörnle IA

The cultivation of flax

There is evidence for flax plants in the occupation (AH1 and AH3) and burnt layers (AH2). Boring samples in this area showed the evidence of typical flax-weed plants (*Capsela bursa-pastoris*) (Maier 2001:68); flax-seeds stored in a pot are evidence of threshed flax (for food or crop seed) (Maier 2001:68, Schlichtherle 1990:154-156).

Original mixed forest of lime, beech and oak was cleared by the settlers of Hornstaad Hörnle IA (Maier 1999:89). Based on the pedological survey and the reconstruction of Neolithic soil situations, it is thought that the village cultivated a large field area (*Parabrauerden*) on the drier, fertile soils away from the lake shore, relatively close to the village, within a radius of 200-700m from the settlement (Maier 1999:89-90, Maier & Vogt 2000:124-129, Vogt 1990:139-143). Comparison from the examination of woodland weeds in the cereals and flax suggests that flax may have been cultivated closer to pioneer woodland than to the cereals (Maier 2001:104).

Field cultivation methods are part of a wider debate in archaeology (for example, Bogaard 2004). Taking a site-specific approach, the lack of woodland plants, perennial weeds and dominance of annual seeds in the cereal store of Hornstaad Hörnle IA suggests that after the initial clearance the fields were cultivated continuously for many years without fallow periods and were not worked as a shifting cultivation system (Maier 1999:90). Similarly, lack of perennials indicates that cultivated land was worked intensively by digging and hoeing, preventing these weeds from taking hold (Maier 1999:91). From a different perspective, Rösch et al. argue that on the basis of extensive experiments with shifting slash and burn cultivation, these practices could have created similar results at Hornstaad Hörnle IA, as fire acts to suppress weeds (Rösch et al. 2002:150ff)

In terms of the sowing season, flax may be sown in winter or spring. There is some indication from the weed species at Hornstaad that cereals were winter crops (sown in winter), the same conclusion that was reached for Neolithic settlements in the Zurich area (Brombacher & Jacomet 1997:264 quoted in Maier 1999:92). In terms of the harvest time, concentrations of partially broken flax seeds, interpreted as remains of faeces rather than lost seeds (Maier 2001:69), indicates that flax plants were for food as well as fibre, and therefore would need to be harvested late in the summer when the seeds were fully developed. The remains of preserved flax stems with roots indicate that, at harvesting, flax was pulled up by its roots rather than cut, (Maier 2001:70, Körber-Grohne & Feldtkeller 1998:137). This would be best practice for the exploitation of fibre, as it retains the maximum length of the fibres.

The procurement of tree bast

Tree bast, mostly worked into cloth, is preserved charred and un-charred (Körber-Grohne & Feldtkeller 1998:154). Analysis of the preserved cloth indicates that lime, oak and elm were used to make cloth: lime was the preferred source of tree bast at Hornstaad Hörnle 1A, with rare examples of elm and oak; alternative sources of tree bast may have been used for create decorative effects by colour or structure (Körber-Grohne & Feldtkeller 1998:154). Lime, oak and elm were part of the wider tree flora and are represented in the pollen diagrams (Rösch 1996:76-77). Although elm and lime were decreasing in dominance in the late Neolithic forest in comparison with earlier periods, they were still common (Maier 1999:88).

In terms of the age of trees exploited for bast, the finest extracted fibres used for thread and constructions such as twining are only 1-2mm wide and two to three year-rings thick; the narrowness and fineness of the fibres suggests that young trees and branches were used. Thicker fibres, and hence threads, are wider, 8-10mm and have numerous year-rings, probably coming from more substantial trees or branches (Körber-Grohne & Feldtkeller 1998:154).

Despite the large quantities of wood used for building the lake dwelling there is very little lime or elm (lime is a poor wood for building), with a small quantity used for the horizontal wooden construction. Oak, however, is one of the most important timber sources used for the vertical stakes (Schlichtherle 1990:152). This is very much in contrast to the proportions of bast fibres, where lime is the most common bast, followed by elm and then oak. It would appear that these processes were not especially interconnected and may be related to the different age requirements of the processes: bast was possibly removed from trees that were too young to be useful for building, or possibly bast was removed from a living tree as opposed to a felled tree.

Based on the analysis of soil types and the archaeobotanical remains, Vogt and Maier offered a model of possible areas where these tree species grew (Maier 1999:88, Maier & Vogt 2000:125,fig.3.), Figure 5.3.c. Near the lakeshore the damp soils (gleys) supported mainly willow and poplar; woods with oak and elm were found in the wet area between the lake and the dry soils. These dryer soils supported mixed woodlands with oak, beech and lime (Maier 1999:89, Maier & Vogt 2000:125,fig.3.), including species suitable for bast, such as *Tilia cordata* and *Tilia platyphyllos* (see Chapter 4.). Whether the woodland was managed by methods such as coppicing remains unclear. Based on the dendrotypological evidence of the wood posts used in the lake village it is possible that coppicing occurred in the surrounding woodland (Billamboz 1990:199-201).

Processing flax to extract fibres

The presence of flax seeds, broken capsules, stem fragments and scutching debris, in both organic layers before and after the fire, and stored in houses during the fire, shows that flax was being exploited throughout the occupation of the site. One area of the burnt horizon has sufficient concentrations of flax stems to suggest a flax store (for fibre); this is in the area of Houses 11 and 10, and included two bundles of whole charred flax plants (Maier 2001:68), as would be expected if the occupants were storing dried flax plants to process for fibres. Broken seed capsules represent threshing debris, probably the by-product of a method similar to that practised in farming communities in the 19th century, when the seed capsules were combed from the stems (rippling) after the plants were dried, then later in the autumn crushed to remove the seed and sieved. There are several concentrations of such broken capsules in AH1 and AH3 (Maier 2001:68-69). From the microscopic examination of the flax fibres and fibre bundles, the missing stem-epidermis in the spun fibres as thread suggests that the stems were thoroughly water retted (Maier 2001:71, Körber-Grohne & Feldtkeller 1998:152-154). On the basis of comparisons to historical processes, it is likely that the bundles of flax stems were submerged in water (in the same autumn?) for several weeks to remove the outer-wall of the stem, leaving the central woody area and fibres; the lake would have been an ideal place for retting.

After retting and subsequent drying the stems are then ready for breaking (to break the central woody part) and heckling (to comb out the individual fibres) (Maier 2001:71, Körber-Grohne & Feldtkeller 1998:152-154). Although no tools have been identified in relation to this process, the remains of the broken woody part of flax stems, "scutching debris" (c.1-5cm long), found in 27 areas of the excavation, are evidence that after retting the flax plants were being broken to allow the fibres to be extracted in the village (details of process see Chapter 4). Nearly all of these deposits were found in AH3 (Maier 2001:70).

Processing tree bast for fibres

The processing stages for tree bast are not so well understood as those for flax. As observed from microscopic examination, the processing of tree bast at Hornstaad Hörnle IA does not seem to follow the most well-known historical examples of water retting, whereby the annual bast layers would be separated out and the plant's storage cells would decompose (Körber-Grohne & Feldtkeller 1998:154). In other cases, the annual layers remain attached, as do the storage cells, making it clear that the bast must have been prepared differently. Multiple layers of bast fibres as well as clearly split fibres can be recognised at Hornstaad Hörnle IA (See Körber-Grohne & Feldtkeller 1998:taf.32). In some cases the tree bast was probably used directly with the bark removed, for example to tie on net-weights (Körber-Grohne & Feldtkeller 1998:155). The question remains of how the fibres were rendered supple enough for the production of cloth (Körber-Grohne & Feldtkeller 1998:155).

Treatment methods from northern Europe, researched by Fledtkeller (Körber-Grohne & Feldtkeller 1998:157) suggest that the bark could be removed later in the year, even in late autumn, by heating over a fire or in an oven. The dampness in the wood would force the bast to split from the bark so that it could be peeled and scraped off; the bast is then rubbed and agitated between the fingers like a rag to separate the fibres (Körber-Grohne & Feldtkeller 1998:157). This or a similar method is possible at Hornstaad Hörnle IA

Evidence of strips of tree bast, between 2-3 and 8mm wide, are either waste or tree bast stored in a crude state to be reworked later. Some of these strips are only one-year ring thick and appear to have come from young branches (Körber-Grohne & Feldtkeller 1998:148-149). There are other strips of tree bast in its unprepared state (AH2-3, Schlichtherle 1990: Taf 46, 1135-1137), and numerous un-charred bast strips c. 2-3mm wide and 2-7.5 cm long from AH1 and AH3 (Schlichtherle 1990:196, 1140). A charred, knotted bundle of tree-bast, probably lime, is on display in the Konstanz Archäologie Ländesmuseum; this looks like a stored hank of bast thread but does not appear to have been examined in the textile reports.

From fibre to thread: twisting, spinning and plaiting

The villagers were using a range of thread types, including simple-spun and plied, all in fine and coarse versions, Figure 5.4.a-c. More rarely, threads in the passive system (warp) are narrow plaits made of single twisted threads (Schlichtherle 1990:194), Figure 5.6.a.

As described in Chapter 4, threads can be spun with the hand against a smooth surface, such as the thigh, with no additional equipment. Plaited threads require no tools or equipment either. These methods are especially suitable for long fibres, such as tree bast (Médard 2003:83) and were probably practised at Hornstaad Hörnle IA. The use of a twisting device, such as a spindle or spindle with spindle whorl is most useful for finer threads, but spindle whorls do not appear in the archaeological record of the Lake Constance area until the late Neolithic[8] Horgen culture, (Schlichtherle 1990:131), although they are known in the Lagozza culture from the early fourth millennium (Baioni, Borrello, Feldtkeller, & Schlichtherle 2003:99). Even when spindle whorls are present in later Pfyn sites, they appear in low numbers (Leuzinger 2002:119-120), which may suggest that other spinning methods were common. The tool used as a spindle for fine thread may simply be a stick rotated in the hand (Chapter 4) (Altorfer & Médard 2000:63-65, Leuzinger 2002:120).

[8] Endneolithischen

a)

b)

c)

Figure 5.4 a). Twined tree bast cloth with coarse, loosely spun, simple threads (HORN-006) (Photograph from Körber-Grohne & Feldtkeller 1998:Taf.15). b) Fine, two-ply thread (s2Z), 0.2-0.3mm diameter, detail of net bundle (HORN-014) (Photograph from Körber-Grohne & Feldtkeller 1998: 170 Taf.5.c.). c) Plaited threads, 4.5-6mm wide (HORN-005) (Photograph from Schlichtherle 1990:194, Taf.51,cat.1076;)

Although there is little besides the threads themselves to investigate the time and place of thread production at Hornstaad Hörnle IA, what is apparent from all historical or ethnographic accounts is that spinning is a time-consuming task. Many accounts talk of spinning and thread production carried out in short bursts alongside other tasks, filling all available hours of the day (Franquemont & Franquemont 1987:57). In other cases, large numbers of people are recruited to spin en masse to produce the required amount of thread; either or both models may have been practised at Hornstaad Hörnle IA. Spinning is a particularly mobile task: fibres and tools (spindle) can be carried and worked practically anywhere, and there are plenty of examples of people spinning when walking or travelling (Evans 1985:29).

The amount of time required to produce each of these threads can vary. However, based on a relative scheme, finer threads take longer to spin than coarse ones, and if using the same cloth construction technique, more fine threads are required to make the same area of cloth than coarse threads. When comparing the amount of time spent spinning thread in relation to cloth construction, spinning thread is always a more lengthy process than weaving (Evans 1985:35). An experienced spinner and weaver who was working on the construction of a Neolithic type plain-weave linen cloth for a museum suggested that the spinning would perhaps take ten times longer than the weaving (Riitta Sinkkonen-Davies pers. comm.): therefore a relative scale of time in spinning would be that finer threads are more time-consuming than coarse ones and that spinning would be the most time-consuming aspect of creating cloth. All of these thread types are seen at Hornstaad Hörnle.

Cloth construction

The majority of cloth finds are twining, including spaced (Figure 5.6.a&b), close or pile twining (Figure 5.8.a&b), and netting (Figure 5.5.a-c.), with a number of examples of plain-weave linen cloth (Figure 5.7.a), and some more unusual cloth types, including plain-weave tree bast with un-spun threads of various scales (Schlichtherle 1990:124,Körber-Grohne & Feldtkeller 1998:169). This conforms broadly to the proportion of cloth types at other Neolithic lake dwelling sites (Rast-Eicher 2005:118-119) (see Chapter 4). In terms of understanding the chaîne opératoire of cloth production, without recognised tools associated with the production of cloth (netting, twining, plain weave), the evidence comes from the cloth artefacts themselves. I shall describe the cloth types first, and then consider implications for time and place.

All the "true" plain weave fragments (using two-ply spun thread and fine under-over weave), consisting of eight small pieces in total, are made from z2S (two z-spun threads in S-spun two ply) flax fibres (Körber-Grohne & Feldtkeller 1998:135), Figure 5.7.a. In terms of the density of weave, they vary between 6-8 thread per cm (cat.no. 1,3,4) and 9-10 thread per cm (cat.no.2); the threads range from 0.3-0.6mm to 0.8-1.0mm (Körber-Grohne & Feldtkeller 1998:135). This shows potential differences in quality and the relative amount of time to construct. Without more diagnostic weaving characteristics (starting boarder, selvedges, and so on), it is difficult to make a judgement as to the loom type.

All the meshes of the nets are made of s2Z linen thread, while the starting cords are tree bast thread (Körber-Grohne & Feldtkeller 1998:135), Figure 5.5.b. Based on 19 examples examined by Körber-Grohne and Feldtkeller, there are two types of net. Of these, five have fine threads measuring between 0.2-03mm to 0.5-0.7mm and have large meshes[9] which are between 39-65mm and are knotted with fish-net knotting[10] (Körber-Grohne & Feldtkeller 1998:136). The nets with coarse threads, measuring between 0.7-1.0mm to 2.8mm, often have smaller mesh-widths from 2-7mm to 10mm, although some have wider meshes; from 15-40mm. They are constructed with a type of knot that is characteristic of the Neolithic lake dwellings called *Pfahlbauknoten* (lake dwelling knot), as named by Vogt (Körber-Grohne & Feldtkeller 1998:136, Vogt 1937:35). Through an analysis of the way the knots are worked, it appears that the nets were probably knotted in the round, creating a tubular construction; only one net was worked in rows as if to create a flat net (Körber-Grohne & Feldtkeller 1998:136, tab.1).

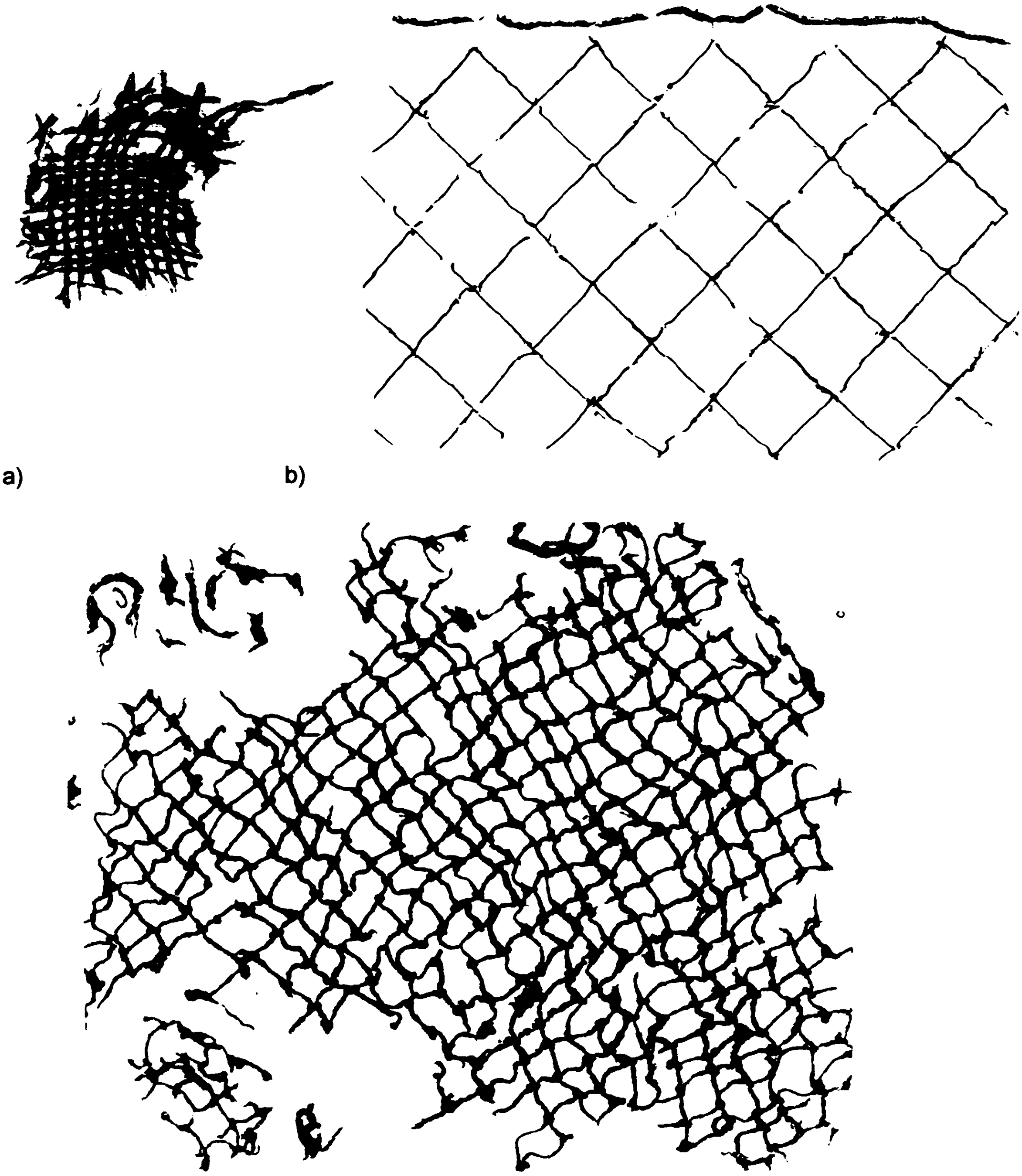
There are several types of twined cloth, varying in scale and construction. Fine examples include what are interpreted as the bottom of sieves (Figure 5.7.b), produced with tightly-spun two-ply thread of tree bast, twined to leave holes between 1.1x1.5mm to 2.0x3.0mm (Körber-Grohne & Feldtkeller 1998:144). There are numerous examples of wide-spaced twining with coarse threads; most are of lime bast. Some of these have thick threads that lie two per centimetre apart in the weft and are only loosely spun; the twined rows are spaced 2.5-3cm apart, creating a dense and solid cloth (Körber-Grohne & Feldtkeller 1998:144), Figure 5.6.b. Of similar construction but less dense are a number of twined cloth fragments from layer AH2 thought to come from the same piece (Schlichtherle 1990:127,194, cat.no.1082-1100). This example has simple spun

[9] The mesh width is taken along the net between two knots
[10] Filetknoten

threads 2-3mm thick in the weft, at intervals of 2-3cm. The starting border is worked by knotting the wefts over a cord, but other types of starting border are known (Schlichtherle 1990:127,Abb.87. 1,3, and 4).

There are also examples of twining with plaits (Figure 5.6.b), where the passive system is constructed with plaits and the twined rows with loosely spun thread (Körber-Grohne & Feldtkeller 1998: 177, cat.no.86). As at other Neolithic settlements, there are a number of examples of fleece-twining (twining with pile), mostly from lime bast (Figure 5.8.b), although there is one example of fleece-effect twining from elm-bast with surprisingly fine threads (Körber-Grohne & Feldtkeller 1998:218, Taf.18.d.e). The method of adding pile into the garment varies (Schlichtherle 1990:127, Abb.87.9,10&11, Körber-Grohne & Feldtkeller 1998:145).

The villagers were clearly able to produce a wide range of cloth types using the twining technique. Depending on the size and flexibility of the threads, this could have been worked on a simple frame (Schlichtherle 1990:124), suspended or lying on the ground, or worked by hand without a frame (see Chapter 4). These skills and techniques were practised throughout the life of the settlement and the continuity of these cloth types in later periods is evidence that the skills and techniques were passed on through the generations. On the basis of similar house inventories, Deickmann suggests that each house was responsible for producing its own resources, in a broadly egalitarian manner (Dieckmann 1991:100). However, there is evidence of materials coming in from outside the area, for example flint and stone (Hoffstadt & Maier 1999:31,Abb.8), which suggests that the lake dwelling villagers participated in some form of trade and exchange. Cloth is notoriously hard to source, but as the villagers were preparing the flax and probably also the tree bast themselves, it seems highly likely that at least some of the cloth was produced in the village; if not all of it.



a) b)

c)

Figure 5.5 a) Plain weave linen cloth 2x2cm in size, threads z2S 0.8-1.0mm diameter, lightly spun, 7-8 threads per centimetre (HORN-031) (Photograph from Körber-Grohne & Feldtkeller 1998:Taf.1.d.). b) Netting with fine threads and wide meshes. Mesh width 3.9-4.2cm, possibly Z plied threads 0.4-0.6mm diameter; the starting cord is s-spun. Total size of fragment 32x85cm (HORN-036) (Photograph from Schlichtherle 1990:Taf.52). c) Close-mesh net with Pfahlbauknoten in alternating directions. Mesh width 10mm, medium fine s2Z threads 0.9-1.2mm in diameter. Total size of fragment 17x21cm (HORN-002) (Photograph from Körber-Grohne & Feldtkeller 1998:Taf.3.c.cat.no.21).

a)

b)

Figure 5.6 a) Twined cloth with plaited passive system. 12 plaits 4.5-6mm wide, spun thread of active system is s-spun, 1.5-1.8mm in diameter. Total size of fragment 15x18cm (HORN-015) (Photograph from Schlichtherle 1990:Taf.51). b) Fig.10.15. Twined cloth with spaces between the twining, found with a number of other fragments, which probably belonged to a single piece, simple-spun threads, 2-3mm in diameter with fairly regular spaces of 2-3cm between the twined rows (HORN-034) (Photograph by Susanna Harris).

Cloth for containers, tools, parts of tools and clothing

The use of only a few of the cloth fragments can be recognised; of these it is certainly easier to identify artefacts with cloth types that are associated with other evidence.

In terms of containers, there is a rather unusual artefact that is a small, complete draw-string bag, Figure 5.7.b. Made from a roughly circular piece of plain woven linen with a draw string also from plain weave cloth (Körber-Grohne & Feldtkeller 1998:170,cat.no.5), the bag is only 9.5cm in diameter and 17cm max. length including draw-string. This small artefact would be highly portable and used to keep small items together in one place. It is the only complete artefact of plain weave at this site and also the only container, although it is highly likely that other cloth fragments were once part of containers (bags, sacks etc).

Schlichtherle argues that the knotted nets were used for fishing, on the basis that the nets are too big to be bags or hair nets; one is over 1m². In addition, they are associated with weights and fish bones (Schlichtherle 1990:126-127), as well as fish bones constituting a significant proportion (14.8%) of the bones from the site (von Kokabi 1990:145). The variation of knots in the same or alternating directions suggests that both flat and round nets (such as lobster pots?) were produced (Körber-Grohne & Feldtkeller 1998:135). Analysis of the spatial distribution of nets and net-weights shows that they were found in many of the houses (Dieckmann 1991:96,Abb.8). The nets were presumably used to fish in the lake.

Twined, tree bast cloth, spaced to create a fine mesh, was used for the bottom of sieves (Figure 5.7.b) (Körber-Grohne & Feldtkeller 1998:144, Schlichtherle 1990:128-129). Not only do complete examples look like sieves, but bits of charred grain were found stuck in the mesh: a task necessary to remove the weed seeds from grain (Schlichtherle 1990:129). A similar type of fine mesh is imprinted on the bottom of a pot, showing that, in this case at least, a twined piece of cloth was used as a mat during pottery production (Schlichtherle 1990:128). Sieves and sieving were probably a regular part of household life, preparing grain before it was ground for food.

There are three examples of fleece-twined cone-shaped artefacts from Hornstaad Hörnle IA, one from AH2 and two from AH3 (Feldtkeller 2004:59,Abb.5), Figure 5.8.a&b. Interpreted as hats, similar artefacts are found at other sites in the region from later periods including from Wangen-Hinterhorn, c. 3800-3600 BC, Sipplingen-Osthaften, c. 3300 BC (on lake Constance, western end) and Seekirch-Achwiesen, c.

2900-2600 BC (on lake Federsee) (Feldtkeller 2004:59). This temporal continuity in the geographical area shows that the manufacture of this type of garment, like the cloth construction types, was a skill passed on through the generations.

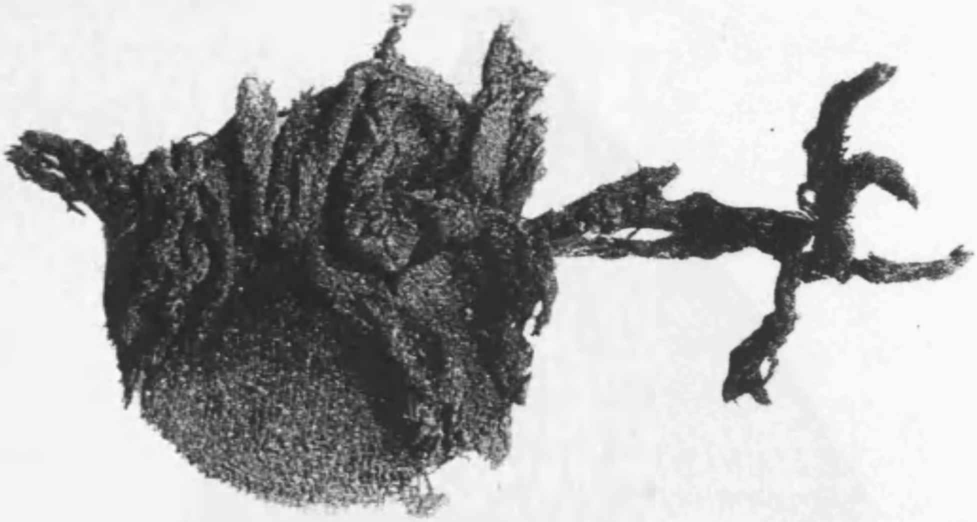
In the section above I have looked at the evidence for the extended chaîne opératoire of cloth with particular attention to time and place. In the following analysis I focus on these time and place structures to consider the wider social implications.

Analysis of time and place structures of cloth at Hornstaad Hörnle IA

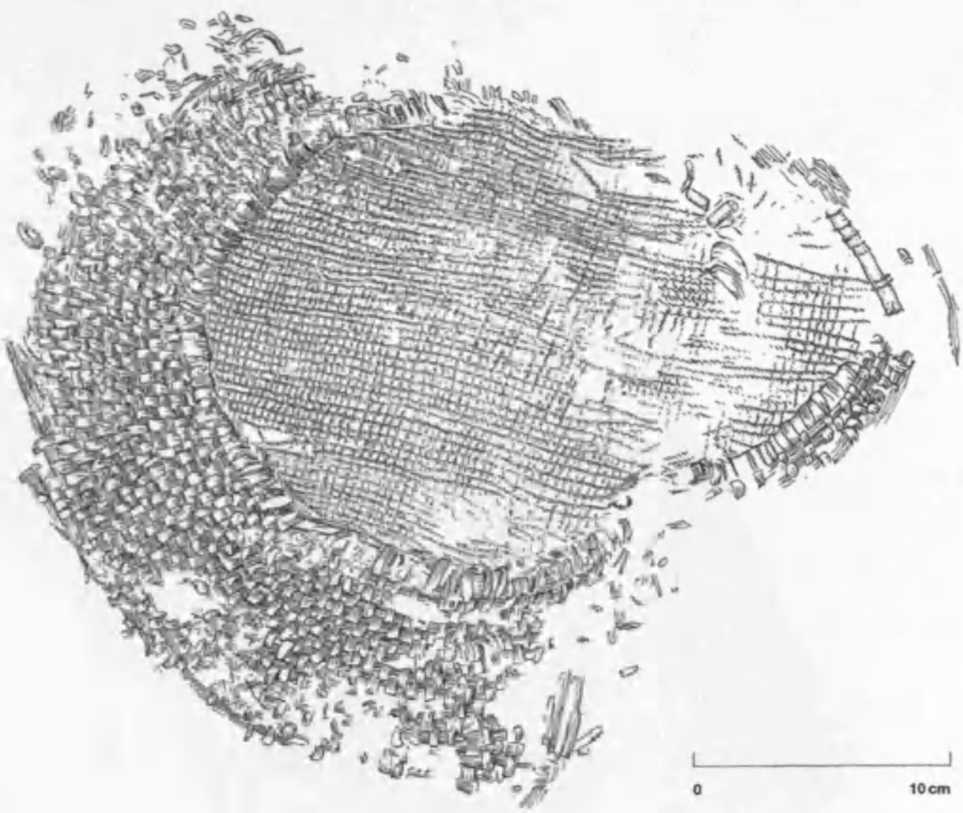
Here I shall approach the issues of time and place structures in cloth at Hornstaad Hörnle IA in a number of interrelated ways. I shall draw together the evidence for time indication, including seasonal and annual time structures, as well as the tight time-frame for the existence of the village, over a period of around twelve years between 3917-3905 cal. BC, punctuated by a devastating village fire in the early autumn of 3909 / 3910 cal. BC. I shall consider issues of time, that is, the length of time ascribed to each activity, or the nature of how this time is inter-dispersed with other activities. In terms of place, I consider the evidence of where events of the chaîne opératoire of cloth occurred, distinguishing between fields, forest, village and house.

Digging and tending flax fields

At Hornstaad Hörnle IA, flax would have been sown in fields prepared by digging either in the spring (summer flax) or late autumn (winter flax); based on the weed-plant evidence discussed above, it seems most likely that flax was sown as a winter crop, but both cycles are possible (Table 5.1.a). In terms of place, flax cultivation would have been in the cultivated land area along with cereal crops, about 500m from the village (from Maier 1999:89,fig.3), Figure 5.9.a. The fields of flax appear to have been grown closer to the woodland than the cereal crops. Digging the ground, sowing, weeding and care of flax crops would have required constant care; this would have meant individuals or small groups tending the fields on a regular basis, creating a repeated pattern of visiting the same place. As the flax harvest requires the whole plant to be pulled up by the roots, historical sources often talk of the flax harvest as a time of intensive, communal work. A crop of flax could have been grown each year, either in the same field or following a crop rotation system. Table 5.2 shows cycles of annual flax growth. In terms of seasonal or annual activities and place, flax falls into a similar time / place structure to cereal and poppy cultivation (Table 5.1.b) (see Maier 1990:132,Abb.13).

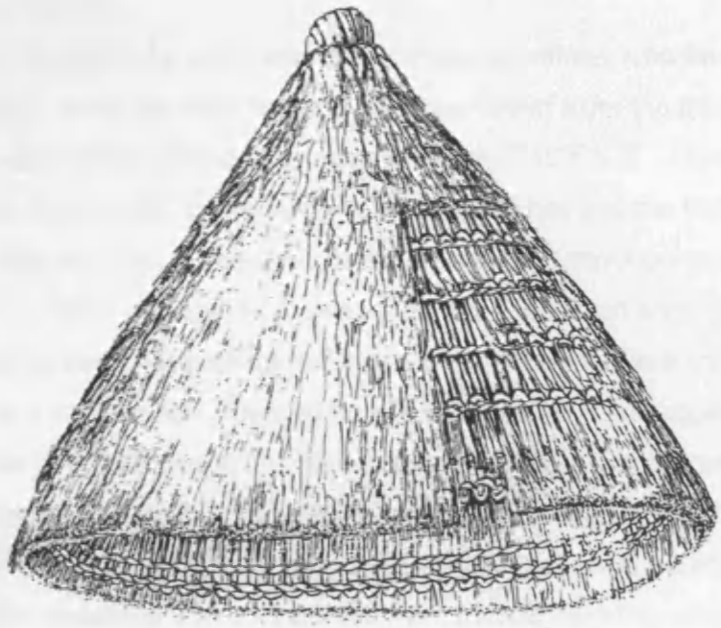


a)



b)

Figure 5.7 a) Draw-string bag in plain weave linen cloth, 9.5x17cm (HORN-037) (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:278,). b) Sieve with twined sieve area in the centre (HORN-016) (Drawing from Schlichtherle 1990:Taf.48,cat.no.1107).



a)

b)

Figure 5.8 a) Reconstructive diagram of a complete pile hat (Drawing from Feldtkeller & Schlichtherle 1987:Abb.3). b) Example of conical lime bast hat with pile from Wangen, Lake Constance (WANG-002) (Photograph from Körber-Grohne & Feldtkeller 1998:Taf.16).

Fibres from the forest

On the basis of comparisons with historically known practices, tree bast was either collected in spring, when the bark is most easily removed from the tree, or in autumn, when the whole branch is heated to remove the bast (Table 5.2). Lime, oak and elm trees grew in the forest area, possibly surrounding and beyond the fields, Figure 5.9. Depending on how the bast is removed, a single branch cannot be cropped each year: there must be a number of years of rejuvenation between each crop (Table 5.2 showing six-year cycles). Therefore trees would be harvested in a rotating system over a number of years or decades. Gathering tree bast would have required individuals or groups of people to walk through the forests to areas with suitable trees, in order to judge each branch for suitability in terms of species, age and quality. If undertaken in autumn, the collection and place of gathering tree bast may have coincided with the collection of other seasonal fruit and berries from the surrounding woodland (see Maier 1990:132,Abb,13).

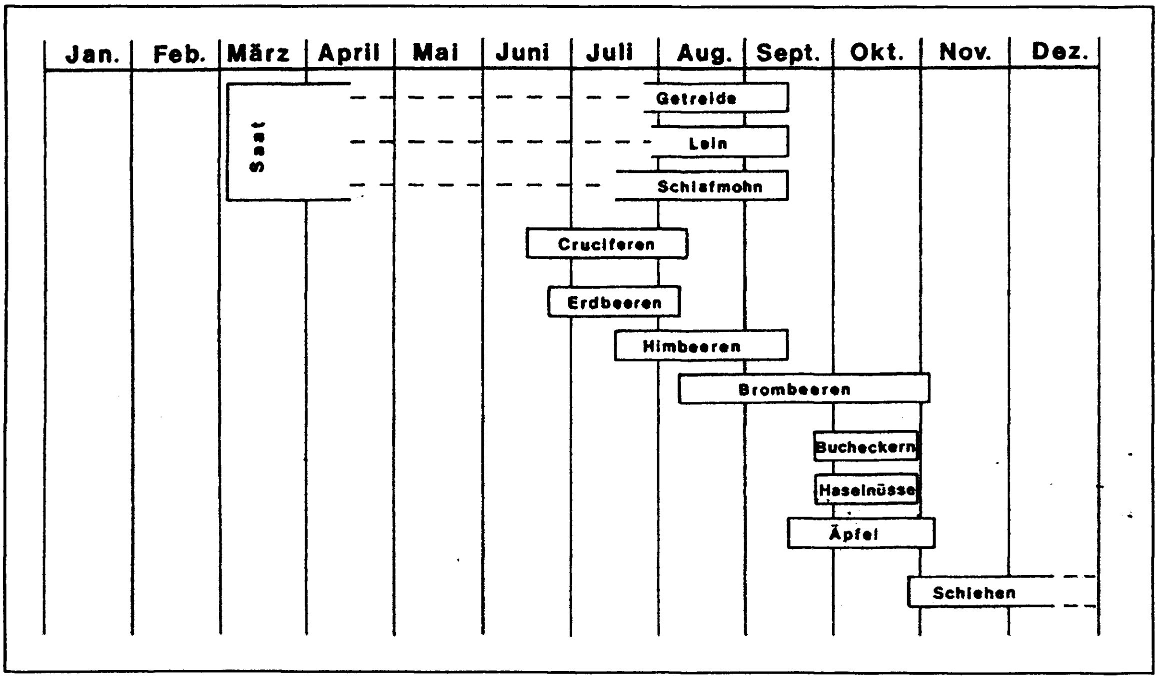
Cloth in the village and home

Following the harvesting and gathering of flax, the dried stem bundles were stored in the houses until there was time to prepare the fibres. Fibre preparation (for either tree bast or flax) may have occurred annually or as required: evidence of the piles of flax fibre suggests that this occurred throughout the village. Whether tree bast was processed in the village or outside is difficult to judge, as the evidence of tree bast strips may represent either processed stored fibres or waste from processing fibres. They are present in all layers of the site and suggest that this task was also practiced regularly, probably annually.

With few details on the exact methods of spinning thread and of the frames or looms used for constructing cloth, the following comments are based on general comparisons of time and place structures, as outlined in Chapter 4 and represented in (Table 5.3.a). The thread types present in the village show that the villagers were engaged in a number of different thread-producing activities. As spinning is time-consuming and it appears that the villagers owned relatively large quantities of cloth items, spinning was probably rather widespread. As each house appears to have had similar tool kits (Dieckmann 1991:91), it seems reasonable to assume that each house also spun for its own, varied requirements. Attributing gender to specifics tasks in the Neolithic is problematic; however, it is very likely that tasks were divided in relation to gender groups.

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Flax: Summer crop			Prepare fields Sow crop		Growing season			Harvest				
Flax: Winter crop					Growing season			Harvest		Prepare fields Sow crop		
Tree bast Spring collection			Collect bast									
Tree bast Autumn collection									Collect bast			

a)



b)

Table 5.1. a) Alternative seasonal time structures for the cultivation of flax and collection of tree bast. b) Seasonal time structures for cultivated crops and gathered fruits and berries from Hornstaad Hörnle IA, based on the archaeobotanical analysis. Translation of German: Saat=sowing, Getreide=grain, Lein=flax, Schlafmohn=poppy, Erdbeeren=strawberry, Himbeeren=raspberry, Brombeeren=blackberry, Bucheckern=beechnut, Haselnüsse=hazelnut, Äpfel=apple, Schlehen=Sloe, (Diagram from Maier 1990:132,Abb. 13).

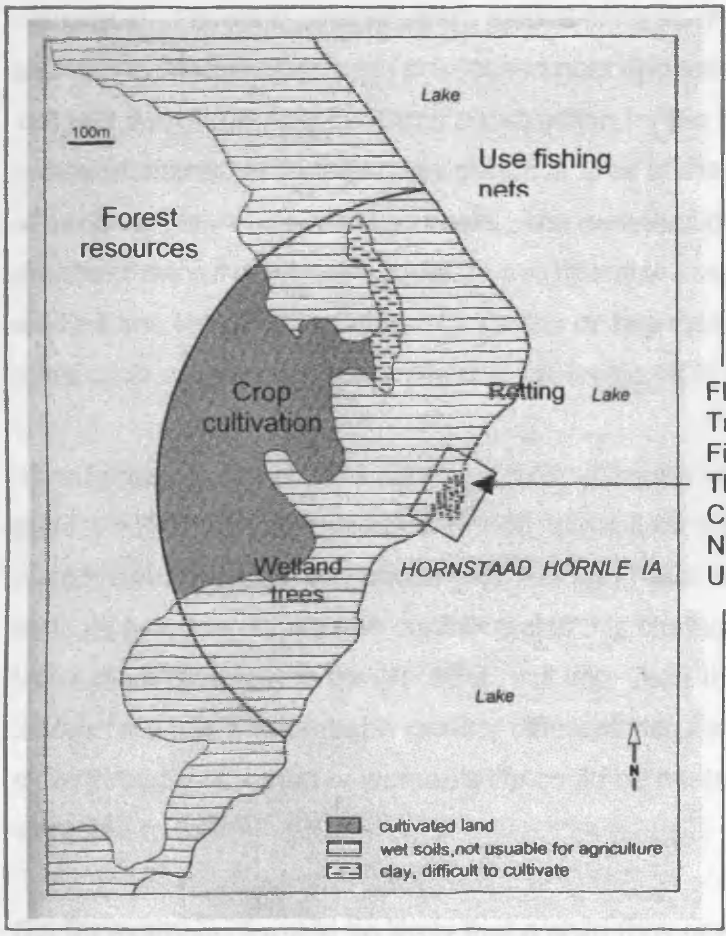


Figure 5.9 The place of cloth related in activities at Hornstaad Hörnle IA. Tree bast collection from wetland trees or forest resources, crop cultivation area marked: flax fields those closest to forest margins. Retting in shallow water area. Flax plant storage, flax and tree bast processing carried out within the village. Spinning, weaving, twining and net construction probably occurred within the village area. Use of nets in the lake and stored in house; sieves used in the village (adapted from Maier 1999:89,fig.3).

3917	3916	3915	3914	3913	3912	3911	3910	3909	3908	3907	3906	3905
Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax	Flax
Tree bast						Tree bast						
	Tree bast						Tree bast					

Table 5.2 Cycles of annual flax growth based on planting and crop each year, compared with a six-year time cycle for the growth of tree bast.

So far there is no spatial analysis of the distribution of twined and woven cloth by household. However, Dieckmann's spatial analysis of nets throughout the village shows that many households possessed nets and net-sinkers (Dieckmann 1991:94,Abb.6, 96,Abb.8). Cloth construction for the household requirements probably occurred mainly within the house or house area of the settlement, being attended to either on a daily or as-required basis. The construction of cloth such as nets or large sheets of twined cloth would take up considerable floor or wall space when being worked on. However, a net can be folded up between periods of construction and other cloth construction types may be left on the loom between work periods.

Throughout the life of the settlement, from when the village was established around 3917 cal BC to when it was abandoned, some time after 3905 cal BC, youngsters would have grown up and adults grown older (Table 5.3.b). Although there is little to indicate how men or women contributed to this chaîne opératoire at Homstaad Hörnle IA, or more generally in the Neolithic, it is very likely that there was some division of labour, and this was probably gender differentiated. In this case, the development of skills throughout a man or woman's life could be related to the gender role they were expected to fulfil.

So, for example, it would be likely that a child (boy or girl) who was 6 (Table 5.3.b) when the village was established was already being trained in appropriate skills such as spinning, digging, tending the fields, gathering in the forests, making cloth and cloth artefacts as well as using the finished cloth in appropriate ways. These skills and practices would have developed over the years, and young people would have been given increasing responsibility as appropriate to their gender role. At the time the village burned down, the young person would have been 13-14 years old, presumably with a number of personal responsibilities in some or all of the tasks involved in producing cloth depending on the way tasks were distributed in the village. The catastrophe of the village fire meant that valuable stores and seeds were lost, including fibres and crop seed, as well as cloth artefacts such as fishing nets, clothing and containers that were necessary for everyday life. These would have needed to be remade and there is evidence that production continued after the fire. This period probably increased the workload of all village members, as they rebuilt their lost homes and stores. Five years later, at 18, the person may have had a family of his or her own; they may have been ready to leave the village taking their skills and cloth artefacts with them.

In the second example (Table 5.3.b), an adult man or woman aged 20 at the time the village was established would have already had many skills, as appropriate to their gender role. Some such individuals were surely involved with establishing fields and with the first crops of flax that were sown there, requiring a combination of tasks which were probably divided according to the gender of participants. During regular visits to the woods, these adults would have been familiar with the trees to use for tree bast and would have known where to go each year to find branches of a suitable age and quality; again the collection of such fibres may have been carried out by a particular gender group. At the time the village burnt down, men and women in this age category were probably the most experienced and skilled village members, with responsibilities for younger members of the family, for coordinating the rebuilding of houses, and for the production of cloth equipment, passing on their skills of producing cloth to other members of the group. Besides this, men or women of this age may have been required to produce cloth for ceremonies such as marriages and burials or other rite-of-passage events: they may have constructed cloth to exchange for items that they wanted to acquire.

The houses of the village are built close together; men and women, boys and girls carrying out tasks such as fibre processing, spinning, net-making or weaving would have been a noticeable part of village life, and cloth construction probably took up a sizable amount of many individuals' time. In the situation of the village, skills would be taught and passed on through the generations and between families. This is recognisable in the archaeological record through the reoccurrence of cloth types over many generations and more specifically in the area of the west of Lake Constance through the continuity of piled cloth hats both within the Hornstaad Hörnle IA settlement and several hundred years later. People would know about work within their own house, and probably that of their neighbours: small groups or individuals would have to plan ahead to have the right resources and time to produce the cloth that they needed. How these skills were divided between gendered groups is uncertain, but as I have discussed above it is likely that such differentiation existed.

Whether for clothing requirements (work clothing, rain clothing, wedding clothing, best festival clothing), the cloth used to make fishing nets or other tools such as sieves or containers, the requirement for cloth would have requiring planning. So, for example, if a plain weave flax cloth was needed for a particular event, the complete chaîne opératoire of cloth production would need to be set in motion. Once in possession of a seed crop, the fields would need to be prepared and weeded, and the crop tended until harvest time. If the crop was successful, after harvesting it would need to be retted and dried, preparatory to processing. Processing was carried out in the village. This was probably in late autumn of the same year, as it is best done on a warm sunny day. The whole process could be worked at intervals: the prepared fibres, raw or retted flax stems stored at this stage and processed later. At this point, a year of work would have been invested in the flax.

The chaîne opératoire of collecting and processing tree bast, in spring or autumn, required a different time frame. To harvest annually, a number of trees would have been exploited, in a rotating system, to allow the trees to recover and re-grow suitably to be cut or stripped in subsequent years. As a forest resource, it may have been loosely managed to prevent over-exploitation of individual trees, or to encourage the growth of trees that they wanted to encourage; some form of coppicing may have occurred. Like flax, tree bast may be processed immediately, or stored; this is difficult to recognise in the village. Tree bast is slower growing than flax, but as there were ready supplies of forest lime, elm and oak in the vicinity, tree bast was readily available to the villagers.

Without complete pieces of cloth, or a clear idea of the method of spinning and cloth construction, there is no accurate way of measuring the time taken to produce a piece of cloth, although this can be seen in a relative frame (Table 5.3.a). This production may have taken a few hours for a small piece such as a twined sieve bottom or a coarsely spun and woven plain tree bast cloth construction. Larger pieces of other cloth types probably took several days or months of intensive work for an individual or small team working together: for example, to have spun and worked a large, fine net ,or to have spun and twined a large piece of tree bast.

Process	*Place*	*Fixed time*	*Time duration*
Flax fibre preparation	In concentrated areas around village	Annual, seasonal work	Unspecified
Tree bast preparation	Unspecified	Annual, seasonal work	Unspecified
Spinning	Mobile, sitting, standing, walking	Regular, daily task or practised as required	Substantially longer than cloth construction time
Weaving	Loom may be fixed in place, or movable between work sessions	Regular, daily task or practised as required	Finer, more dense construction longer than coarse, open constructions
Non-loom	Worked from a sitting or standing position with no frame or loom	Regular, daily task or practised as required	Finer, more dense construction longer than coarse, open constructions
Netting	Worked from a starting line or frame, movable between work sessions	Regular, daily task or practised as required	Finer, more dense construction longer than coarse, open constructions

a)

<table>
<tr><td>3917 cal.BC</td><td>3916</td><td>3915</td><td>3914</td><td>3913</td><td>3912</td><td>3911</td><td>3910</td><td>3909</td><td>3908</td><td>3907</td><td>3906</td><td>3905</td></tr>
<tr><td colspan="7">AH1 (stratigraphic layer)</td><td colspan="2">AH2</td><td colspan="4">AH3</td></tr>
<tr><td>Establish fields & village</td><td colspan="6">Village occupation</td><td colspan="2">Burning incident / rebuilding</td><td colspan="4">Village occupation</td></tr>
<tr><td colspan="13">Examples of age sequence
First example starting at age 6, second example starting at age 20.:</td></tr>
<tr><td>Age 6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr>
<tr><td>Age 20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td></tr>
</table>

b)

Table 5.3 a) The working places and time structures of cloth related tasks in the village. b) Examples of the age of village inhabitants in relation to the life-span of the village based on the dendrochronology dates of building and burning phases.

Investigating symbolic structures of cloth and social interaction through shared time and place associated with cloth at Hornstaad Hörnle IA

In the methodology, outlined in Chapter 3., I discussed the significance of conceptualising the process of the chaîne opératoire in a social context, to avoid the separation of the "functional" from the "symbolic". Social theories promoting the complexity of internal social dynamics give theoretical pointers to investigating these aspects of society: Giddens expressed the idea of society through the relationship of agents to structure and the importance of locales and temporal structures, while Bourdieu developed the idea of unconscious, repeated practices through the *habitus* In this case study I have particularly focused on this issue of time and place, and here discuss the implications of these results in relation to symbolic structures and social interaction through shared time and place in relation to the extended chaîne opératoire of cloth.

Take, for example, growing a field of flax or collecting tree bast. Some of the villagers (male, female, young, old?) were travelling to the fields used to grow flax year after year. Presumably they met, spoke, and shared tasks, advice and gossip? Their journeys were dictated by the seasonal demands of their crops, (flax, cereals, poppies) where and when to dig and prepare the ground, sow, weed or harvest. At another time (the same or other?) people were going out into the forests, or perhaps to trees closer to the village to collect the tree bast they needed; at the same time gathering other plants, keeping an eye out for animals, or other people? Knowing the short time frame of the village, it is possible to recognise that individual lives were built by repeated years of these practices that were repeated with the seasons. It is impossible to know how these communities conceived of these time structured patterns, but recognising them brings cloth production into part of an integrated aspect of the villagers' lives.

On this basis, the interpretation remains a broadly functionalistic approach to "getting the job done". This would be to lose sight of how such time and place structures are the location of social interaction and the development of social relationships: the framework through which people "attend to one another" (Ingold 1993:518). Certainly, through this investigation of cloth, it is possible to recognise people coming together through shared tasks: occupying the same places and time or through co-ordinating aspects of a chaîne opératoire.

For this, it is worth considering the idea of cloth as part of food production: in the examples at Hornstaad Hörnle IA this can be recognised in sieves to sort grain or nets to catch fish. Based on evidence that nets or net weights were found in a number of the lake dwelling houses, it seems that fishing was a household activity; the size of the nets suggests that more than one person would have participated in these tasks: in addition fishing may have been gender or age related. In another example of using cloth related to food production, sieving grain in the house might be a place and time of interaction with other people in the area or a quiet individual activity: again these could well have been gender or age related tasks. These shared places and times might have been of a quite different character. The often communal and social task of preparing food may have also been a time for talking or teaching; the time taken in working with the material culture that societies produced can be seen as one way in which people interacted. So the shared task of hauling in nets or checking net traps might be seen as a time and place that people occupied together.

These combined events of time and place with different activities probably held their own social character in the village. A single event in the autumn beating the flax stems to remove the fibres was probably quite in contrast with the time spent carefully netting a fishing net or weaving the cloth for a small bag: yet all related to a larger extended chaîne opératoire. Directing attention to these as aspects of time and place structures as contrasting parts of village life associated with cloth at Hornstaad Hörnle IA allows the possibility that they were valued and perceived in symbolic spheres, even though any value attached to these tasks remains unknown.

It is significant that the villagers of Hornstaad Hörnle IA were able to produce (or otherwise acquire) cloth of a number of types and found these practices mutually compatible. The way this was achieved remains elusive, whether by the same people producing a number of different types of cloth, by the division of cloth-production tasks among the village members (by gender, age, household or family ties), or with or without the sourcing of some cloth from trade contacts. It is quite likely that a combination of such means were used. By this analysis, however, it is clear that these cloth types varied by more than their physical attributes: they are also different in their characteristic structures of time and place. Looking at ethnographic and historical examples, such "locales" and *habitus* are readily, and frequently, imbued with symbolic meaning. This, I have argued, shows that behind these different types of cloth lie contrasting potentials for social relationships and contrasting ways in which these structures were interpreted symbolically by the members of the village.

Conclusion

In the case study of the production and use of cloth at Hornstaad Hörnle IA I have approached the evidence of the extended chaîne opératoire of cloth through concepts of time and place within the village situation. I have considered people visiting places in the surrounding landscape to collect or cultivate the raw materials for cloth, and contrasted the idea of people working regularly in fields planting annual crops with the exploitation of resources of tree bast from species of trees that needed years to rejuvenate and had to be harvested in cycles. By comparison with other environmental evidence, these activities can be understood in relation to other tasks, such as growing cereals or collecting wild apples or hazelnuts. After this, it seems that the processing and construction of the cloth was carried out in or near the village: the debris of flax fibre extraction or tree bast waste fell from house platforms to the water or ground below. *Thread production* and cloth construction are less clearly placed as there are few indications of how the villagers carried these out. Yet it seems likely that this did occur in or around the village, probably at a household level, and that some items also came from outside the area.

While many of the cloth artefacts are too fragmentary to allow an understanding of how they were used, fishing nets and sieves are well represented, showing how cloth was closely related to aspects of food production and in this was associated with preparing food: activities that may have represented shared tasks and time of meeting and interaction.

Taking advantage of the narrow date range of this lake dwelling village it is possible to envisage these annual cycles and daily tasks in terms of single life-spans. In this way cloth production and use can be viewed in terms of skills being developed and passed on throughout men's and women's life times and put into practice to replace cloth lost in the village fire. In this way cloth occupies a time frame of growing up and growing old and fulfilling the expectations of being a man or woman in the village.

In this way, through cloth, the inhabitants of Hornstaad Hörnle IA were negotiating the relationships necessary to produce cloth (shared tasks, teaching and learning), planning ahead to anticipate their needs (social or material) or evaluating what they had in relation to their needs or the judgement of others (material possessions). This occurred in a regular rhythm of annual cycles, of daily events that created the predictable shape of an individual's life (gender, age, abilities), punctuated by irregular events, such as the fire catastrophe and recovery from it.

Another significant aspect to consider is the way in which such time and place structures changed and continued throughout prehistory as societies' demands and cultures changed. Therefore, the decline or increase in the production or use of a particular type of cloth, and subsequent subtle or substantial shifts in time and place structures, may be seen in relation to changes in social interaction surrounding cloth, either with an increase, decrease or simply changed emphasis on social interaction in particular spheres.

By focusing on time and place of the extended chaîne opératoire of cloth remains preserved at Hornstaad Hörnle IA, I have shown how it is possible to build a picture of how cloth was part of the social life of the village. This approach was possible due to the thorough excavation of the site, detailed publication of finds, precise dating and preservation conditions. From this evidence, I have been able to consider a number of issues of time and place, which allows overriding patterns of time and place to be developed in relation to the extended chaîne opératoire of cloth activities. In the next case study of the Iceman from Alto Adige, I change the focus to a more individual (or agency) based approach through considering the relationships between people created through the sequence of the extended chaîne opératoire.

CHAPTER 6

The Iceman from Alto Adige, Italy c.3300BC; sequence in cloth production and use.

In the last case study, I was able to investigate the issues of cloth production and use during the dozen or so years of the occupation of a village on Lake Constance. In this case study, the focus is quite different, being on an individual caught in a moment of time, with an assemblage of artefacts including clothing and cloth equipment that was prepared prior to that moment but equipping him for it. He was found at high altitude in the mountains, and although there is little doubt that he belonged to a larger community, the nature and location of that community remains unclear. The frozen conditions allowed the preservation of all organic materials, including animal skins and plant fibres, and provide unique evidence of a mixed assemblage of cloth artefacts. These have been the subject of detailed and well-funded research, published by the Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz, and a dedicated series of publications "*The Man in the Ice*". The main publications that I have referred to in this case study include Egg (1993), Egg et al. (1993), Goedecker-Ciolek (1993), Groenman-van Waateringe and Goedecker-Ciolek (1992), Groenman-van Waateringe (1993 and 1995), Pfeifer and Oeggl (2000) and Winiger (1995). The strength of this find is in the rarity of the cloth artefacts, and the knowledge of the cloth artefacts, from raw materials to use assemblage, gained from the detailed analysis of the materials. Therefore, unlike the other case~~s~~ studies, in this case study I am dealing with the whole chaîne opératoire.

Investigating sequence in archaeology and social anthropology

Taking advantage of this evidence, my aim in this case study is to focus on the theme of sequence in the chaîne opératoire. By sequence, I mean the chain of events, their order, and the links between different aspects of the chain. I will approach this in a number of ways. On one level this sequence is about the way materials are transformed from one state to another. This can be documented through the analysis of the materials, which is at the heart of the chaîne opératoire (Leroi-Gourhan 1993 (first published 1964):230-233, Tite & Sillar 2000:4). Putting this in a social context, and therefore important to this study, this sequence is marked by the way people convene and intervene to carry it out, the way they do this, and the relationships between them. The archaeologist Marcia-Anne Dobres made the case for focusing on the sequences of chaîne opératoires to understand social relationships created and perpetuated through technologies and the way these engender meaning (in particular, Dobres 2000, ch.5). Her method, based on the chaîne opératoire, has offered me insights into investigating the data in this way. As in the other case studies, I find it useful to look at examples of this theme in social anthropological studies of small-scale societies in the modern world and in the recent historical past, as a means to develop further concepts in investigating sequences from a social perspective.

In Barnes and Eicher's introductory chapter to "*Dress and Gender: Making and Meaning in Cultural Contexts*" they state: "To understand the role of dress in a given society, an analysis of the creative act of making dress is essential" (Barnes & Eicher 1992/3:4). This concept is developed in Barnes' examination of a man's headhunting ensemble from villages in the Naga Hills, Burma (Barnes 1993). Here, following a successful raid, the headhunter wears an ensemble of headdress, loincloth and ornaments, composed of skins, feathers, claws tusks, and teeth. The base of the loincloth is a small woven textile: this is a minor part and often unrecognisable as it is covered in ornaments added by the men. Apart from this woven textile, made in the village by women, the rest of the materials are sourced by the man from the forest outside the village (Barnes 1993:33-37). This assemblage contrasts with the mantles made primarily of woven textile that are gained by other feats of merit, such as setting up stone monuments or animal sacrifices. These mantles are made in the village and associated with women (Barnes 1993:34). In their origins, it is in part the way people convene and intervene in the sequence, the source of raw materials and gender of those producing the garments and relationships that make these contrasting costume assemblages valid and appropriate for their intended use. In this, the sequence of actions, gender interactions, time, technique and events are a means of understanding appropriate cloth use and context. Barnes' example shows clear distinctions between gender roles, yet often these relationships can be more complex than they appear on the surface.

Bruce White brings this out in an account of gender roles (and to a certain extent ethnic roles) in the Ojibwa fur trade north of Lake Superior, Canada (White 1999). He argues that in historical accounts the fur trade is presented as a simple economic exchange between European and Ojibwa men. However, on re-examination of the evidence, Bruce shows that in reality both Ojibwa men and women participated in these trade relationships, although with different roles and opportunities. In trade, Ojibwa men were most likely to attend trade ceremonies and receive credit from European traders, while Ojibwa women supplied commodities that were bartered, therefore not in the money sphere of exchange, and through marriage exercised control of the distribution of goods (not only furs) and information in both directions (White 1999:124-125). The concerns, status and relationships between Ojibwa men and women are different yet complementary and contrast to those of the Europeans, to such an extent that European ethnographers completely overlooked the women's roles in exchange (White 1999:125), showing the kind of Eurocentric bias that is problematic in other aspects of the literature. This example illustrates the complexity social roles and how they contribute differently to related activities.

Moving this time to an example from East Java, Rens Heringa calls the communal process of making cloth the "social experience of cloth" (Heringa 1993). Here she identifies the sequence of growing cotton and weaving cloth in terms of the division of labour between the members of an extended family, typically of three generations. Broadly, the agricultural tasks are shared between the whole family, with specific tasks assigned to individual members according to age and gender; in addition, textile tasks are divided among the women, as opposed to other tasks, such as carpentry, which are assigned to men (Heringa 1993:156). These tasks are performed as part of an annual cycle, creating a "never-ending continuity" to the sequence, which is operated by a family working together and sharing the products. Within these sequences, individuals perform their roles (these individuals obviously knew each other), and were part of the perpetuation of this sequence by other families in the compound or hamlet cluster, and at a regional level; these shared experiences created through each family working in such a way are tied to shared ritual cycles of textile making and agriculture (Heringa 1993:164-166). In this example Heringa shows how, through similar activities and the division of tasks, a sequence of action based in gendered and regional practices becomes a foundation for beliefs, ideology and ritual.

In this way, sequences can be seen as a means to investigate the relationship between the action of individuals or groups of individuals and the perpetuation and recreation of a wider social structure, which is based on ideas from Giddens's Structuration Theory (Giddens 2003, first published 1984), and Bourdieu's concept of social theory in practice (Bourdieu 1990, Bourdieu 2003,), as discussed in Chapter 3, Method and Theoretical Approach.

I have chosen these examples as they provide a foundation for investigating the concepts of sequences through the chaîne opératoire of materials and offer a means to understand how cloth assemblages are socially constructed and made meaningful. This is part of my wider concept of investigating the relationship between cloth types, not only through material results but also according to these socially embedded sequences. In this case study, I will first establish the evidence for sequence in the chaîne opératoire of materials and then discuss these sequences in a social context, considering social networks and sequences of people as understood through the material sequence.

The archaeological context of the Iceman

In 1991 the body of a mummified and frozen man was found near the Tisenjoch pass in the Tyrolean Alps, on the Italian / Austrian border at 3210 metres above sea level (Spindler 1995). The man is often referred to as "the Iceman"[11]. The limited degradation has preserved a number of whole organic artefacts, and others in fragmentary form enabling reconstruction and interpretation of their use. This offers a unique insight into a man's assemblage of artefacts in the context of the mountains; a large proportion of these artefacts are cloth. The cloth finds are summarised in Table 6.1. Bolzano Museum, where the original finds are displayed, has a reconstruction of the man, clothing and equipment (Figure 6.1). This is a visual summary of the finds; issues concerning their interpretation are discussed below.

The man probably died in late spring / early summer (Oeggl 2000: 102-106). The question as to what he was doing at this high altitude has attracted various interpretations. The earliest interpretations were that the man was a hunter, shaman, metal prospector or shepherd who was overcome by the elements or possibly involved in an accident (shepherd: De Marinis 1994b: 28, general reference: Egg 1993:96-98, injuries that suggest a fight Spindler 1995:180). Later proposals suggested that the Iceman was involved in a form of transhumance, possibly similar to historical forms of Alpine transhumance (Spindler 2003:222-223). Since an X-ray revealed an arrow head embedded in his shoulder and a two centimetre slit in the skin matching the trajectory

[11] The mummy has attracted various names, most commonly: the Iceman, Ötzi, the Similaun man, the Iceman from the Hauslabjoch, Frozen Fritz and, of course, versions of these titles in Italian, French and German. I refer to this find as "the Iceman".

of the arrow (Pain 2001), it seems likely he died of his wounds. This does not preclude that he was a hunter, shepherd.

Radiocarbon dates for the Iceman were taken from bone and skin. Excluding the earliest date, which stands apart from the rest, the 1σ range falls between 3371 – 2928 cal. BC and a 2σ range of 3501 – 2910 cal. BC (Skeates 1994:215), belonging to the Copper Age in the Italian chronology or Recent Neolithic (Jungneolithikum) in the German literature (Pedrotti 2000b:185). The origin of the Iceman both in terms of belonging to an archaeological "culture" or geographically remains contested (Barfield 1994b:19, Dickson 2000: 84, Groenman-van Waateringe 1993:114-121, Spindler 1995:186-254, Winiger 1998: 241-243). Evidence from pollen in the man's gut suggests that he frequented the lower and higher altitudes of the Lower Venosta Valley of the Vinschgau (Oeggl 2000:103).

Artefact and catalogue no.	***Raw material***	***Processing***	***Construction of cloth***	***Construction of artefact***	***Decoration***	***Assemblage***	***Comments on use***
Striped garment ICEM-005	Goat skin or deer type animal	Scrape skin	Fat & smoke cured	Cut & sewn	Dark and light stripes of fur/hair	Costume	Unsure if there were sleeves
Leggings ICEM-006	Goat skin or deer type animal Red deer skin for tongues that fit into shoes	Scrape skin	Fat & smoke cured	Cut & sewn		Costume	
Loin cloth ICEM-008	Goat skin	Scrape skin	Fat & smoke cured	Cut & sewn		Costume	
Belt with bag ICEM-016	Calf skin (wild or domestic)	Scrape skin and depilate	Fat & smoke cured	Cut & sewn	Stitching pattern	Costume / Equipment	
Shoes ICEM-009	Upper of red deer skin bear skin soles Tree bast, lime?	Scrape skin	Fat & smoke cured Knotted netting	Cut & sewn		Costume	Fur on sole worn inwards, fur on uppers worn outwards
Hat ICEM-004	Brown bear skin	Scrape skin	Fat & smoke cured	Cut & sewn		Costume	Worn fur side out
Cape ICEM-010	Grass Lime bast	Prepare fibres and spin cord	Twining	Wrapped & tied		Costume	
Quiver (Straps unidentified) ICEM-011	Chamois, ibex or roe deer skin	Scrape skin	Fat & smoke cured	Cut & sewn		Equipment	
Knife sheath ICEM-015	Tree bast, lime	Prepare fibres and spin cord	Twining	Sewn		Knife & sheath Equipment	
Wide mesh net ICEM-003	Tree bast, lime	Prepare fibres and spin cord	Knotted netting			Equipment	Rucksack net cover or bird catching net
Related artefacts							
Strip used to bind axe to haft	Skin species unidentified Tree bast, lime	Scrape skin	Fat & smoke cured	Cloth cut into strips		Equipment	As narrow binding strips

Table 6.1 Table of identification and extended chaîne opératoire of cloth artefacts

Bear skin hat

Quiver

Twined grass and tree bast cape

Belt with pouch

Skin straps to bind axe blade to haft

Striped garment

Leggings (loincloth not visible)

Shoes of netting, red deer uppers and bear skin soles, stuffed with grass

Figure 6.1. Reconstruction of the Iceman's clothing and cloth equipment at Bolzano Museum, Italy. The loincloth and knife sheath are not visible (Photograph Susanna Harris).

a)

b)

c)

Figure 6.2. Cloth artefacts found with the Iceman: a) The belt bag and contents. Visible to the left of the cord knot is the remains of the belt both ends are torn and the other belt sections are not in this photograph. The bag section of the belt is to the right of the cord knot the contents including tinder, awl, stone tools and antler retoucher. ICEM-016 (photograph from Egg 1993:55 colour plate XI). b) Knife with sheath in twining technique, length 12.8cm, ICEM-015, (photograph from Egg 1993:63 colour plate XIII), c) Bearskin hat 25cm high, ICEM-004 (photograph from Egg 1993:79 colour plate XX).

a)

b)

Figure 6.3. Striped garment and quiver found with the Iceman: a) Striped garment, maximum preserved length of 94cm ICEM-005 (Photograph from Egg 199374:colour plate.XVII). b) Arrow quiver, c.92 cm long, ICEM-011 (photograph by Koler, in Egg 1993:40 colour plate VIII).

Evidence for the material sequence of the extended chaîne opératoire

In the following section I look at the evidence for the sequence of the extended chaîne opératoire in the clothing and cloth artefacts of the Iceman. To do this, I consider the chain of events surrounding the cloth from raw materials to cloth assemblage. Through the analysis of the materials I then consider how people convened and intervened in the preparation and use of this cloth assemblage. The main sequence understood through the analysis of materials is summarised in Figure 6.4.

The raw materials

In the analysis of the species used for the animal skins, four species were identified securely: goat (loincloth), wild or domestic calf (belt-pouch) -(Table 6.1), red deer (legging tongues, shoe uppers) and brown bear (shoe soles, hat) -(Groenman-van Waateringe 1993: 121-128). The other skin artefacts were more problematic. The striped garment and the main part of the leggings is probably goatskin, although there is the possibility that these are made from a deer-type animal. Similarly, the quiver could be from either chamois, ibex or roe deer (Table 6.1) (Groenman-van Waateringe 1993: 123-128). Except for the grass stems used for the vertical element (warp) of the cloak (Goedecker-Ciolek 1993:109-110), all the plant fibres analysed were lime bast (Pfeifer & Oeggl 2000). (Results summarised in Table 6.1). Red and roe deer, bear, chamois and ibex would have been hunted. Hunting tools may have included bows and arrows, slings, spears and other thrown weapons (for example Ramseyer 2000). There is little evidence of traps, but that does not exclude their use. Domestic animals including goats and calves would need to have been cared for throughout the year, possibly near to the settlement or possibly by a transhumance strategy (Spindler 2003). Once the animal was dead (hunted or domestic), it needed to be skinned using sharp tools such as knives. The skin would then be ready for processing.

All the fibres, except the grasses, analysed from the Iceman are lime bast (Pfeifer & Oeggl 2000:70). Lime bast comes either from the main trunk or outer branches of lime trees and, depending on the method, this probably required the use of a sharp tool, possibly an axe, to create a starting cut in the bark before pulling the strip off (see Chapter 4). The grasses have been identified as tall species which grow in the high Alpine zone (Goedecker-Ciolek 1993:109). Once harvested, they would need little further processing.

Processing the raw materials

Unless the skins are preserved by methods such as freezing or salting, to prevent decay, the fatty under-layer would need to be removed immediately after skinning. As is the case with the belt and pouch, the fur may have been removed by soaking and / or scraping with a stone scraper, sharp bone or other implement (Chapters 4&5). At this stage the skin would need washing in water. Scrape-marks from this process are visible on the flesh-side of some garments (Egg 1993:72-73). It seems that whole animal skins were used: there are two teats on one of the skins and a natural bulge, possibly from an animal's knee, on another (Groenman-van Waateringe & Goedecker-Ciolek 1992:413).

The tree bast seems to have been processed in a number of ways. In their analysis, Pfeifer and Oeggl state that only the fine threads used for sewing the animal skins were subject to a water retting treatment, all others including those for twisted and spun fibres, were used fresh from the inner bark (Pfeifer & Oeggl 2000: 71).

The lime bast fibres were spun into single and 2-ply thread (Pfeifer & Oeggl 2000: 76) and used for the shoes, weft of the grass-cape and the knife sheath (catalogue ICEM-9, ICEM-010, ICEM-015). It is highly likely these long tree bast fibres were made without any specialist equipment using the hand-spinning method (Médard 2003:83, Seiler-Baldinger 1994:2) (see Chapter 4).

Cloth construction

Based on a microscopic examination of the skins, it is likely that the skins were treated using a process such as fat and smoke curing (Groenman-van Waateringe 1995: 69, Spindler 1995:135-6) (see Chapter 4).

Two of the cloth artefacts, the grass-cape and the knife sheath, are made using the weft twining technique. For the cape, long grasses were prepared in bundles, looped over a starting cord to create the warp and twined with two single-ply, s-twist threads at intervals of 6-8 cm for 8 rows. The last 34cm of the grass fibres were left to hang free (Goedecker-Ciolek 1993:109,Abb.48, Egg 1993: 80). On the side-edge of the third row from the top is fastened a 6mm diameter cord, and this and other cords on the upper-edge were probably used to fasten the cape (Goedecker-Ciolek 1993:109-110). The knife sheath is made from a small piece of twined cloth from tree bast (Goedecker-Ciolek 1993:110).

There are two netting cloth artefacts. The poorly preserved fragment of knotted wide-mesh net is made out of spun and plied thread of c. 2-4mm in diameter (Goedecker-Ciolek 1993:112). The shoes are worked with spun threads of 2-6mm in diameter (Goedecker-Ciolek 1993:101-106, Abb.42, Egg 1993:71, Farbtafel.XVI). In her experiments, Jacqui Wood found that the shoes are made with a technique in which the thread that is used to make the netting is lengthened throughout the construction process (Wood 1999). That is to say, as the worker (or spinner) used up the thread, they then spun more fibres into the short end to make it longer. The bear-skin soles were added at the same time (see Chapter 4).

Artefact construction

The Iceman's cloth possessions include clothing of striped garment, cape, leggings, loincloth, belt, shoes, grass-cape and equipment including a quiver and belt-pouch, and a wide mesh net which may be a back-pannier cover or bird hunting net (Spindler 1995:118), knife sheath and various straps (Figure 6.1-3). Skin straps cut from cloth were used for binding; and the axe is fastened into the wooden handle socket with birch-tar and wrapped with skin straps (Egg 1993:56). Some of the cloth artefacts excavated with the Iceman were easily identified as they were complete or nearly complete: the quiver, right shoe, belt pouch, hat, knife sheath and various straps cut from skins (Groenman-van Waateringe & Goedecker-Ciolek 1992: 413-416). Artefacts that were incomplete when excavated were reunited by matching the edges of original sides and seams, following the shape, colour and direction of fibres and, in the case of skins, fur (Groenman-van Waateringe & Goedecker-Ciolek 1992). The artefact analysis was assisted by the position in which they were found relative to the body (for example, Spindler 1995 138-139). Despite some criticisms, for example in relation to the neck closure of the grass-cape(Wood 2004), or the problem of the shape of the striped garment, this identification of artefacts is convincing and the method of identification is well explained (Groenman-van Waateringe & Goedecker-Ciolek 1992).

Cutting, sewing and fastening

All the skin artefacts, except the binding straps, were cut into pieces from the original skin and sewn. The striped garment is sewn with alternating strips of dark and light fur (Egg 1993:73). The pieces are preserved only up to the arm-pit and shoulder, with no evidence of sleeves, and the garment was probably knee length (Egg 1993:73-80). The conical shaped leggings, worn fur-side outwards, were made of many irregular, smaller pieces sewn on the flesh-side using sinews in overstitch (Goedecker-Ciolek 1993:107-107). The loincloth is made of several long strips sewn together with animal sinew; the upper edge is wider than the centre, and only the front is preserved. The total length was probably about one metre (Goedecker-Ciolek 1993:108, Spindler 1995:141). It is a wrapped garment and must have been held up by a belt, probably the same belt that held up the leggings (Goedecker-Ciolek 1993:108). The belt is made of two overlapping strips of skin with an additional strip attached to form the pouch. It is nearly two metres long and could have wrapped twice around the waist (Egg 1993:50, Spindler 1995:107). The hat is made of pieces of bear-skin, sewn with sinew in overstitch (Goedecker-Ciolek 1993:109). The deer panels were sewn to the shoes over the netting (Wood 1999). The quiver body is made out of a roughly rectangular piece of fur sewn together with thin leather strips, the damaged top fastened with a roughly semi-circular piece of fur: no evidence remains of the carry-strap. One side is reinforced with a hazel rod, attached by a leather strip threaded through the bored holes (Groenman-van Waateringe & Goedecker-Ciolek 1992:413, Egg 1993:39, Abb.7-14).

As already mentioned, the shoes and cape were shaped as the thread was worked into the artefact. The shoes were covered with skins and a leather loop was sewn onto the knife sheath (Goedecker-Ciolek 1993:111-112).

The assemblage of clothing and equipment

The costume includes leggings, loincloth, striped garment, cape, belt, shoes and hat. The quiver contained arrows, two sinews, a tree-bast cord, a bundle of bone points and a curved antler point (Egg 1993: 39-50). Inside the belt bag was a flint scraper, small flint blade, flint borer, a bone awl, and a dark mass of what is thought to be tinder (Spindler 1995:108, Egg 1993:50-53). Other cloth items include the net, which may have been used to catch birds (Spindler 1995: 118) or to cover the wooden frame (Spindler 1995:92), as part of a back pannier (Egg 1993:58). A knife sheath would have prevented damage to the knife or person.

Together, this assemblage of cloth artefacts, along with the other artefacts he carried, including his bow and arrow, axe flint tools and tinder, enabled the man to undertake many activities and tasks. These presumably included lighting a fire (the tinder kept dry in the pouch), sewing to repair cloth (the awl and sinew in the quiver), hunting animals or shooting other humans (the bow and arrow in the quiver), catching birds (the net), to sleep in (the grass-cape), and cutting activities (flint blades in the pouch or knife and sheath).

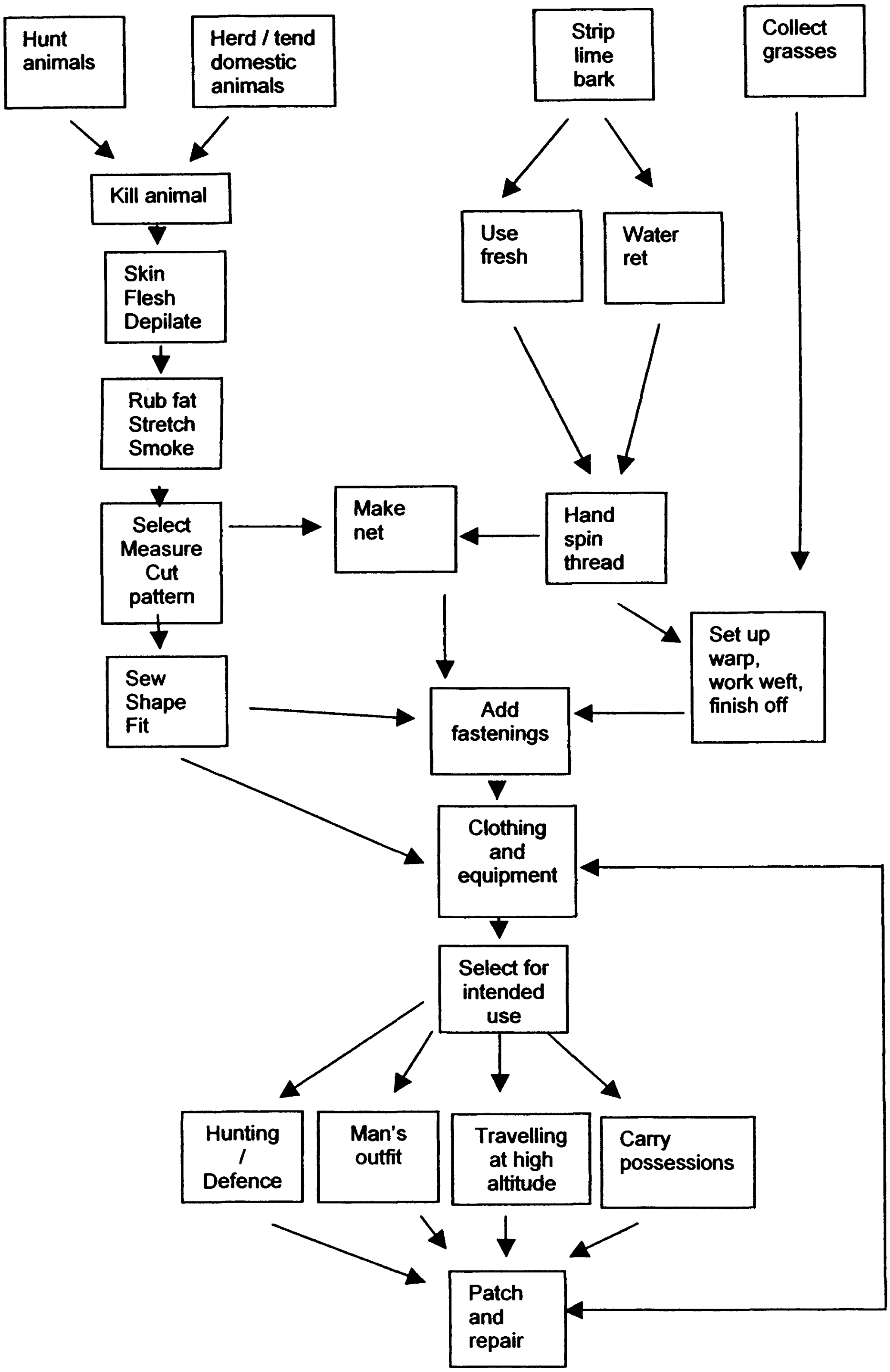


Figure 6.4 . Sequence traced through the analysis of cloth materials

In this, the chaîne opératoire of the cloth assemblage does not end when it is worn, but becomes part of the tool kit for these and other tasks.

Repairs

The leggings are frequently patched, which suggests wear (Egg 1993:73) and the repairs used s-spun, Z-plied 0.7mm animal hair thread (Goedecker-Ciolek 1993:106). The striped garment has fewer repairs than the other garments (Egg 1993:73). There are coarsely executed repairs with crude grass thread. This may suggest that the original sewing was done by someone else and that the man repaired these himself (Egg 1993:73, colour plate XVIII), or that the repairs were done in a hurry using tools that differed from those used for the original sewing.

Discussion

Above, I have cited the evidence for the material sequence based on the analysis of artefact analysis, which is summarised in Figure 6.4. In the following section I take this evidence and consider the sequences of time, place, techniques and people. These processes have been described throughout Part II of the thesis, based on comparisons with ethnographic and historical data and experimental archaeology, and are brought together here in relation to the assemblage of the Iceman.

Time sequences

By time sequences, I refer to the sequences that follow seasonal time cycles and the amount of time that activities took to complete, the repetition of activities, and the time that elapses between activities as understood through the longevity of materials, as referred to in Chapter 3 (Method and Theoretical Approach).

If skins were hunted for furs, at least some of the hunting probably occurred during the autumn / winter, as this is when the furs are of the highest quality (see Chapter 4). Domestic cattle and goats would need daily attention, possibly interspersed with a period or periods of transhumance (see Chapter 4). If the fur quality is not essential, or as was the case with the belt and pouch, the fur is to be removed, the season is not important: skins are suitable from the carcass, whenever the killing takes place. Seasonal cycles are summarised in Table 6.2. Whether the animal is wild or domestic, the process of skinning is most easily carried out shortly after death. The process of scraping animal skins and removing the hair prior to curing was probably carried out on the same day or shortly after the animal was skinned, unless the skins were frozen, dried or salted to prevent decay setting in (see Chapter 4). Based on the evidence, some kind of fat and smoke curing process was practised on the Iceman's skin clothing and equipment. This procedure would take place over several days with periods of intensive work, whether the skins were worked singly or in batches. Once cured, skins resist decay, so they can be stored and used for clothing and other cloth artefacts. In this case, the cured skins were cut, sewn, shaped and provided with fastenings to provide the Iceman with various garments and to make containers for the quiver and belt-bag. In terms of time, sewing artefacts constitutes hours of work (see Chapter 4).

The collection of plant fibres for cloth, including the lime bast and grasses, probably followed seasonal time cycles, with grasses collected at any time from late spring to late autumn and the majority of bast being either removed from the tree in spring / early summer or autumn depending on the way it was intended to be treated. The water retting would have required several months (see Chapter 4); as the heat of the water is essential for this process, retting was probably carried out over the summer and therefore the fibres would be ready to work in late summer, although alternative time cycles could have been practised. Once retted and dried, lime bast fibres can be stored ready for spinning. Some of the lime bast fibres were worked fresh or by means other than water retting, although the exact process is unclear. Spinning is one of the most time-consuming aspects of cloth production (see Chapter 4). In this case, the twined cloth types contain little spun thread and only the cape has spun thread in the weft. The knife sheath could easily be made by one person in a couple of hours; the cape is a similar construction on a larger scale and could have been worked in a few hours (Wood 1999). The thread spun for the shoes was worked progressively, adding new fibres to the end of the thread to make it longer (see Chapter 4), and Wood estimated that a pair of shoes could be made in a day (Wood 1999).

Once made, the artefacts were used repeatedly, as there are numerous patches on the leggings and repaired seams (Egg 1993:73). The durability of clothing and equipment depends on wear and resistance to decay: for example, shoe soles wear out quickly, whereas a hat lasts longer. Re-use is less evident in the artefacts of plant fibres. Items may have been produced for particular occasions or seasons of the year. Although the Iceman's death was in the late spring/early summer, assemblage of this type of clothing and cloth was not necessarily restricted to this time.

<table>
<tr><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td></td><td></td><td></td><td colspan="3">Iceman uses clothing and cloth equipment</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hunt Furs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Hunting wild animals for furs</td></tr>
<tr><td colspan="12">Domestic animals slaughtered and skinned</td></tr>
<tr><td></td><td></td><td colspan="7">Collect grasses</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Collect tree bast #1</td><td></td><td></td><td></td><td colspan="2">Collect tree bast #2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="4">Water retting tree bast</td><td></td><td></td><td></td><td></td></tr>
</table>

Table 6.2. Seasonal cycles associated with production of cloth types used in the Iceman's assemblage. Each row shows the seasons when different activities were probably carried out; blank boxes are times when this activity was probably not a high priority.

Place sequences

By place sequences, I refer to the location of interaction with cloth during production and use in the extended chaîne opératoire of cloth types found in the Iceman's assemblage.

All the raw material species identified are indigenous to the Alpine region. They occupy different habitats and environments: the chamois in rocky areas with pastures or woods and up to high altitudes; ibex at the highest altitudes, although on lower slopes in summer; roe and red deer in woods with water and not usually above the tree line; brown bears usually in extensively wooded, mountainous areas (Abram 2004:64,66,67,97,117). Lime trees occur in forests or stands, and the grasses in the high Alpine zone (Goedecker-Ciolek 1993:109) (see Chapter 4). Although there was exchange in this period (Della Casa 2003: 205, fig. 8), this is hard to trace for cloth. As all the raw materials in this cloth assemblage were available from local resources, it seems likely that the Iceman's clothing and cloth equipment was, or could have been, made entirely by the community to which he belonged. After obtaining the raw materials, a water source would have been required to rett plant fibres and wash skins; water would have been available in the lakes, streams and rivers throughout the Alps.

In terms of the way the artefacts were used, the clothing of furs and plant fibres would have been warm and resistant to the cold, wind and precipitation. For example, the shoes were (at least partially) covered with fur and stuffed grasses so they would have fitted well and been warm; the cape probably reached below the knees of the Iceman and could have been a type of rain-coat (Goedecker-Ciolek 1993:110). Woods notes that her constructed cape is "very lightweight, hard-wearing and extremely warm to wear" (Wood 1999). The observation that the cape was light weight is also significant, as this would make it suited to walking in the mountains. The clothing and equipment is also suitable for someone on the move, with cloth containers used to carry many different pieces of equipment. However, this clothing and equipment is not confined to high altitudes and cold weather. In the analysis of the pollen trapped on the fur clothing (Groenman-van Waateringe 1993: 114), the occurrence of pollen typical of human settlements, and woodland as well as cereal pollen and grains, suggests that clothing had been worn in settlements, agricultural and woodland environments (Groenman-van Waateringe 1993: 118-119), and was therefore not exclusively worn at high altitude. As with all garments, these items of clothing could be put on and taken off, worn singly or in costumes that would adapt to the context of different places and times, whether socially or seasonally dictated, indoors or out. In terms of containers, the quiver and belt-bag could well have served the man in a number of different situations. Therefore, although the find context of the Iceman is in the high altitude mountains, it does not exclude that such clothing and equipment was used elsewhere.

The sequence of tools and techniques

Looking at the chaîne opératoire of cloth production and use associated with the Iceman in Figure 6.4, a wide range of tools and techniques would have been necessary to produce the Iceman's clothing and cloth equipment, and again involved in the way it was used; some of the tools and techniques are referenced in both the production and use of the assemblage.

To acquire the wild animal skins would require equipment and skills in hunting animals as diverse as deer and bear, and the techniques and skills to use the appropriate weapons. In contrast, techniques of animal husbandry require rather different skills, whether by transhumance or looking after animals in closer proximity to the group / settlement. Both husbandry and hunting for skins were used for the Iceman's clothing and equipment. All skins can then be treated in a similar way by using various scrapers, frames and smoky fires. A further tool assemblage and range of skilled techniques is associated with cutting and sewing, including in particular awls and needles.

Gathering the plant fibres may have required the use of axes or other cutting tools for the tree bast, and few tools for the grasses. Similarly, the hand-spun thread did not need special tools and, in terms of twining constructions, the cloth of the knife sheath was probably worked without any equipment, whereas the cape would need a frame or two posts (even trees) to secure the starting cord.

Clothing was wrapped around or pulled on and fastened to the body. Worn or carried, this clothing and equipment was used to attune to the mountain climate, to carry bow, arrow, awls, tinder, flints, drill bit and sinew and to dress the man appropriately. Interestingly, the very tools that I have already mentioned in many of the processes of producing cloth are found with the Iceman: the means to hunt and kill animals with a bow and arrow, whether solely as a hunter or as someone protecting a herd of animals from predators, and an awl and tendons for sewing.

These tools are a suggestion of an array of techniques, informed by a considerable knowledge of materials. Just as one person could have performed all these tasks and known all these techniques, these tasks could equally have been shared out by the people of the community to which the Iceman belonged. The implications are that these were probably techniques in which many people in the community were skilled and which would have been shared by various means, whether by gender, age or more extensively by exchange.

Cooperating and participating in the sequence

In the introduction to this case study, I stressed the importance of investigating the way in which people convened and intervened in the sequence of events that are described in this extended chaîne opératoire. In this section, I investigate the possible ways in which people came together and were involved in these events. Of course, these people were not only repositories of skills, but had gender, social roles, family and social relationships.

One of the ways to recognise how people may have come together and been involved in the sequence of the cloth production and use of the Iceman's assemblage is through investigating the gender of tasks. As mentioned in Chapter 1, during the Copper Age weapons, including arrows, are associated with men in burials, as for example at Remedello Copper Age cemetery (Barfield 1986:243-4), and may have represented men on the stelae of Sion (Gallay 1995:178) and other areas of Europe. In addition, it is argued that hunting large game, such as the deer, bear, chamois and ibex, does show repeated, world-wide patterns of being predominantly a man's task (see Chapter 4). However, Owen argues there is an inherent bias in ethnographic research to support men as hunters, excluding accounts of women contributing to these activities (Owen 2005:ch.1.). Women in the Copper Age may have participated in these predominantly male-gendered tasks, as is suggested by the possible association of female skeletons with weapons in the Remedello and Spilamberto cemeteries of northern Italy (Whitehouse 2001:31).

There is little research on how domestic animals were killed in this period. There are many possibilities, including bows and arrows, spears and knives. These practices may have followed a similar gendering of tasks as in the case of hunting. Herding and transhumance brings into question different gender, age and social roles; children and elderly people may have been involved. There may be some distinction between agility and age in these tasks: Owen notes that hunting is frequently carried out by able-bodied young men rather than women and children, disabled or old men (Owen 2005:13).

There is little to identify the people responsible for the collection of grasses and the stripping of bark for tree bast. There is some association of men with axes in the Copper Age. Axes are associated with male burials at the Remedello burial site (Barfield 1986:243-245), and are represented with other apparently male-gendered artefacts, such as daggers and halberds, on the stelae of Arco, Trentino (Pedrotti 1995:44-45) and the Valcamonica (De Marinis 1994c:82-85). However, this does not convincingly associate tree-bast collecting exclusively with men; for a start, tree bast may have been collected without axes, and there is distinction between the way axes are used, including battle axes, polished stone axes used in prestige exchange, wood working axes, and felling axes, which may be further associated with a social role or status. It is particularly difficult to relate processes of skinning and curing, or hand spinning and twining, to any particular gender, age or other social category, although it is realistic to consider that a broad cross section of the community was involved in these diverse tasks. The ability to make thread, sew and skin animals was probably very common in these societies.

Although some of the stages of the sequence (as mentioned above) are difficult to associate to the gender, or other social identity, of the people behind them, the sheer diversity of skills and activities in these processes suggests some division of labour according to gender. Building on earlier research of the gender division of labour worldwide, Costin notes that when men and women work together on the same task, there is "actually a gendered division of labour by subtasks or a distinction between female and male artisans by material, technology, products, or markets" (Costin 1996:122-123), , very rarely do men and women do exactly the same thing. In this case, therefore, it seems highly likely that there were a number of people, men and women, and of various ages, participating at different stages of the extended chaine opératoire.

If not through gender, then the division of labour is more readily approached through considering the number of people required for each task, or subtask . Small skins (chamois, goat) are easily worked by an individual at all stages, but large, thick skins (bear) are not, which possibly indicates that small groups were formed to work together to deal with them (Kellogg 1984:30, Oakes & Riewe 1996:46-47). Individuals could well have collected and worked tree bast and grasses, but this does not preclude that people may have worked in small groups. As a technique, hand spinning is the task of one person, but monotonous; it is easily made a sociable task, with several people spinning their own threads at the same time, or alongside other tasks (see Chapter 4). Similarly, the twined constructions could have been made by an individual, although the larger piece of weft-twining for the grass-cape may have been worked by two people. The technique of working the shoes with simultaneous thread making and netting construction must have been worked by an individual or at least one person at a time (as, for example, in experiments by Wood 1999).

Like sewing and cloth construction, an individual can achieve the necessary pattern cutting and sewing. However, the person making the clothing would need to fit it to the body, by taking measurements and creating the right shape. In small communities (for example, Oakes & Riewe 1996:18), these people probably knew each other (no "off the peg" clothing). In the case of the Iceman, exactly who was making his clothing and cloth equipment (mother, wife, himself, brother, uncle, exchange partner, village specialist, neighbour, friend), remains unknown, although the discrepancy between neat seams and repairs suggest that at least two people worked on the sewing. In North American Inuit societies, women sewed the family's clothing, but men were able to carry out running repairs (Oakes & Riewe 1996:18-19). These exchanges between family members are exactly the sort of material exchanges that form, create and establish social relationships.

The Iceman's assemblage dressed his body to protect it from the elements and provided him with tools and equipment and a way to carry his possessions and all that these enabled him to do, but it also dressed the social body: creating the man. In this way, the clothing and cloth equipment are the tools and techniques of social importance. With so little to compare, on top of the problems of identifying exactly how it was worn, it is difficult to establish if this is typical male dress for his age or region. There are some comparisons. The striped cloaks of the statue stelae from Arco, Trentino (described in Pedrotti 1995) can be compared in effect, if not materials, to the cloak of the Iceman (Bazzanella & Mayr 1995b:110-111). For example, the stele from Lagundo B, Val Venosta, and Arco II, III, IV and V are convenient examples (Pedrotti 1995: 56, Bazzanella & Mayr 1995b:109). These are not geographically so distant from the Tyrolean Alps where the Iceman was found, are dated to the third millennium (Pedrotti 1995:56), and hint that the striped garments were possibly common, regional items of clothing, worn by both men and women. Other comparisons can be made with the engraved dagger sheaths on the statue stelae of Copper Age monumental compositions of the Valtellina, northern Italy (Anati 1968:25-26, Casini, De Marinis, Fedele, Fossati, & Odone 1994a:154-155). The context of these items on the stelae and monumental compositions further adds to the idea that they may have had social significance beyond the purely functional, bringing into question whether they were acquired through merit, or were symbols of gender or age given to mark life-cycle events or personal relationships.

Combined evidence of sequences

From this analysis of sequence in the extended chaîne opératoire it appears that the cloth assemblage was worked throughout the course of the year, with periods of intensity at different times. The raw materials come from a variety of Alpine environments, with particular emphasis on the forest and higher altitudes, other than, in the case of the domestic animals. The variety of skills needed to make this one assemblage was probably shared by a number of people who at times worked together and at other times alone on aspects of cloth and artefact production. This assemblage was found with one man, but other adult men probably had similar assemblages, and some items may have been common to other members of the society. In this, the materials moved through the hands of a number of different people who prepared the assemblage throughout the year, which eventually was worn by the Iceman. Through this we glimpse the social networks and cooperation (or coercion) of individuals who together produced the cloth material culture to enable this individual to dress, to carry his possessions including various tools and weapons, to travel at high altitude, to keep warm and dry and, as far as we understand, to be appropriately socially dressed and equipped for a man's role in his society. These sequences relate directly to the clothing and cloth equipment found with an individual. One of the concerns with this find is whether it is representative of cloth assemblages in the Copper Age.

Alternative cloth sequences in the Copper Age

The cloth evidence with the Iceman is so unusual that it is difficult to evaluate in relation to other cloth finds of the period, which come from the waterlogged lake dwelling villages and only preserve plant fibres. The Iceman's cloth assemblage does not include a number of cloth types that were available at that time in the region. There is some question as to why these cloth types are not found with the Iceman (Spindler 1995:132-134, Winiger 1995:119-121).

Based on evidence of cloth finds from the waterlogged lake dwellings, cloth from plant fibres such as lime bast and grasses are to be expected, as are cloth types of netting and twining. This can be compared with contemporary sites such as Arbon-Bleiche 3, Switzerland (Leuzinger 2002, Jacomet et al. 2004), or the Horgen culture layers of Feldmeilen Vorderfeld, Switzerland (Winiger 1981). Skins are not usually preserved but their use is expected for the period (see Chapter 4). The species used for skins are from animals known in the Alpine region. The types of artefact - quiver, knife cover, belt, tunics and capes - are known from other contexts (see Chapter 4). Even the decorative effect of the striped garment is found on the stelae of Trentino, North Italy, although these are dated roughly 500 years later. Absent from the Iceman's assemblage is evidence of either wool or flax as raw materials. Examples of linen woven cloth are known from the beginning of the fourth millennium and contemporary sites, including those mentioned above (see Chapter 4). Wool was probably known and used by this time in the Alpine region; evidence suggests that sheep were exploited for wool at Arbon Bleich 3 (Hosch & Jacomet 2004:391-402).

Although these have been seen as surprising absences, there are other aspects of this assemblage that show it is not representative of all available cloth types. There are no skins from pigs, birds, fish, dogs or wolves. Neither is there oak, willow or elm bast. In terms of techniques, several other twining techniques, such as close mesh twining or twining with plaited wefts are not represented. What we are looking at is a selection of cloth types and artefact types from the Copper Age, interesting as much for their presence as for the absence of a number of other cloth types.

Were cloth better preserved we may not be surprised at these finds. After all, how many hundreds of durable remains such as knives and arrowheads are known that potentially had similar sheaths or quivers? How many people (women or men like the Iceman) went up into the mountains to hunt, herd animals, travel or gather plant materials, and would have needed such clothing and cloth equipment? Here, I will approach this issue by considering cloth types as a product of sequence. From this perspective I compare the cloth types found with the Iceman with linen, wool, woven textiles, animal skins of other species. I will assume that the Iceman, or at least people in his wider community, knew about these cloth types and probably possessed some of them (see Chapter 4).

As I proposed in the Introduction to this case study, alternative cloth types may be made appropriate or inappropriate in contexts of use not on the basis of physical material differences, which may be so slight as to be irrelevant, but because of the sequence of production and use. So, for example, linen may not have been appropriate because of its association with farmed land, whether because the Iceman and his community chose not to grow flax, were unable to produce linen, or because linen was considered appropriate only for different uses: for children's clothes, for ceremonial clothes, for grain storage bags, or for garments that did not get worn in the high mountains. It is less clear how common wool was at that time, but again its absence in this assemblage may be to do with the appropriate use of wool, rather than the physical ability of wool to be "useful" in such a situation. The absence of linen and woollen cloth is also related to the issue of weaving. There are no woven textiles, whether linen or wool. There is no doubt that these cloth types were known by the Iceman and his community (see Table.4.4.4), and it may seem surprising to us that woven textiles are not in this assemblage. However, some aspects of the sequence in the production of this cloth may have meant that it was not appropriate for this context of use, whether because it was associated with a loom, the person working the loom, the amount of time it took to produce, or the technique. In the same way, other animals may or may not have been hunted for their skins, or their skins may have been reserved for other contexts of use: ceremonial uses, housing, saddlebags.

Complex social relations in the sequence of constructing the Iceman's clothing and cloth equipment

The complexity of social relationships can be appreciated in the relationship between the sequence of production in the cloth components of the Iceman's assemblage and its use. The social networks leading to this assemblage are recognisable in the many different stages that were involved in its production and, I have argued, probably included a wide range of people. The shear diversity of environments that were exploited throughout the year to gain the raw materials, the number of skills, techniques and tools used to process the skins and plant fibres into cloth and then into artefacts, and particularly the processes where several people needed to work together, suggest that this assemblage comes from the work of a community, including men, women and children, not just of one man. Therefore, although the assemblage is worn by a man, and enables him to fulfil his social role, the preparation would have been embedded in social networks of cooperation, exchange and reciprocation with other people in his community or wider social networks. Considering cloth in this way adds complexity to the social roles ascribed in the Copper Age; this example shows how many people, including men, women and children, were needed to prepare one man to go into the mountains to hunt, herd, trade or otherwise.

Interaction at a family, settlement and regional level in the sequence of cloth production and use in the Copper Age

As I have argued, the cloth types found with the Iceman are not exceptional, except in their excellent preservation. This means that other individuals, families and communities were involved in producing these cloth types and using them as clothing and cloth artefacts. The implications are that the sequences of time, place, techniques and tools, or people were repeated extensively across the Alpine region. In this, whole communities were forced to share rhythms and routines whether they chose to conform (men hunt) or to not (striped clothing not allowed). It is difficult to know how these rhythms and routines were converted into beliefs and ideologies, but there are some hints. As discussed above, weapons are associated with men in burials and in representations, certain species of animals (deer, sheep, goats, dogs, pigs, cattle) are repeated in the Alpine rock art in the Valcamonica, northern Italy (Fossati 1994) and traction animals are represented in the rock art of Mount Bégo, France, (Barfield & Chippindale 1997:120-122).

Conclusion

The Iceman has received wide attention in the analysis and literature on the Copper Age. Beyond the analysis of materials, the main focus of attention in relation to the clothing and cloth equipment has been to verify their suitability to the cold climate and mountain terrain (for example Leitner 1999:25, Pedrotti 2000b:228, Whittle 1996:315), with a questioning of how specialised this type of costume may have been (Spindler 1995:133 Leitner 1999:26). In this case study, I have used the method of the extended chaîne opératoire focusing on the importance of sequence in the production and use of these cloth artefacts to question the wider context of cloth as a component of this man's life, and that of the community to which he belonged.

Through this method I have suggested that the Iceman shows how cloth was used to keep the wearer warm and dry, and was presumably also suited to his gender and other aspects of social identity such as regional traditions of dressing. The production of cloth was also a structuring aspect of the year, with periods of acquiring raw materials from the wider landscape or at the death of a domestic animal which had been cared for throughout the year. In terms of people and collaboration in these tasks, while many of the skills and techniques could have been performed by a single person, some, such as curing a bear skin or looking after animals, were more likely to have been a collaborative effort. Other tasks, such as sewing the skin clothing, seem to have been carried out by others as well as the Iceman, who seems to have carried out his own running repairs. It is difficult to make a case for exchange in cloth types as the materials are all locally available, although some cloth types, notably the bear skin hat, may have come from some kind of specialists and therefore could have been exchanged. Nevertheless, the evidence of the production of these cloth artefacts is that the Iceman benefited from the cooperation and collaboration with other people in his community or family to equip and prepare him suitably for his journey in the mountains.

Another conclusion based on my approach, is that the combination of cloth types found with the Iceman (wild and domestic skins, fur and depilated, twining, netting) is the type of cloth that would be expected in this period, but does not include all the known cloth types. The absence of wool or linen, woven textiles or other species of animals for skins brings into question why these cloth types were excluded from this assemblage. In this, I suggest that it is not only the material qualities of cloth types that may make a material appropriate or inappropriate to belong to a particular context, but also that such cloth types may have been reserved for other uses. These choices may have been made on the basis of their origins and the social context of these materials on the basis of the resulting socially held values.

CHAPTER 7

People and place in the representation of cloth on the stelae of Sion, Petit-Chasseur in the Swiss Valais, c. 2700-2150 BC

In contrast to the other case studies, and in fact the bulk of archaeological evidence of cloth for this period, the evidence for this case study is not cloth *per se*, but the representation of cloth engraved on anthropomorphic standing stones (*plural*: stelae, *singular*: stele), erected at funerary sites and re-used to build burial structures (cists). There are a number of clusters of stelae dating to the third millennium BC across Europe. I have chosen to focus on the site of Sion, Petit-Chasseur, Swiss Valais, Switzerland as it has some of the richest evidence in terms of engraved costumes and is one of the best excavated, published and dated of these sites. It was the subject of systematic excavation between 1961 and 1992 and the documentation resulted in an eight volume report (Bocksberger 1976a, Bocksberger 1976b, Bocksberger 1978a, Bocksberger 1978b, Gallay & Chaix 1984a, Gallay & Chaix 1984b, Gallay 1989b, Gallay 1989a). The style of the stelae, their erection in rows, and their re-use to build cists, has close parallels to the site of St Martin de Corléans, Aosta, Italy, excavated in the 1970s to 1990s (Mezzena 1998:90). In addition, there are a number of other stelae known throughout the Alpine region. I shall refer to these for comparative purposes where necessary in the case study.

The combination of artefacts engraved on the stelae, including patterned clothing, is especially significant as evidence of costumes in the late Copper Age is rare. However, this is an oblique reference as these costumes are engraved on stones, which were initially erected at funerary sites and then re-used to build burial cists. Therefore, the stelae and the costumes engraved on them form part of the architecture of the site In relation to the extended chaîne opératoire, this case study refers to the role of cloth decoration and assemblages of cloth use, and the role of cloth in representation.

Investigating people and place in cloth representation

In this case study I will consider the engraved costumes through the broad themes of people and place. People are investigated through questioning "who?". People refer to agents involved in the different stages of the extended chaîne opératoire.

In terms of the extended chaîne opératoire of the stelae, people can be approached through considering the artist, prototype, index and recipients (after Gell 1998:ch. 2). This includes the intentions of the *Artist* who creates the representation in the image of the *Prototype.* In terms of the stelae, the artist is the engraver and the prototype is the character who was engraved. Once made, the *Index,* or stelae, which is created by engraving (placing) the representations, including cloth, on the stone, is then visible to be seen by the *Recipient(s)* (Gell 1998:ch.2). At Sion, the recipients include the people who visited the site and people bringing dead bodies to be interred, which occurred on numerous occasions and over several generations. By place, I question "where?". I use this in a broad sense to include the place of clothing on the body and its assemblage into a costume as represented on the stelae. I also use the sense of place to investigate the context of the stelae in the funerary area, and their subsequent re-use in burial cists. These issues have several key points.

Costume: conformity and differentiation through visual appearance

Clothing and its combination in costume is one of the most direct and immediate ways in which people change their appearance. Through their choice of costume, the wearer may show conformity or differentiation between themselves and others. In their introduction to "Cloth and Human Experience", Jane Schneider and Annette Weiner consider how cloth is part of human actions to "consolidate social relations and mobilise political power", citing as one of the ways of doing this the "manipulation of cloth as clothing, the uses of dress and adornment to reveal or conceal identities and values" (Schneider & Weiner 1989b:3). It is the decorative potential of cloth combined with its ability to be shaped and formed, the way it is placed on the body, where it is placed on the body (as discussed by Wobst 1977:31-335), the combinations of cloth, and its ability to be changed at will, which make it an ideal vehicle to materially represent simultaneously concepts of social identity, beliefs and values.

What is a suitable costume for the agent in one context may be entirely inappropriate in another context, so the timing and place, in terms of social events and interactions, of such costumes is critical. This is no trivial matter: an inappropriate costume may jeopardise the wearer's social aspirations, just as much as an appropriate costume may enhance it. There are many examples of such a situation I could point to, but two articles illustrate this point well. In one, Sophie Woodward describes women choosing appropriate outfits for a social occasion and their estimation of success in terms of whether they were "really me" when worn in the anticipated situation. In this, the women are all aware of matching their costume to the social nuance of the occasion and place they intend to go to, and the other people they will see, both issues of "place and people" in relation to the foreseen social situation (Woodward 2005:21-23). Woodward shows how their view of success on these occasions, or even ability to attend, is closely related to their ability to look the part and feel comfortable. However, they are not completely able to anticipate the effect their outfit will have and therefore sometimes getting it completely wrong (Woodward 2005:34-40). Woodward illustrates the problem of costume as an "external self", with the unpredictable nature of its reception by others. Her account focuses on the ability of the women to prepare themselves for the situations they encounter, but this is not always such a proactive stance.

Costume also opens the wearer to the scrutiny of others. It may directly mark the person as unwanted and unwelcome. Irma Alicia Velásquex Nimatuj recounts the negative reaction to her traditional Mayan dress in Guatemala City (Velásquez Nimatuj 2003). Following an international meeting, Velásquex Nimatuj and her colleagues wanted to go to a restaurant for dinner; however, at the door of one establishment she alone was refused entry because of her Mayan dress. Outraged at this refusal, she goes on to analyse the daily cultural, racial, social and political implications for Mayan women who wear their traditional dress (Velásquez Nimatuj 2003:158-160). The details of this make interesting reading on how costume is readily used to differentiate, classify and sometimes exclude, with no regard for the individual's own intentions.

Representation: people and pattern

The issue of costume as visual culture is very relevant to this case study as I look at the evidence of the chaîne opératoire of cloth representation. However, the stelae are representations of people wearing costumes not the actual cloth itself. This adds another layer to the interpretation of the stelae.

In his work on images in art, Gell considers the role of idols, particularly those that physically resemble the deity they are made to represent (Gell 1998: ch.7.). Through various examples, he discusses the way these symbolic beings are granted agency (the ability to act and react) by those who interact with them, whether ascribed through magical powers, religious beliefs, or simply the imagination of a child playing with a doll. His in-depth discussion draws out many examples of how this may be achieved and perpetuated. However, details aside, the significance of this view is that representations of people can be imbued with personalities and powers with relative ease and acceptance. In this they are "social others" conforming to the social rules that are expected of such idols (Gell 1998:128), and in turn influencing their audience's behaviour. This dimension is significant in this case study as the life-size anthropomorphic representations bring into question their role as deities or ancestors at the site.

This relates to another of Gell's arguments, that it is not only human representations that influence in this way. In "The Technology of Enchantment", Gell considers how artefacts with striking appearances are intended to have effects with social consequences (Gell 1992:43-44). Gell takes as his first example the elaborately decorated canoe-prows that were used to transport Kula valuables in the Trobriand Islands as part of an exchange system. He argues that these canoe-prows, which contrast with the otherwise typically drab visual culture, are intended to be so visually stunning that they influence people's behaviour in the ensuing exchange of valuables (Gell 1992:44). Gell argues that this is not solely due to ethnological responses to patterned stimulus or "eye-spots" but also because of their technical virtues and, importantly, the way they are imbued with cultural concepts of magical power that are created by the carving magic of the artist (ibid:46). This is the "enchanting technology" which is used in what Gell considers as a means of "thought control" or "psychological warfare" (ibid:44, 46-7).

Considered together these two views bring into focus the role of cloth in creating the characters in the engravings and the role of elaborate cloth as decoration in the context of a funerary site, and are relevant to the interpretation of the archaeological evidence at Sion, Petit-Chasseur.

Archaeological context of Sion, Petit-Chasseur

The site of Sion, Petit-Chasseur is a megalithic funerary site with stone cists containing collective burials, which was constructed and revisited from the final Neolithic to the Early Bronze Age. A number of engraved stelae were found, re-used to build the burial cists; originally they stood erect in the ground, some in rows in front of the cists. The stelae are mainly anthropomorphic figures, or fragments of these, engraved on stone slabs (Figures 7.2-7.6). They were produced in a range of sizes, from stones that could have been found in the landscape to stone that was quarried from rocky outcrops nearby: they were shaped and engraved with stone tools (Gallay 1995:174).

The 2-sigma radiocarbon dates for the site range between 3350-1315 cal. BC (Gallay 1995:188-189). The earliest date precedes the erection of the stelae in the final Neolithic and the latest one dates to a period of interment after the monuments have largely disappeared in the Early Bronze Age (Gallay 1995:175, 188-189). At Sion the engraved stelae were all found in the "Horizon Supérieur", which dates to the beginning of the final Neolithic, the Bell Beaker period and the Early Bronze Age, dating from c.2700-2150 BC, and is divided into nine phases (Gallay 1995:168-171). Phases 1-7 are summarised below as they include the use and re-use of stelae at the site. The following summary is based on a synopsis by one of the excavators, Alan Gallay (Gallay 1995:168-178). The site plan is illustrated in Figure 7.1.

Sequence of activity at Sion, Petit Chasseur

Phase 1. Construction of cist MXII, final Neolithic, c. 2900 BC. This cist has a triangular base structure, similar to that of cist MVI. However, it contains no stelae. Interments are accompanied by funerary goods, including engraved pendants, leaf and lozenge-shaped arrowheads, and stone disc-shaped beads.

Phase 2. Construction of cist MVI, final Neolithic, c. 2700 BC. The cist has a large triangular base and contains stele 7, of type A (see below) (Figure 7.3.a), which is probably in its original position as part of the south-west extension of the cist (Gallay 1995:170). Interments are accompanied by funerary goods, including decorated pottery, stone spindle whorls (Figure 7.10.a), pig canines, ornaments and daggers of Grand Pressigny flint.

Phase 3. Construction of cist MI, MV, MXI, final Neolithic, Bell Beaker period, c. 2450 BC. These three tombs do not have bases; however post-holes around cist MXI suggest that the monument was protected by a wooden construction. The stelae re-used in construction include type A and B. MI is constructed with stele 1 (Figure 7.2.a) as a north facing slab, with two phases of engraving, one directly over the top of the first and obscuring it. Cist MV is built with stelae 16 and 17 (Figures 7.4.d&e), MXI is constructed of stelae 20, 21, 22, 23 (Figure 7.5.c-f). Interments are accompanied by funerary goods, including bell beakers and numerous sea-shell ornaments.

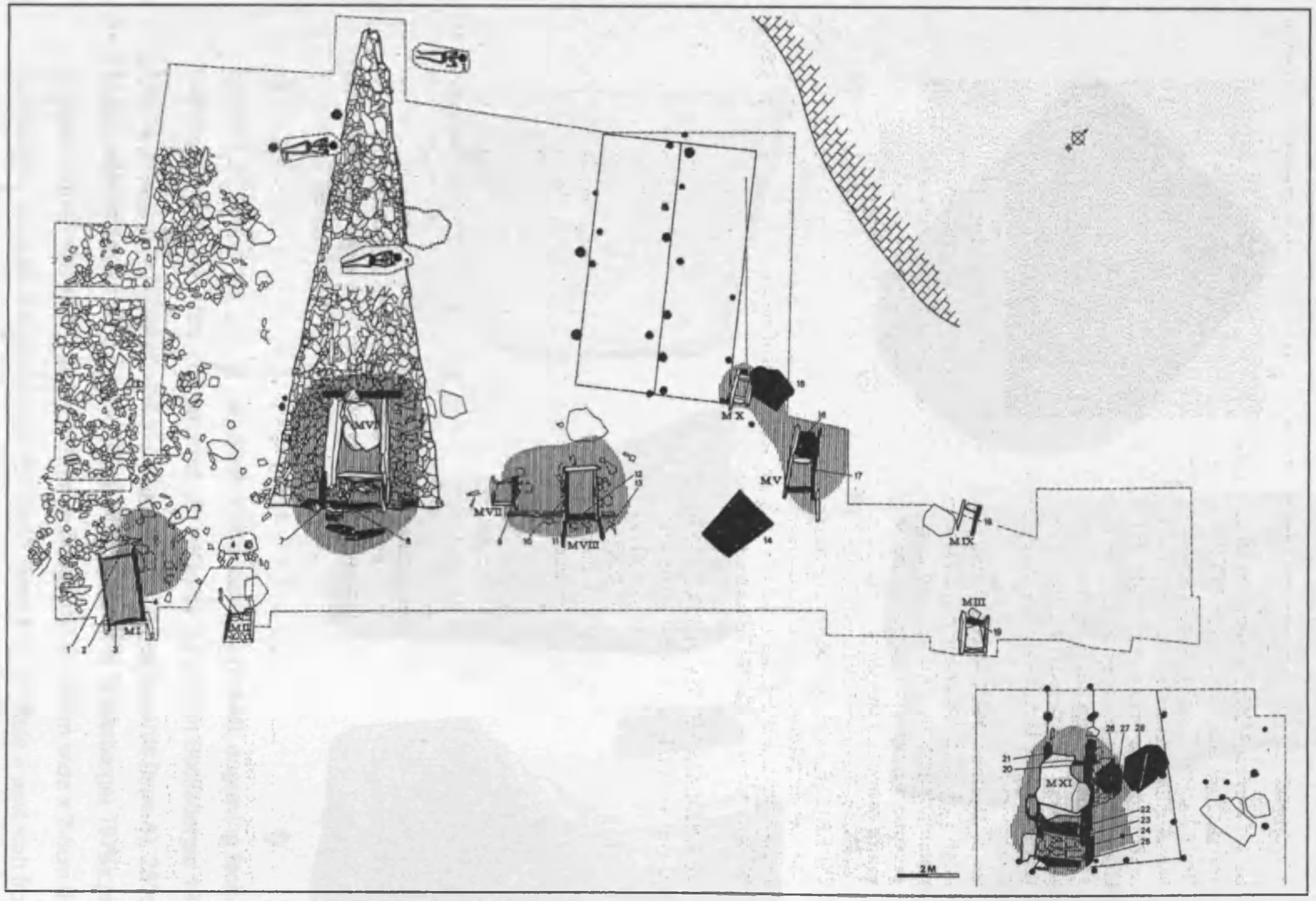
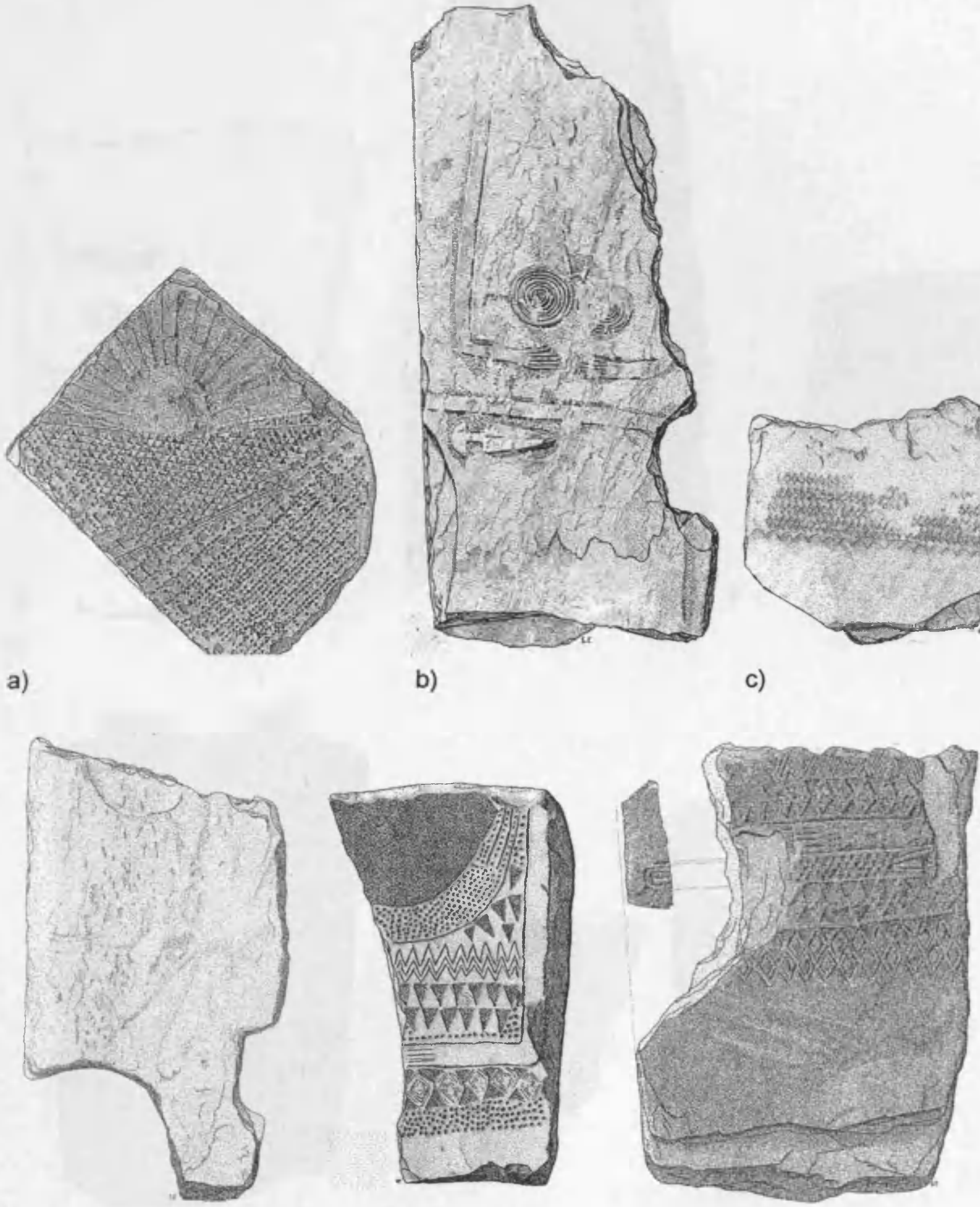


Figure 7.1. Site plan of the funerary site of Sion, Petit-Chausseur, Swiss Valais. Arabic numbers point to the position of engraved, numbered stelae and Roman numerals denote the cist numbers. Limit of excavation marked by a dashed line, engraved stelae shown with filled black shapes, non-engraved slabs shown with black outlines, post holes shown as filled black circles, ditches of stelae shown as filled black shapes without numbers, accumulation of stones denoted by vertical lines, early bronze Age burials shown as skeletons (Drawing by S. Aeschlimann in Gallay 1995:169, fig.2).



d) e) f)

Figure 7.2 . Stelae 1-6: a) Stele 1 from north slab of MI, engraving facing inwards, 128cm high x 102cm wide x 6-7cm thick (Drawing by S.Favre in Bocksberger 1978a:65,plate 18). b) Stele 2 from MI, west slab of cist, engraving facing inwards (type A), 250cm high x 112cm wide at base x 8-9cm thick (Drawing by S.Favre in Bocksberger 1978a:plate 16). c) Stele 3 south slab of MI, facing outwards, 95cm high x 102cm wide x 7-8cm thick (Drawing by S.Favre in Bocksberger 1978a:68, plate 21). d) Stele 4 east slab from MI, facing outwards, 250cm high x 145cm wide x 15cm thick engraving facing outwards (Drawing by S.Favre in Bocksberger 1978a:64, plate 17). e) Stele 5 from MII north slab, 67cm high (Drawing by S. Favre in Bocksberger 1978b:73, plate 26). f) Stele 6 from MII, west slab 113cm high (Drawing by S. Favre in Bocksberger 1978b:72, plate 25).

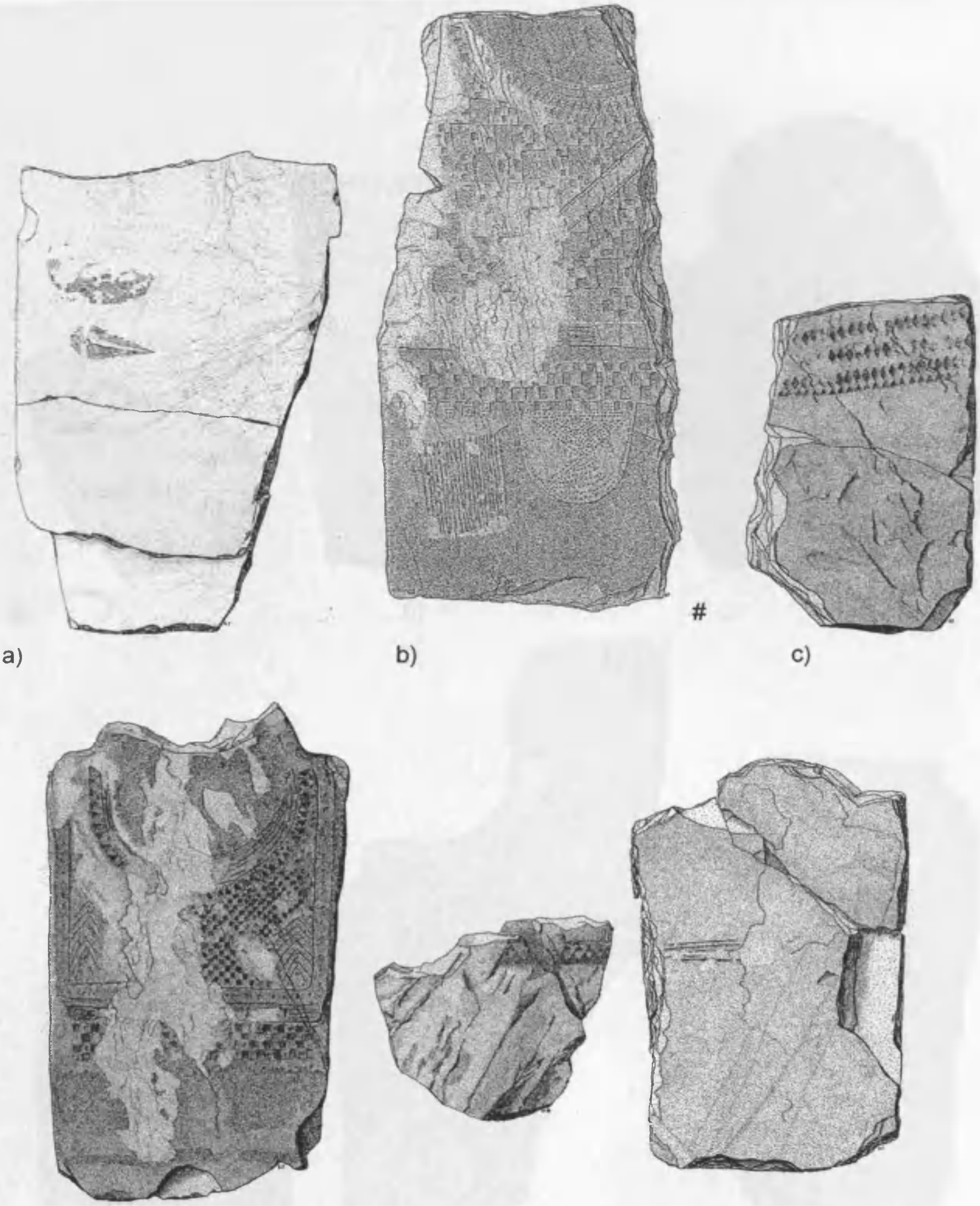


Figure 7.3. Stelae 7-12: a) Stele 7 from MVI, west antenna, facing inwards, 188cm high (type A) (Drawing by S.Favre in Bocksberger 1976a:119, plate 26). b) Stele 8, south slab of extension from MVI, 160cm high (Drawing by S.Favre in Bocksberger 1976a:118, plate 25). c) Stele 9 from MVII, east slab probably represents part of stele below the belt 90cm high x 60cm wide (Drawing by S.Favre in Gallay 1989a:105). d) Stele 10 from MVIII, west slab facing outwards, 165cm high x 100cm wide at shoulders (Drawing by S.Favre in Gallay 1989a:plate 4). e) Stele 11 from south west extension of MVIII, 90cm high x 70cm wide (Drawing by S.Favre in Gallay 1989a:111). f) Stele 12 from southern end of MVIII, planted "head" down in soil, 120cm high x 82cm wide x 10-13cm thick (Drawing by S.Favre in Gallay 1989a:109).

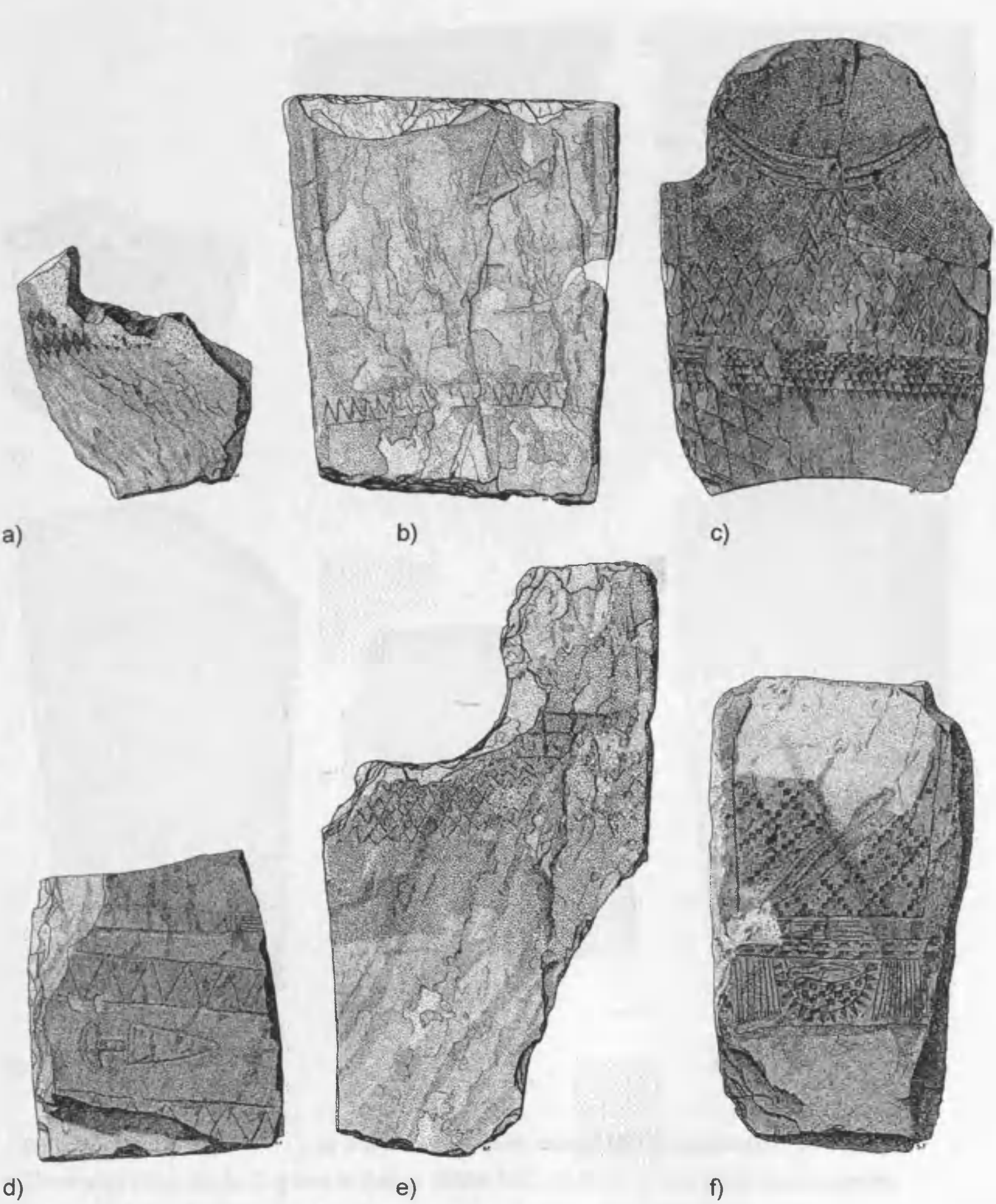


Figure 7.4. Stelae 13-18: a) Stele 13 from south east extension of MVIII, lower part below pattern buried in soil, the rest broken off, 100cm high x 75cm wide (Drawing by S.Favre in Gallay 1989a:111). b) Stele 14 fallen and not part of a cist (type A) (Drawing by S. Favre in Gallay 1989a:plate2). c) Stele 15 from MV, lying flat 150cm high x 110 cm wide at shoulder (Drawing by S. Favre in Gallay 1989a:plate 3). d) Stele 16 from MIX, north slab of cists (type A), 87cm highx71cm wide (Drawing by S. Favre in Gallay 1989a:21). e) Stele 17 from MV, east slab of cist facing inwards (Drawing by S. Favre in Gallay 1989a:plate1).
f) Stele 18 from MIX, 98cm high x 55cm wide at shoulders, facing inwards (Drawing by S.Favre in Gallay 1989a:159).

Figure 7.5 . Stelae 19-23: a) Stele 19 from north slab of MIII facing inwards, 63cm high x 73cm wide (Drawing by S.Favre in Gallay 1989a:187). b) Stele 20 two sided, here showing side facing outwards north slab from MXI, (20exterior) 153cm high (Drawing by S.Favre in Gallay & Chaix 1984a:plate 3), c) Stele 20 two sided, here showing side facing inwards north slab from MXI (20interior), 153cm high (Drawing by S.Favre in Gallay & Chaix 1984a:plate 3). d) Stele 21 west slab from MXI. c.3m high (Drawing by S.Favre in Gallay & Chaix 1984a:plate1). e) Stele 22 south slab from MXI, facing outwards but enclosed by later extension of cist, 1.6m high (Drawing by S.Favre in Gallay & Chaix 1984a:plate 5). f) Stele 23, east slab from MXI, c)3.5m high (Drawing by S.Favre in Gallay & Chaix 1984a:plate 4).

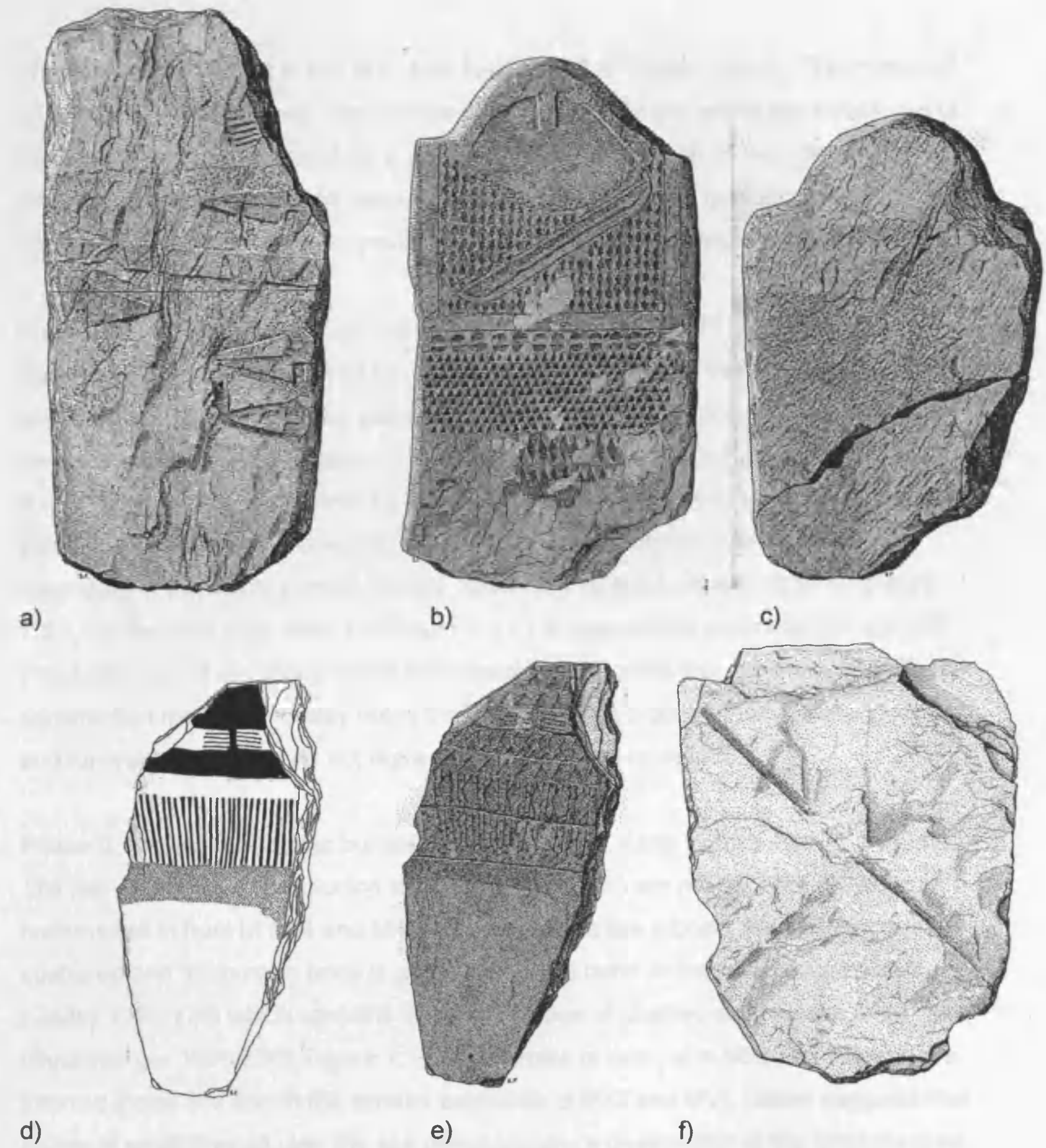


Figure 7.6. Stelae 24-28: a) Stele 24 from MXI, east antenna, facing inwards, 192cm high (type A) (Drawing by S.Favre in Gallay & Chaix 1984a:plate 6). b) Stele 25 from south slab of extension of MXI, facing outwards left side down, 158cm high, its reuse in the early Bronze Age is the latest in the cemetery (Drawing by S.Favre in Gallay & Chaix 1984a:plate 7). c) Stele 26 blocking entrance of MXI, 125cm high x 80cm wide (Drawing by S.Favre in Gallay & Chaix 1984a). d) Stele 27 blocking the entrance to MXI with two phases of engraving, here showing first phase (type A), 91cm high x 42 cm wide (Drawing by S.Favre in Gallay & Chaix 1984a:document 48). e) Stele 27 showing composite phases of engraving A and B (Drawing by S.Favre in Gallay & Chaix 1984a:document 48). f) Stele 28 from south-west extension slab of MXI,1.5m high (Drawing by S.Favre in Gallay & Chaix 1984a:plate 24).

Phase 4. Re-interment in cist MVI, final Neolithic, Bell Beaker period. The interior of MVI is cleared out to make way for new inhumations. All the bones are thrown out of the tomb; the skulls are carefully lined up at the base of a wall on the edge of the triangular base. Inhumations associated with the Bell Beaker tradition (see Introduction) are interred with grave goods similar to those listed in Phase 3.

Phase 5. Construction of small cists, MII, MIII, MVII, MVIII, MIX, MX, final Neolithic, Bell Beaker period, pre c. 2150 BC. All the stelae re-used in these construction phases are of type B and the funerary goods remain the same as for phase 3 and 4. MII contains stelae 5 and 6 (Figure 7.2.e&f), MVII contains stele 9 (Figure 7.3.c), MVIII is built with stelae 10, 11, 12 and 13, of which 11 and 13 (Figure 7.3.e & 7.4.a) form the extension of the cist and are probably in their original position, although now only fragments of the bases remain (Gallay 1995:190). MIX is built with stele 18 (Figure 7.4.f) on the east side, stele 19 (Figure 7.5.a) is used as the north slab for cist MIII. This is the end of the phase which is characterised by collective burials and particular construction methods. Gallay notes that the phases 3-5 contain very similar pottery and funerary goods and do not represent a typological evolution.

Phase 6. Violation of earlier burials and inhumations, Early Bronze Age, c. 2150 BC. The last stelae, type B, including stele 8 (Figure 7.3.b) are erected and an "altar" is constructed in front of MVI and MXI. The old burials are robbed, the grave goods are scattered and the human bone is gathered up and burnt in the burial ditch of MVI (Gallay 1995:174) which contains five small scraps of charred plain-weave linen cloth (Bocksberger 1976a:86), Figure 7.10.b. A female is interred in MXI and children are interred inside MV and in the exterior extension of MXI and MVI. Gallay suggests that traces of small fires all over the site possibly show a desecration of the funerary area.

Phase 7. Stone cairn and deposition of pottery, Early Bronze Age. The area is frequented but ceases to be a burial ground. The monuments are covered by piles of stones, including large pottery vessels which may have been a type of offering. Cist MXI gradually fills up with stones, domestic animal remains and ceramics. This phase includes a few fragments of stelae. Gallay suggests this may represent acts which honour the old site, but without fully understanding its original significance. In the later phase of the site the stelae are no longer in focus, so I will not consider them in this case study.

Type A and type B stelae

Two types of engraved stelae are recognised at the site: type A and B (Gallay 1995:178). Type A stelae have comparatively sparse engravings. They belong to the earlier phases of the site and are therefore older. The only cloth artefacts depicted are the belts. These include simple bands (stele 2), fringes (first phase of stele 27), another consisting of parallel lines (stele 12) and three with zig-zag patterns (stelae 14, 16, 24). The stelae are also engraved with representations of daggers with triangular shaped blades and semi-circular pommels attributed to the Remedello type (stelae 16, 7, 24), stele 2 has a double spiral pendant hung on the chest (Gallay 1995:178).

Type B stelae are chronologically later (Gallay 1995:178). The clothing is noticeably more elaborately decorated with a variety of geometric patterns, including numerous horizontal rows of different patterns including triangles (stelae 5, 6, 15, 9, 11, 20 interior, 21), diamonds (stelae 5, 13), concentric diamonds (stelae 6, 15, 20), diamonds with internal dots (stelae 3, 6), checked squares (stelae 6, 8, 10, 20 interior, 21) zig-zags (stele 20 exterior) and small squares arranged in diamond motifs (stelae 18, 20 interior). There are several examples of belt motifs (stelae 6, 15, 10, 20 exterior), and semi-circular shaped appendages hanging from the centre of the belt (stele 19, 18, 8). The figures are associated with bows and arrows (stelae 25, 20 interior, 18, 1) and daggers (stelae 8, 18). Where preserved, the faces of the stelae are represented by stylised triangular nose-shapes (first phase of stele 1, stelae 15, 25). Patterned decoration around the neck with beads (stelae 25, 21) or central pendants may represent necklaces (stelae 20 exterior, 15), other patterns around the neck may be elaborate necklaces or wrapped cloth garments (stelae 20 interior, 10, 8, 5). This is discussed further below.

The European context

One of the debates surrounding the anthropomorphic stelae of the Alpine region, including those at Sion, is who or what the stelae represent. The figures have been interpreted by various authors as representations of deities, living heroes, guardians of the tombs, representations of the dead, ancestors and fertility figures, or people of high rank (debates as summarised in Barfield 1995:16, De Marinis 1994a:55). However, any of these interpretations may be correct and all share the premise that the stelae represent known personages, whether human or deity. By contrast, there is a related group of engraved boulders from the Valcamonica and Valtellina of northern Italy with motifs of similar artefacts, such as daggers, textiles and dress ornaments, but which do not represent anthropomorphic beings. On these compositions some of the engravings may represent textiles, but not necessarily clothing, which brings into question the role of cloth in relation to other items depicted in the engravings, whether as clothing, items of trade or symbols of a deity or other personage (Harris 2004:76-78).

The stelae are considered to be part of the wider phenomenon of engraved anthropomorphic stelae throughout Europe in the Copper Age; this phenomenon shares characterises and a general association with funerary remains, while local regions have their own peculiarities, noticeably in the items engraved on the figures and the style of engraving (overviews of European stelae in Barfield 1995, De Marinis 1994a). The funerary site and stelae at Sion are typologically very similar to the site of Saint Martin de Corléans, Aosta, in the Valle d'Aosta, Italy, which was excavated between 1969-1990 (Mezzena 1997:64,99). However, there are discrepancies in the dating and sequence.

Most attention to the costume on the anthropomorphic stelae of the Alpine region, including those of Sion, has focused on identifying garment types and issues of gender or status differentiation in these costumes; they are usually seen as sources of evidence for clothing and costumes worn at the time (for example, Casini 1994c, Pedrotti 1998, Rast 1990b, Winiger 1995:124-128), or as evidence of cloth types, whether woven textiles (Harris 2004) or type of cloth decoration (Rast-Eicher 2005:125-127). The analysis of costumes and cloth types will be discussed below.

Evidence for people and place in the chaîne opératoire of cloth representation

In this section I analyse the evidence for the cloth assemblages represented on the stelae in several ways. First I consider the evidence for cloth and costumes on the stelae, both in relation to costumes they represent and how the cloth and costumes are used to represented different characters. I then consider the relationship between the representations on the stelae and preserved cloth artefacts. In the second part of the analysis I consider how the representations of cloth and costume on the stelae are part of the funerary site architecture and a changing feature of the place through their erection and subsequent re-use, and then look at the wider evidence for cloth at the site. This is therefore a chaîne opératoire of the representation of cloth, and is complementary to the extended chaîne opératoire of cloth production and use as examined in the rest of the thesis.

Engraved cloth and costumes

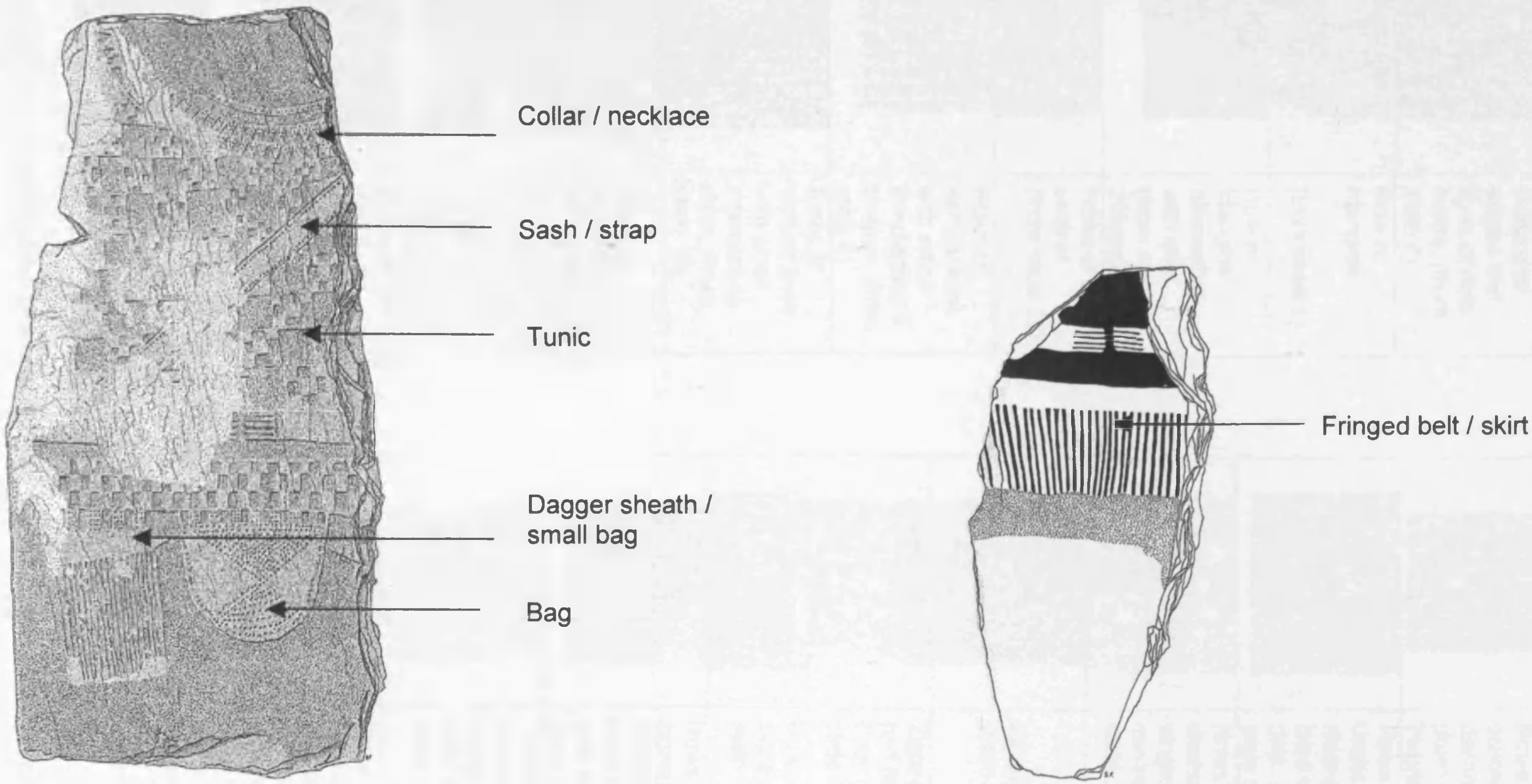
Many of the engravings on the stelae of Sion are interpreted as clothing, and share some common characteristics with stelae from other areas of Europe. I look at these through the identification of clothing and costumes, their roles in the representation of social identities and relationship to actual artefacts.

Identifying clothing and costumes on the stelae

On type A stelae depictions of clothing and costumes are limited to the belt motif worn around the centre of the body; some are decorated with zig-zags (stelae 14,16,24), one with a fringe (stelae 27) (Figure 7.7.b). Belts are common on other European stelae, including those from southern France and Germany (examples in De Marinis 1994a: 37-40), and anthropomorphic engravings (Bazzanella 1999:196).

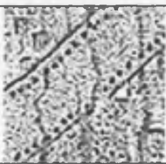
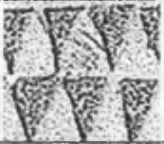
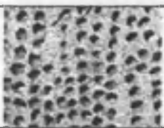
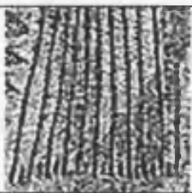
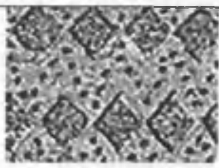
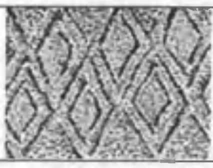
There are more clothing items on type B stelae (Figure 7.7a), including patterns that extend above and below the belt and are interpreted as tunics (Pedrotti 1998:300) or shirt and skirt (Feldtkeller & Schlichtherle 1987:75). The semi-circular shapes in the lower-central belt are identified as bags (Rast 1990b:123, Winiger 1995:128, Zidda 1997:240), also engraved on the stelae of Aosta (Zidda 1998a:170). The objects with "fringes" to the left and right of these bag on stelae 8 and 19 may represent dagger covers, which could have been made of cloth; similar objects are interpreted like this on a stele from Aosta (stele 30) in northern Italy (Zidda 1998a:170), others see these as fringed skirts (Winiger 1995:128), such as the first phase of stele 27, or fringed ends of scarf worn around the waist (stele 18) (Pedrotti 1998:302). The "fringed scarfs" on the stelae of southern France are sometimes interpreted instead as schematic legs; the fringes as toes (De Marinis 1994a:38).

The patterns engraved around the neck (stelae 5,8,10) may represent necklaces, or large metal collars (Pedrotti 1998:303, 306) or, in the case of the largest patterns, wrapped cloth garments such as shawls (Casini 1994b:105-106). Lines around the upper body of the female stele of Arco IV, Trentino, are also interpreted as wrapped upper garments (Pedrotti 1995:50). The heads of most stelae are missing, but stele15 is wearing a checked headdress, visible top left (Feldtkeller & Schlichtherle 1987:77). Other European stelae have patterns around the face, notably the one from Trets-Orgon in southern France (De Marinis 1994a:40) and Arco IV, as mentioned above. Some of the stelae from Sion have diagonal lines engraved across the chest (stele 8 and stele 1 first phase).



a) b)

Figure 7. 7. The identification of cloth artefacts: a) Stele 8, type B, b. stele 27 first phase of engraving, type A (Drawings by S. Favre a. in Bocksberger 1976a:118, plate 25. b. in Gallay & Chaix 1984a:document 48).

	Horizontal stripes two rows of dots inside, (from stele 8)
	Row of triangles. (from stele 5)
	Row of triangles alternating with dots, (from stele 20interior)
	Rows of dots, vertical (from stele 19)
	Rows of vertical lines with small intersecting v-shapes, (from stele 8)
	Rows of vertical lines with small intersecting dash, (from stele 18)
	Rows of diamonds, (from stele 22)
	Rows of diamonds, bottom half filled with dots (from stele 25)
	Rows of diamonds alternating with dotted zigzags, (from stele 20exterior)
	Rows of double concentric diamonds, (from stele 6)

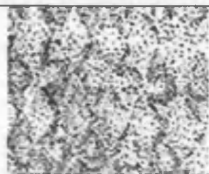
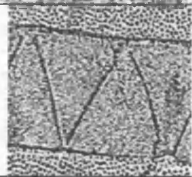
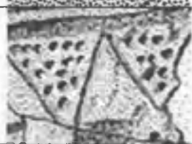
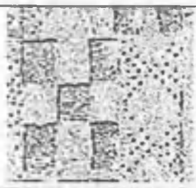
	Rows of triple concentric diamonds, (from stele 20exterior)
	Rows of dotted diamonds filled with dots, (from stele 6)
	Rows of diamonds with single dot in centre, (from stele 3)
	Zigzag band, (from stele 16)
	Zigzag band half filled with dots, (from stele 19)
	Rows of zigzags, (from stele 6)
	Rows of zigzags, altenating rows filled with dots (from stele 22)
	Cheques with intersecting triangles in dots, (from stele 23)
	Rows of blocks of cheques in diamond patterns, (from stele 18)
	Rows of squares, (from stele 20 interior).

Figure 7.8 Some of the different engraved patterns on the costumes of the Sion stelae (details taken from drawings by S.Favre).

These are interpreted as a sash or harness for weapons in reference to similar artefacts engraved on stelae groups from southern France (Winiger 1995:124), and could well represent a cloth artefact.

Significantly, there are other garment types represented in the Alpine region, such as striped cloaks worn over the back and shoulders that are known from Arco, Trentino (Arco II, III, IV and V) (Pedrotti 1998:301) (see Chapter 4 and examples from southern France, for example the stele from Saint-Sernin (Winiger 1995:125, Zidda 1998c:194-195). Striped, fringed rectangle motifs of the Valcamonica and Valtellina are sometimes interpreted as cloaks (Casini 1994c:95). There is a type of belt of gathered loops represented on the Arco stelae (Arco I and II), Valcamonica and Valtellina (Pedrotti 1998:302). In general, there are no shoes or leg coverings represented on the European stelae (Feldtkeller & Schlichtherle 1987:77). Some stelae groups, however, show practically no indication of clothing, such as the Lunigiana group from north western Italy (De Marinis 1995a). Comparison with other stelae, as well as the change from type A to type B at Sion, suggest that clothing styles changed through time and in different regions.

There is also variety in the way the clothing is decorated. On type A stelae some of the belts are decorated with a zig-zag pattern (stelae 14, 16, 24), a plain belt (stele 2) and what appears to be a fringe (stele 27, first phase of engraving, type A). Type B show numerous decorative patterns associated with clothing. The patterns are varied and include checks, diamonds, diamonds with dots inside, triangles, concentric diamonds, dots, zig-zags, triangles with dots inside. The diversity of the individual patterns is remarkable and appreciated through S. Favre's drawings, Figure 7.8.

As these are representations, it is unclear which cloth types are being depicted in terms of raw materials or construction methods. Based on the analysis of patterns and comparisons with known cloth types, there are a number of suggestions. Lines of zig-zags, triangles and checks are frequent motifs in woven textiles, as are fringes (Harris 2004:56-60). Some of the patterns may represent other cloth types, for example Zidda suggests that the patterned semi-circular motifs centrally below the belt on stelae 19 and 8 may be embossed leather bags (Zidda 1997:240), and Pedrotti similarly suggests that the neck decoration of stele 5 may be embossed leather or rows of beads (Pedrotti 1998: 303, fig, 5.2). Others compare the striped skin garment of the Iceman with the striped garments depicted on the stelae of Arco, (Bazzanella & Mayr

1995b:111). In all of these cases the issue of cloth type is a hypothesis, but ultimately remains debatable.

Clothing and costumes and the representation of social identities

Gender is clearly represented on some European stelae due to the presence of engraved sex organs. This is not the case at Sion, although differences in clothing may be attributed to gender. The primary means of presumed gender differentiation which archaeologists use at Sion is the presence or absence of weapons and, to a lesser degree, necklaces. The stelae with representations of weapons are considered to be male gender, and those without as female (for example: Winiger 1995:128-129). If this gender division is accepted then it is possible that the looped belts are a female item of cloth as they are not associated with weapons and are associated with large necklaces (Winiger 1995:128), which fits with the wider European association of females with necklaces as represented on stelae and figurines, which are clearly intended to be female as they have breasts (Whitehouse 2001:32). However, there are those that consider that all the stelae at Sion are male (Gallay 1995:178). Winiger associates the comparatively small size of stelae 8 and 18 as a possible indication of youth, and both of have a fringed motif hanging on either side of the semi-circular motif, which may be a garment type (perhaps a fringed skirt?) associated with youth (Winiger 1995:128).

Winiger associates the concentric lozenge patterns with female stelae (stelae 5, 6,15, 20 exterior) and considers them to be an ancient symbol of femininity. He does not reference why this is the case, but presumably bases the view on Gimbutas' association of women with these patterns (Gimbutas 1989), a theory which is now outdated. Another possible association may be the complex check pattern on the upper body with weapons, as is the case in the second phase of engraving on stelae 1 (not illustrated), stelae 18 and 20 exterior view, all associated with bow and arrow. This motif is also visible on the upper body of stele 23, but no representations are visible on the damaged surface and stele 8, which depending on the interpretation of the sash and / or dagger sheath motifs may or may not be associated with weapons.

The dominance of cloth in these representations may especially be contrasted to the lack of facial features or lack of obvious sexual features such as breasts, beards, or sex organs. Combinations of clothing types, patterns on cloth or other artefacts probably had symbolic values that represented social identities. While there is an overall conformity in the cloth artefacts of type A and B stelae in type, pattern shape and scale, each stele composition is unique. These combinations are mainly interpreted as representing gender distinctions, but other suggestions include distinct social roles, status or achievements (birth of children, rights of passage) (Pedrotti 1998:311-312). These interpretations are significant but usually lose sight of the fact that these are representations. These stelae were produced by the engraver to signify someone, possibly a living person, ancestor or deity; significantly, cloth played a major role in these engravings.

Comparison with cloth artefacts

This begs the question of how far these cloth types relate to the cloth types and costumes of the time. At Sion, the most clear artefact parallels are from the Early Bronze Age site of Molina di Ledro, Trentino (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:148), including a concentric diamond pattern woven on a narrow strip (MOLI-001) and a strip, possibly a belt, with a looped end (MOLI-002) (Bazzanella & Mayr 1995:115-117). The lozenge shapes on the narrow strip from Molina di Ledro measure c.10cm in length (worked out from measurements given in Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:161), which is similar to the size of the representations of concentric lozenges on stele 20 interior, also c.10cm in length. Although only one example, it shows how these representations may actually be to scale and therefore very closely depict known costumes.

It is difficult to judge whether or not such cloth was the standard dress of these people. There are many reasons why it may not be, as they may be costumes reserved for particular people of status or for a particular role or occasion. There is not enough cloth preserved from this period to adequately assess whether decorated cloth was common or rare. It is worth bearing in mind that the engravers were forced to choose one costume at a time for each stele (although two, stelae 1 and 27, were later re-engraved). These engraved costumes probably lasted longer than the real thing and were therefore in place on the person of the stele longer than such garments in real life. In this one, carefully selected representation, it is highly likely that the pattern on the cloth and the garment types had symbolic meanings that were clearly understood by those who saw it. This draws into question the relationship between the stele as representation and those familiar with their depictions.

Representations of cloth at the funerary site

These engraved stelae and the material culture represented on the surface, notably cloth, were part of the changing funerary architecture. This sequence of the place of stelae in the burial ground is understood through the archaeological evidence.

Placing the stelae

There are three engraved stelae that remain with the base in the ground and are in their original position: stele 7 (type A), as the south-west slab of the extension of MVI, facing inwards and stele 11 and 13 (both type B) as the south-west and south-east extensions respectively of MVIII (Gallay 1995:190). There are holes that Gallay considers originally held stelae in an upright position as part of the façade of MVI (Bocksberger 1976a:90, Bocksberger 1976b:fig. 39) and the broken bottom of what were probably erect stelae, two to the west of MVIII and one to the east, which are in line with the south facing stele 12 of MVIII (Gallay 1989a:128-129, Gallay 1995:169, fig.2.). The type of these erect stelae, whether A or B, remains unknown. The concept of stele in lines beside the monuments is supported by evidence from the comparable megalithic burial site at Aosta, where a row of broken bases is in line with the megalithic tombs, including two fallen stelae close to the bases and another engraved stele still erect (Mezzena 1997:75), or Ossimo in the Valcamonica (Fedele 1995).

Most of the stelae were found in a position of re-use: broken, reshaped and the majority facing into the monument where they would no longer be visible to the living, a few were facing outwards including the north (stele 1), south (stele 3) and east (stele 4) slabs of MI, the north-facing end slab of stele 20 (engraved on both sides) of MXI, the southern facing end extension slab, stele 25, of MXI, the west slab, stele 10 from MVIII, the south facing slab of the extension of MVI, stele 8. An interpretation drawn by K. Farjon (in Bocksberger 1976a:150, planche 57, fig.3&4.) shows how the cists and stelae may have appeared in the Early Bronze Age, Figure 7.9.

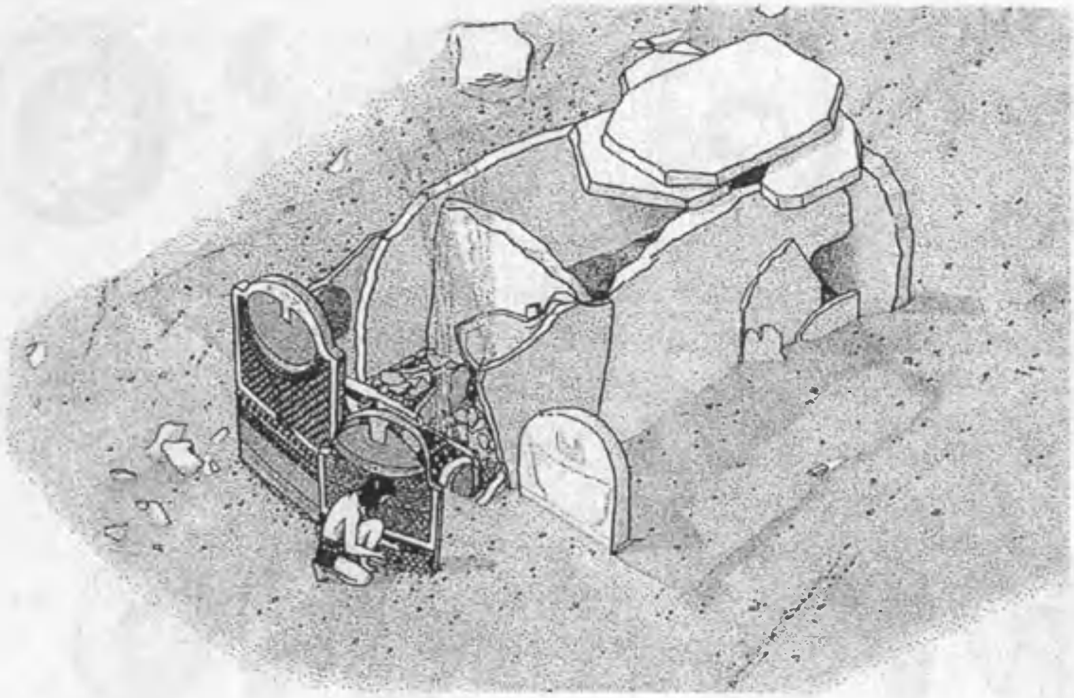
The place of cloth on the stelae

Taking into account only the most intact stelae at Sion, it is evident that they were originally tall and broad: often over 1.5m tall and more than 1m wide, for example: stele 2 (2.5m high x 1.12m at base), stele 15 (1.5m high x 1.1m at shoulders), stele 10 (1.65m high x 1m at shoulders). They are roughly human sized, if not taller and broader in some cases. Cloth representations make up a significant proportion of the type of motifs on the stelae for both types A and B. Of a total of six type A stelae, five are represented with belts, whether with zig-zag patterns (stelae 14, 16, 24) or fringed (stele 27) or plain (stele 2). They are accompanied by a limited range of other motifs, including a double spiral pendant (stele 2), triangular bladed daggers with semi-circular pommels (stelae 2, 7,16, 24) which are associated with the Remedello style daggers of north Italian contexts. Of type B, a large proportion of the surface area is covered by the patterned costumes. For example, of stele 15, there are patterns from the shoulder to the base as well as patterns to the left of the face apparently as if to cover the top of the head, which cover approximately 65% of the total surface area. This dominant surface decoration is repeated on most of the other stelae of type B where a relatively complete body area is preserved (for example: stelae 18, 8, 25, 26). This shows the high significance of cloth in the visual effect of the stelae at the funerary site.

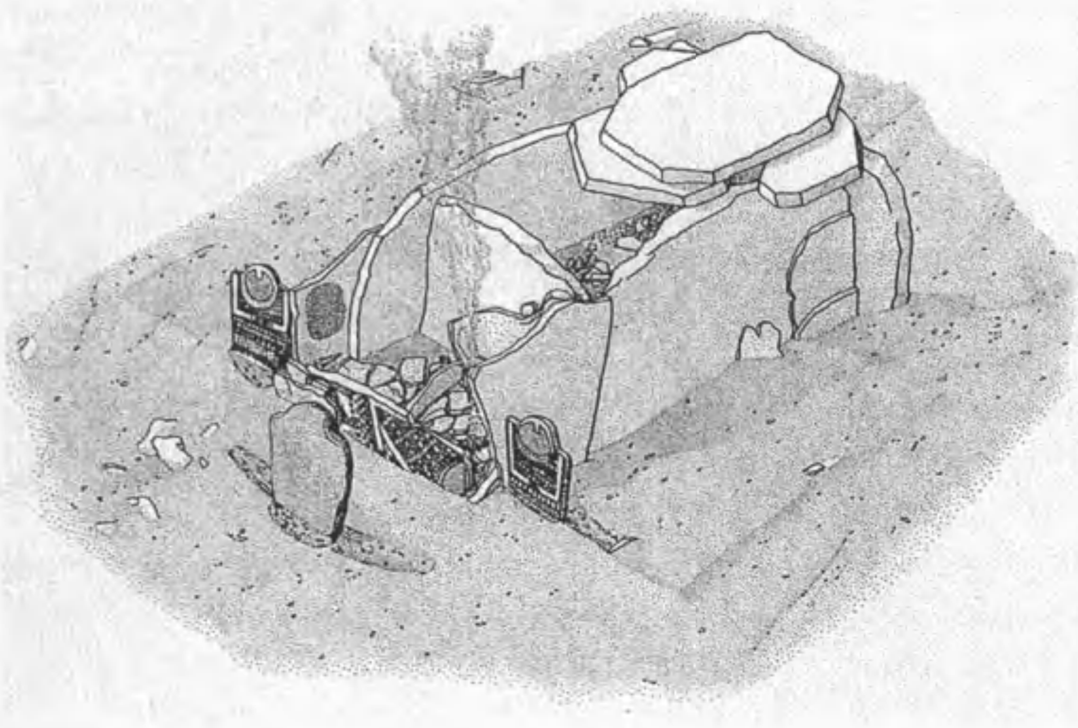
Cloth representing people

This changing funerary architecture may be seen in terms of changing social influences and deliberate actions to show this. Gallay discusses the possible significance of the erection and removal of the stelae as part of wider social rituals (Gallay 1995:185). He suggests that the engraving and erection of a stele could have been a type of consecration of a living person, celebrating their social position, a notable achievement or the alliance of two families; alternatively it may have been like a tombstone marking the death of a person. The destruction of the stelae may represent the actual death of such a person or their social death, such as the deposition of a leader and the election of another: all such consequences are possible, but cannot be proven (Gallay 1995:185). The re-engraving of stelae (stelae 1 and 27) may also be significant. The changing phases of the stelae, type A, replaced by type B along with the move from large megalithic monuments of MXII-MVI to small cists is seen as part of the wider cultural change from the indigenous final Neolithic people and the appearance of the Bell Beaker tradition (Gallay 1995:180), whether this is conceived as an introduction of people or ideas.

However these changes are conceived, it is evident that the representations of cloth were part of this. This includes the shift from the modest representation of belts in the older type A stelae to the elaborate engraved costumes of the type B stelae. The continuing erection and re-use of stelae would have changed the visual appearance of the funerary area: as stelae appeared and disappeared; different stelae, and therefore whomever they represented, would be visible to those visiting the site. The costumes formed a significant proportion of the representations on the stelae, and in terms of effect were (and are) visually striking. This was probably even more the case for people who understood the symbolism of the costumes.

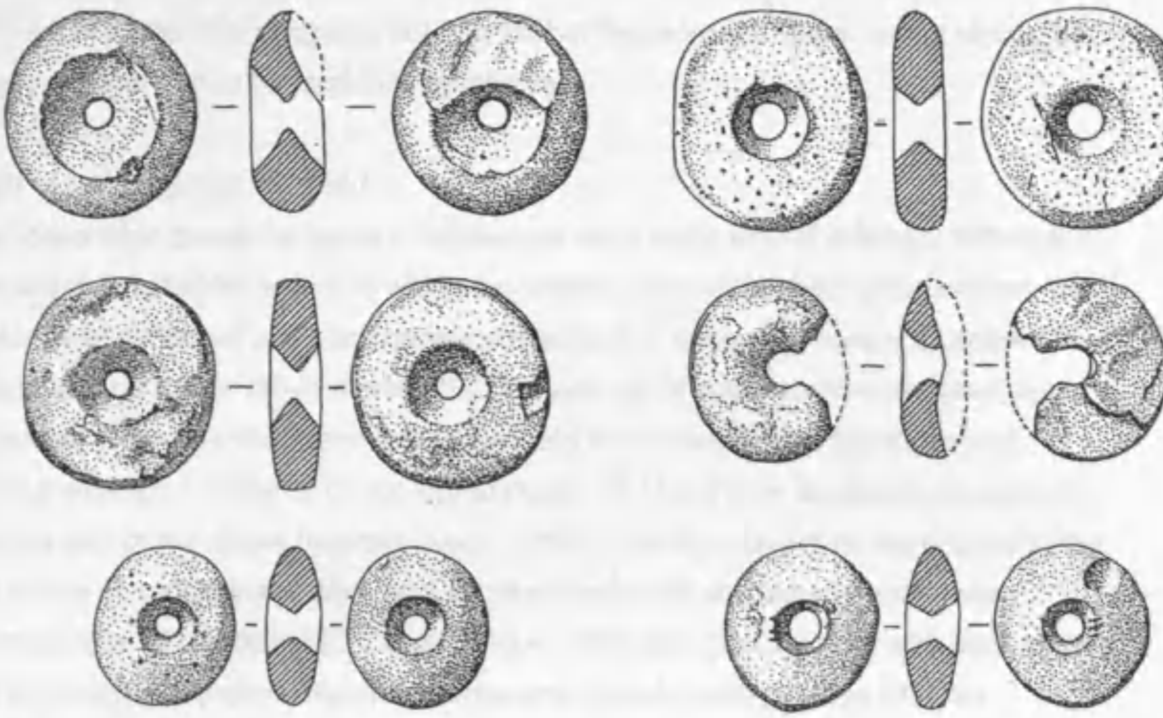


a)

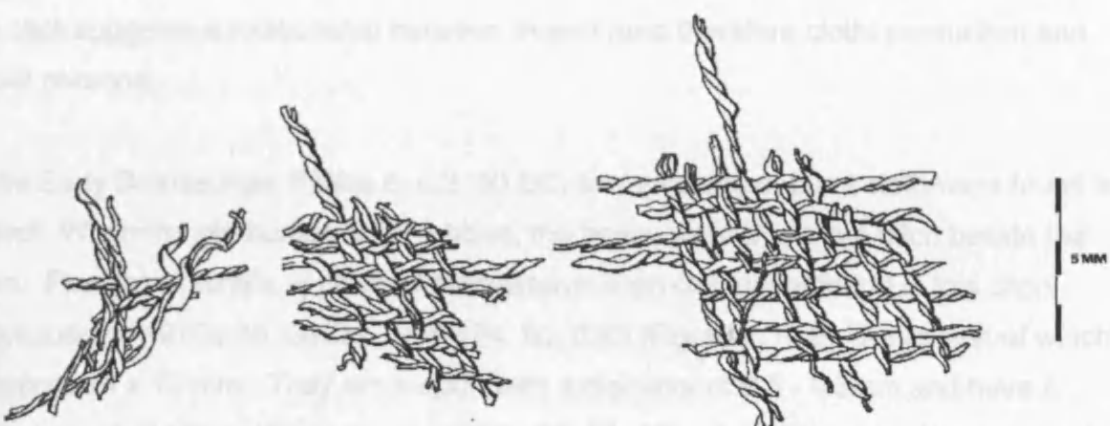


b)

Figure.7.9 a.& b) Interpretive drawings of the appearance of cist MVI showing two of the successive transformations, as they may have appeared in the early Bronze Age c. 2150 BC (Drawings by K. Farjon in Bocksberger 1976a:150, planche 57, fig.3&4.).



a.



b.

Figure 7.10. Stone spindle whorls and cloth: a) Six stone spindle whorls as grave goods in the first interments in MVI, final Neolithic, c. 2700 BC (phase 2.), top left 2.8cm max diameter, top right 3cm max diameter (Drawing from Bocksberger 1976b:122, plate 29). b) Three fragments of burnt linen cloth from the ditch outside MVI, early Bronze Age c. 2150 BC, largest fragment approx 1.5cm maximum height including threads (Drawing from Bocksberger 1976a:129, plate 35).

Cloth as part of the funerary ceremony

For visitors to the site, cloth was not only part of the representations on the stelae, but played a larger part in the activities at the site.

Cloth of the living and the dead

At a reasonable guess the visitors themselves wore some kind of clothing. Although it is impossible to tell the extent to which the visitors wore such clothing themselves, the presence of patterned and plain pottery suggests that decoration was not confined to cloth (Gallay & Chaix 1984b:plates 15-21). Evidence of buttons and dress ornaments excavated alongside the interments in the cists show that the dead were clothed (various examples Gallay & Chaix 1984b:plates 12-15). There are further clues as to cloth as part of the actual funerary event. Eight stone spindle whorls were found in the first phase of burials in cist MVI, and a further five in the subsequent interments (Bocksberger 1976a:plate 29), Figure 7.10.a. They are contemporary with plain pottery and pigs-teeth plaquettes, hammer stones and Grand-Pressigny type daggers (Bocksberger 1976a:85). This equates to Phase 2, the final Neolithic, c. 2700 BC. As grave goods, these were brought to the site by the living to accompany the dead. Used to spin thread suitable to weave into cloth, their association with the people interred in the cists suggests a relationship between thread (and therefore cloth) production and social persona.

In the Early Bronze Age, Phase 6, c.2150 BC, some scraps of burnt cloth were found in a ditch. When the old burials were robbed, the bones were burnt in a ditch beside the cairn. Five small scraps of charred plain-weave linen cloth were found in this ditch (Bocksberger 1976a:86, Gallay 1995:174, fig. 636) (Figure 7.10.b), the largest of which is approx 14 x 12 mm. They are s-spun with a diameter of 0.5 - 0.3mm and have a thread count of 12/cm (Bocksberger 1976a:27, 86, 129, plate 39), which is comparable with other plain weave cloth fragments of the Early Bronze Age. Whether from the initial burial goods (clothing, shrouds), or some other aspect of the later burning, they point towards cloth as an aspect of the funerary ceremonies performed at the site.

Comparing the cloth of the living and representations of cloth

The anthropomorphic stelae invite response and comparison between the stelae, the self and others. The visitors' responses probably varied according to their perceptions of themselves and others in relation to these items of material culture, their beliefs concerning the stelae and the number of times that they had visited the site and the circumstances of the visit. The visual differences and similarities extend to people of other regions, where the representation on stelae are noticeably different. This reinforces the idea that the stelae were not a complete representation of types of clothing worn at the time, but selected appropriately to symbolise the specific attributes that were being demonstrated. Whether by inclusion or exclusion, ambitions to own the items and be whatever these items represent, or rejection of these ideals or the people that were represented, or possibly the recognition of a social or ideological role within them, the represented figures and their position in a funerary area demanded some response.

Discussion

The chaîne opératoire of the cloth representations at Sion includes a number of people. First the engravers, with the diverse repertoire of cloth artefacts and decoration that they incorporated into the engravings to represent the person / deity on the surface of the stone. These stelae then become types of people in themselves, standing life-size, where they would have been seen. Later the people of the stelae were taken down and used as the slabs of burial cists, where they contained the dead that the living brought to the site. At a minimum, the people who came to the site included the living who brought the dead to be interred, those who moved the stelae and probably countless others who left little trace of their presence, whether from the local area or further a-field. They probably were aware of the symbolism of the cloth artefacts on the stelae and may have felt excluded or included from the place by comparison with their own clothes and with the cloth artefacts depicted.

In terms of place, the site held significance and was revisited over many generations: people knew this place and returned to it. The stelae are one of the main architectural features of this site, although their role within the construction of this place changed as they moved from erect stelae to cist walls. Once engraved in stone, the costumes are permanently in place unless deliberately removed. Although there is no evidence of colour on the stelae, it is possible that these were coloured with pigments. Pigments were found at other stelae sites in the Alpine region, including at Cemmo and Ossimo in the Valcamonica (Anati 1976:37, Fedele 1995:50). If this were the case, the colour may have been a transient aspect of the representations on the stelae. There appears to be a chronological difference between the earlier type A stelae and the style of costume which were depicted on the later type B stelae, and on two occasions at least, the costumes are re-engraved (stelae 8 and 27).

Clothing as visual culture: conformity and differentiation at Sion

The clothing on the stelae at Sion shows huge diversity. Unlike normal clothing, the engraved cloth cannot be put on and taken off. The engravers had to choose just one costume for their representation. No two stelae are the same, and even patterns that appear similar have different details: a row of dots intersecting the zig-zags, a change of pattern on different areas of the chest. Despite this, a sense of conformity is noticeable throughout the cloth types, shown by the similar size, range and arrangement of motifs. In all likelihood, these costumes and cloth types followed social conventions: symbolising gender roles, status roles, achievements, attitudes, and ability; whether of known people, mythological beings or deities. It is not only the differences and similarities between the costumes of the stelae of Sion that are significant, in type and composition they both contrast and conform to costumes on other stelae. Whether this was reflected in the actual costumes worn in the locality, or only in what they chose to represent, this would suggest that clothing followed regional traditions in this period, or at least regional traditions of representation. As visual culture, this type of clothing was probably used in this way. If this is the case, then it brings into question the issues of social inclusion and exclusion both in relation to people's deliberate intentions and in the critical gaze of others. This is probably far from being resolved. What it does bring into question, however, is the significance of cloth production and cloth producers.

If, as it appears on the stelae Sion and generally on the stelae of the third millennium, cloth was a significant means of social integration, belonging to a regional group, being a man or woman, showing values, expressing status, or being appropriately dressed for an occasion such as the burial of a relative, then there is an equal risk that a lack of cloth or inappropriate use of cloth would have led to social exclusion or disapproval. Besides the need to chose the appropriate costume for the occasion, as I used in my examples in the introduction to this case study, the implications extend further down the chaîne opératoire into the production of cloth.

This was probably more significant in the societies of the third millennium, where many more of the people's possessions were or could be produced by the community. The time, skill and preparation needed to do this is discussed in other case studies. Suffice it to say here, that people who buy their cloth (as in present day Europe) have little idea of this investment in the production and curation of cloth. Therefore, those who wanted to fulfil these social roles would need to be able to make or otherwise acquire the cloth to do it with. Those who could not may never have achieved their social goals.

Cloth to represent people in stone

Little wonder then, that cloth was one of the principal artefacts used to represent the human figures or deities of the stelae. However, probably because of the scarcity of preserved clothing evidence in the third millennium BC, the costumes of the stelae of Sion (and other sites) have been taken as evidence for what people wore. This is a valid and useful means of enquiry, but only half fits the evidence. After all, these are representations of cloth, engraved to depict human figures or deities, with cloth as one of the main symbols that the engravers used to do this. The costumes represented by the engravers (or *Artists* to use Gell's terminology), along with other aspects of material culture, were used to represent the person they were depicting (or *Prototypes*). By engraving the stones with costumes (to create the *Indices*), the engravers used the socially understood nuances of costume to create the characters they wanted to represent. There were other costumes, other cloth types and other garment types that were known elsewhere, which were not chosen to put on the stelae. Reoccurrence in the combination of these costumes hints at the conformity of social conventions, and a visual code of differentiation, possibly relating to status, age and gender, or other attributes of the *Prototype* (achievements, character, abilities, alliances).

Even if they are not idols, in a religious sense, these images were not casual snapshots of what people wore, but rather the means to create believable persons who became characters at the funerary site and were engaging to the people who viewed them. Interestingly, this is a telling aspect of the stelae: that after millennia of cultural changes, they are still readily approached as characters by people today, even though their original meanings are obscured and some are in a very fragmentary state. It is significant that costume (of cloth) was an appropriate means to represent people and really puts into the forefront the symbolic aspects of clothing and its ability to represent complex social information.

The visual culture of cloth and social consequences

The creation of the stelae (*Indices*) is one aspect of the chaîne opératoire; their changing place within the funerary site is another. The significance of the distributed person in Gell's model is that they demand attention from their viewers and can be treated like people in their own right. However, in addition, the patterned cloth on the costume of these "people" adds another dimension to the site at Sion. It is not only costume, it is also visual culture in its own right. People came and left this site over a number of generations, at least staying long enough to build the cists, to inter their dead and to burn fires. As part of the architecture of the funerary site, the stelae were props in events surrounding the interment of the dead, during which the stelae were erected, taken down, broken, re-used, fires burned and social and political power between the living was negotiated. Some of the people who visited the site were probably related to the dead, or would have known them: their vested interests could have been varied, depending on who they were and what this death meant to them. The significance of cloth does not seem to have been lost on them: the interred probably wore clothing or were wrapped in cloth, some of the dead were buried with the means to spin thread (spindle whorls) that could be made into cloth; and in other places cloth was burnt with bones from the cists. The scale of the patterns may actually represent the actual scale of the cloth that they knew.

The anthropomorphic stelae may have had a presence that was imbued with meaning: representing an actual person or human-type presence at the site, with symbolism that is no longer understood. In this, the pattern of the decoration created focus and drew attention. In this, the stelae were also a means to influence and create an impression, either in terms of the living world and the people who visited the site or on another world that the people at the time believed in. In this, the stelae had social consequences and were presumably intended to do so.

Conclusion

This case study shows how people in the third millennium used cloth to create social personae by placing it on the body and wearing it for particular occasions. The representation of engraved cloth on the stelae, whether meant as tangible people or divine presence, shows that cloth was a significant factor in their symbolic representation. This brings sharply into focus the concern with different cloth types and costumes and the appropriate nature of costume and decoration. If such clothing were needed to show social position, both within the group and outside the group through regional differences in costumes, then the implications are that it was socially necessary to have access to this type of cloth in order to belong to these groups and fulfil these social roles.

This takes our attention back to the action of creating such assemblages - back to having suitable land and skills to grow flax, hunt or herd the right animals, the ability to spin thread or weave cloth, to sew a cloak and through this the ability to create or acquire suitable costumes for oneself and children, relatives, exchange partners or even the ancestors and deities. All this appears much more competitive, and much more necessary, if the social exclusion or inclusion from events, groups and positions that the individual or social group (family, household, settlement) wanted to achieve were at stake. Whether or not these intentions were met, or whether that influence lasted, is questionable. After all, even engraved in stone, the stelae were taken down, remade and rearranged by successive generations.

In my next case study, of cloth production at the Early Bronze Age site of Molina di Ledro, I investigate the processes of spinning, weaving and decorating cloth. I consider how technique and materials and the repeated cycles of producing cloth were part of the norms and habitus of people living in this lake dwelling settlement.

CHAPTER 8

Material and techniques in the production of cloth at Molina di Ledro lake dwelling c.2300-1500 BC

In the previous case study, I focused on the use of cloth in clothing and representation in relation to visual culture and the social consequence of costumes in relation to people and place. In this case study, I consider the relationship between materials and techniques in the production of cloth and how such a treatment of materials may be investigated as a social phenomenon. To develop these ideas I have chosen the case study of Molina di Ledro, a Bronze Age lake dwelling in Trentino, Italy. This site has good evidence for the production of cloth, including tools associated with spinning and weaving, as well as preserved fragments of cloth, particularly woven linen cloth, with evidence for various types of decorative technique. As much of the site was excavated in the nineteenth century, it lacks the detailed stratigraphy of modern excavations, but nonetheless is significant for the variety of cloth and tools associated with cloth production and in particular because there is so little cloth preserved in the Bronze Age of the Alpine region.

The social context of cloth production: techniques and materials

By techniques, I refer to the learned, skilled actions that are performed in the manipulation of a material, in this case, cloth. Technique and materials are directly related: a person applies technique to transform a material. These actions are socially embedded, in that they are part of the way a person is socialised. In archaeology, the evidence includes the tools and materials, which are the means to investigate the technique. In the following paragraphs I consider some of the ways that material and techniques relate to social context.

Making cloth and making the self

At the heart of this issue is the application of these techniques by individuals or groups, which therefore refers directly to the person(s) doing them and the way that they do them. Thomas brings this to life in his historical-ethnographic account of tapa production in Oceania. Here, the action of women beating the bark creates a characteristic sound, "a clear and resonant ringing that carries over considerable distances", and "in Hawaii the legendary character *Kamoeau* was said to be able to learn everything about a woman merely from having heard her beating" (Thomas 1995:131). Even though, Thomas concedes, not everyone had this capacity to recognize a woman's character this way, it shows how the process was related to the person and character of the skilled technician, in this case the woman (Thomas 1995:131). These techniques are directly related to the tools used and material the woman is producing.

Relationships between techniques and the habitus

The example of beating tapa focuses on the individual, but suggests that this feeds into deeply held cultural beliefs. Such beliefs are not necessarily confined to one process, but to a variety of related processes. Adams's work "Style in Southeast Asian Materials Processing", explores the relationship between technical process and ideological aspects of societies (Adams 1975). In this research, she recognises the similarities between ways of processing different materials, and its relationship to gender. In her example she contrasts the actions of women pounding (rice, cotton, pots) (Adams 1975:27), with men binding through tying and wrapping (house beams, roof thatch, cord making) (Adams 1975:27). These gender distinctions are, inevitably, complex, so that tasks may include both aspects, yet be classified as one, or be acceptable to both genders (men and women dig with pounding actions). These actions are repeated throughout the culture, with gongs pounded at ceremonial events and couples bound together at marriage (Adams 1975:28-29).

At a theoretical level, Adams's concept of techniques can be related to Bourdieu's idea of *habitus* and the theory of practice (Bourdieu 2003: first published 1977, Bourdieu 1990). By *habitus*, Bourdieu refers to a set of dispositions, apparent in the movement and training of the body, which have been taught since childhood as the right way to do things and are therefore internalised in the body rather than the mind, and are the means by which a person acts "appropriately" (Bourdieu 1990:56-68, as summarised by Andrewes 2005:46-47). This learned and internalised behaviour is deeply rooted in cultural behaviour, to particular roles within that culture, such as gender, and are realised in all aspects of that culture, consciously or unconsciously (Andrewes 2005, summary of Bourdieu 1990:69-78). As *habitus*, the techniques of manipulating materials appear as sensory manifestations of cultural beliefs. This defies notions of efficiency, as values are perceived culturally (efficiency being a cultural value itself, and possibly a modern one).

Division and unity in practice

So, for example, exploring bodies and dress as cultural tools in Samatite village, Senegal, Andrewes describes the relevance of using hand-tools rather than machines for heavy agricultural tasks, as these practices show the individual's ability to work hard and be useful (Andrewes 2005:113-115). Not only is this ideologically significant, but also visible in the form of the body: creating a strong, tall physique (Andrewes 2005:113), as opposed to the city dwellers' physique resulting from sitting at a desk (Andrewes 2005:138). In this way, the practice of techniques serve as social identities and bodily symbols for shared life-styles and values.

Archaeological approaches to gestures and body techniques

Archaeologists have approached the relationship of material culture and techniques through Mauss's concept of body techniques or gestures (Mauss 1979b). In this sense, body techniques are seen as ways of constructing, maintaining and transmitting social identities and roles (Bremmer 1991, Matthews 2004:16). Matthews discusses the institutionalised, habitual routine of these body techniques (or gestures) in terms of type of symbolic code or performance that divided and joined social groups, whether men, women, warriors, elites, age groups or class (Matthews 2004:16-17). In the context of the Bronze Age, he reflects on the gender of gestures. Interestingly, he points to the gestures of men and swords and women with ornaments as appealing stereotypes in the Bronze Age, but actually minority activities (Matthews 2004:6-16). Concluding, he looks towards a better understanding of the performance of "institutionalised techniques that are learned and transmitted through tradition and constructed through habitual routines", some of which offer a shared cultural basis for the gender, age and class groups of Bronze Age societies (Matthews 2004:16-17).

To investigate material and techniques in archaeology, the first step is to recognise them. I shall do this through the examination of the process of making cloth using the evidence of cloth remains and tools associated with cloth production at Molina di Ledro, a lake-shore settlement on Lake Ledro, in Trentino. I then discuss these in relation to the people who practised them, the relationship of materials and techniques to other activities in the lake dwelling village, and in the wider context of these practices in Bronze Age societies.

The site of Molina di Ledro

Molina di Ledro is a lake dwelling settlement on Lake Ledro, Trentino, Italy. The site is in a hanging valley and lies between the lakeshore and the moraine deposit that blocks the eastern end of the valley. The densely packed wooden stakes that are the visible remains of the building supports and platforms extend at least 100m along the lakeshore, and cover an estimated area of 5000m² (Battaglia 1943:11), Figure 8.1.a & b. The waterlogged archaeological remains were first discovered in 1927 due to the artificial lowering of the water level: the first excavations were carried out that year (Battaglia 1943: 7-8) (or 1929 as stated in:Leonardi et al. 1981: 40) and have continued periodically up to the present. Recent excavations and post-excavation analyses of the Ledro site remain largely unpublished and inaccessible; consequently, this research is based on the earlier published material.

Publication and dating

The site of Molina di Ledro was published in a number of reports; particularly relevant to this research are the original and subsequent site reports (Battaglia 1943, Leonardi, Balista, Bianchin, & Stabile 1981), a comprehensive survey of the artefacts (Rageth 1974) and specialist reports on textiles and textile working tools (Perini 1970, Bazzanella & Mayr 1995a Bazzanella & Mayr 1995b, Bazzanella, Belli, & Mayr 2003a, and entries in the catalogue by Bazzanella, Mayr, Moser, & Rast-Eicher 2003b). The thread and textile finds include two narrow woven strips, four balls of linen thread, two rings of tree bast thread, a piece of knotless netting, and a number of fragments of woven linen cloth, one showing evidence of surface stitching (these finds are presented in Table 13.1). The cloth remains and the tools associated with their production, including spindle whorls, loom weights and weaving knives (wooden knife-shaped objects used to beat the warp into the weft), form the basis for understanding the material and techniques associated with cloth production at Molina di Ledro.

As it is an old excavation, one of the drawbacks of the old excavation of Molina di Ledro site is the poor understanding of dating, stratigraphy and spatial distribution. Radiocarbon dates of wooden beams from the settlement lie between 2329 – 1110 cal. BC (2 σ) and 2202 – 1317 cal. BC (1 σ) (Skeates 1994:216), spanning at least the early to Middle Bronze Age, possibly also Late Bronze Age. Based on artefact typology, Perini argues that the site was occupied from the first phases of the Early Bronze Age to the end of the Middle Bronze Age (Perini 2000).

a)

b)

Figure.8.1. a) Photographs of the site showing the remains of the house posts of the lake-dwelling settlement of Molina di Ledro on Lake Ledro, Trentino (Photo Susanna Harris).
b) Reconstructed house at the Ledro Museum, Molina di Ledro, the exact construction is disputed (Photo Susanna Harris).

In terms of typology, especially ceramics, the site is associated with the Polada culture (Tomasi 1982: 14, Perini 2000: 288,Marzatico & Tecchiati 2002:47-19), and through wider trans-Alpine influences with the Unetice, Madarovče and Gata-Wieselburg cultures (Battaglia 1943:55, Marzatico & Tecchiati 2002:47-49). At a local level, Molina di Ledro can be compared with Fiavé, Trentino (Perini 2000:288): this waterlogged lake dwelling is contemporary with Ledro and only a short (but mountainous) distance away, although to date no preserved cloth has been found at Fiavé.

The cloth artefacts

Unfortunately, it is unclear exactly where the preserved cloth was found during the excavation. In her summary of the site, Marta Bazzanella places the thread and textiles in the lowest levels of the excavation (Early Bronze Age), and therefore the oldest, based on the reference made to these finds by Battaglia (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:148). In the excavation report, Battaglia notes that the thread and textiles *start* to appear in the lowest, and therefore oldest, levels of the excavation (Battaglia 1943:51). When quoting the stratigraphic layer of the four balls of spun linen thread, Battaglia attributes them to stratigraphic layers III, IV and VII (ibid:52). In reference to the chronology of deposits, stratum I is the upper and most recent and stratum IX is the lowest and oldest (Battaglia 1943:13-17). Excluding natural strata, it appears that the balls are found in three different stratigraphic layers that span the majority of the chronology of the site. This clearly makes it difficult to date the cloth and thread remains precisely; therefore in this case study I shall consider them as a contemporary group in the context of the Early to Middle Bronze Age.

It would be misleading to believe that the preserved remains give a complete picture of all the cloth types that would have been found in Molina di Ledro in the Early to Middle Bronze Age: the alkaline waterlogged environment would not support the preservation of animal-based fibres (wool or hair) or skins. The inhabitants of Molina di Ledro almost certainly worked wool, although all that remains is a single wool sewing thread (MOLI-002). The use of wool is supported by the high concentration of sheep and goat bones, especially older animals, at the site (Riedel 1976:33-44). Similarly, it is likely that skins were prepared and used at the site. There are only hints at this, for example in the form of the flint scrapers (Rageth 1974:119,Taf113:1-16) and the presence of clay tuyères (bellow nozzles) (Rageth 1974:176,Taf.90:7-9), used for bronze working, possibly using skin bellows, as in historical examples (Kezich, Eulisse, & Mott 2002:57). Such a range of cloth probably existed at the site. However, as the preservation of plant fibres, particularly linen, is favoured at the site, this case study concentrates on these.

Artefact	*Raw material*	*Processing*	*Thread diameter/mm (warp then weft)*	*Cloth construction*	*Threads per cm (warp then weft)*	Decoration
MOLI – 001 Narrow woven textile with lozenge decoration, rolled up	Linen	s -spun	0.5 – 0.6 0.5-0.7	Plain weave simple selvedges twill decoration	16 12	Lozenge decoration woven into cloth
MOLI – 002 Narrow woven textile with fringe and loop at ends, rolled up	Linen, Wool sewing thread	S-plied (linen thread)	0.4-0.5 0.4-0.5	Plain weave simple selvedges 1 fringe, 1 loop	18 12	Elaborate fringe and loop feature
MOLI – 003 Woven textile with selvedge	Linen	S-plied	0.4-0.5 0.3-0.4	Plain weave with selvedge	12 10-14	
MOLI – 004 Woven textile	Linen	S-plied	0.4 0.5	Plain weave	16 18	
MOLI – 005 10 pieces woven textile possibly from same piece	Linen	S-plied	0.6-0.7	Plain weave 10 fragments, probably from same cloth	14-16 10	
MOLI – 006 Woven textile with seeds sewn onto surface	Linen with 21 small seeds attached	S-plied	0.4 0.6	Plain weave	14-16 12	21 seeds sewn onto surface
MOLI – 007 4 fragments of woven textile	Linen	S-plied	0.6 0.5	Plain weave, densely woven	14 16	
MOLI – 008 Woven textile with embroidery	Linen	S-plied	0.3-0.4 0.4-0.5	Loose plain weave with embroidery decoration	12-13 12-13[1]	Noticeably loose weave, embroidery

[1] Conflicting results of the thread count are published. 18/cm x 14/cm (Bazzanella et al. 2003xx:170) and 12-13/cm for both warp and weft (Bazzanella & Mayr 1995:120)

MOLI – 009 Fragment of knotless netting	Linen	S-plied	0.6	Knotless netting	Mesh dimensions: 3mm x 1.5mm	
MOLI – 010 Ball of thread	Linen	S-plied, ball of thread	0.4			
MOLI – 011 Ring-shaped bundle of fibres	Tree bast, possibly lime	Spool of raw strips of tree bast fibres Un-spun	-			
MOLI – 012 Ring-shaped bundle of fibres	Tree bast, possibly lime	Spool of raw strips of tree bast fibres Un-spun				
MOLI – 013 Dense woven textile in two pieces	-	-	-	Dense, plain weave		
MOLI – 014 Multiple fragments of two-plied thread.	-	Fragments of fine, 2-Sply thread	Less than 1			

Table 8.1. Thread and cloth finds from Molina di Ledro

Evidence for techniques and materials in the chaîne opératoire of cloth production

Techniques and materials for thread processing

All the threads used for cloth and the balls of thread are linen, the diameter is between 0.3-0.7mm, and the threads are all two-ply in an S direction (MOLI-002 to 010), except one which is a simple thread (MOLI-001). The two ring-shaped bundles of un-spun tree bast thread, measure less than 1mm in diameter (MOLI-011,MOLI-012) (Figure 8.2.b), which shows that people practised making thread without spinning.

There are a numerous clay spindle whorls at Molina di Ledro, including a range of disk and cone shaped forms (Rageth 1974:178, taf.92, Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:152-155), Figure 8.2.c. Originally these would have been set on a wooden shaft. Although no shafts are preserved at Molina di Ledro, there are examples of wooden spindles with whorls dating to the Middle Bronze Age, c.1400 BC, from Fiavè, Trento (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:137-138). The weight of spindle whorls, between 17-50g, at Molina di Ledro (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:152-155), corresponds well to the type of thread found at the site. The diameter of the linen thread ranges from 0.3 to 0.7 mm for artefacts MOLI-001 to MOLI-10 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b: 162-174). As discussed in Chapter 4 (Threads for cloth: Spinning with a spindle) whorls more than 20g are necessary for spinning simple threads of flax, whorls lighter than this being more suitable for wool (Grömer 2005a:111). On this basis, at Molina di Ledro the spindle whorls weighed by Bazzanella are a range that would be suitable for both wool and flax.

After spinning, the simple thread would be wound on the spindle shaft, and would then need to be plied, a technique rather similar to spinning that twists two single threads together. The thread is then removed from the spindle and, at Molina di Ledro, appears to have been wound into balls (Figure.8.2.a.); it may have been wound with a reel or by hand (see Chapter 4, Threads for cloth: Plying and winding balls). In terms of the tree bast threads, from my own experiments I have found that retted tree bast can be split easily by running the individual layers of bast through a fine-toothed comb, as discussed in Chapter 4 (Threads to cloth: un-spun fibres strips), or similar device. The strips would then have been rolled into ring-shaped bundles.

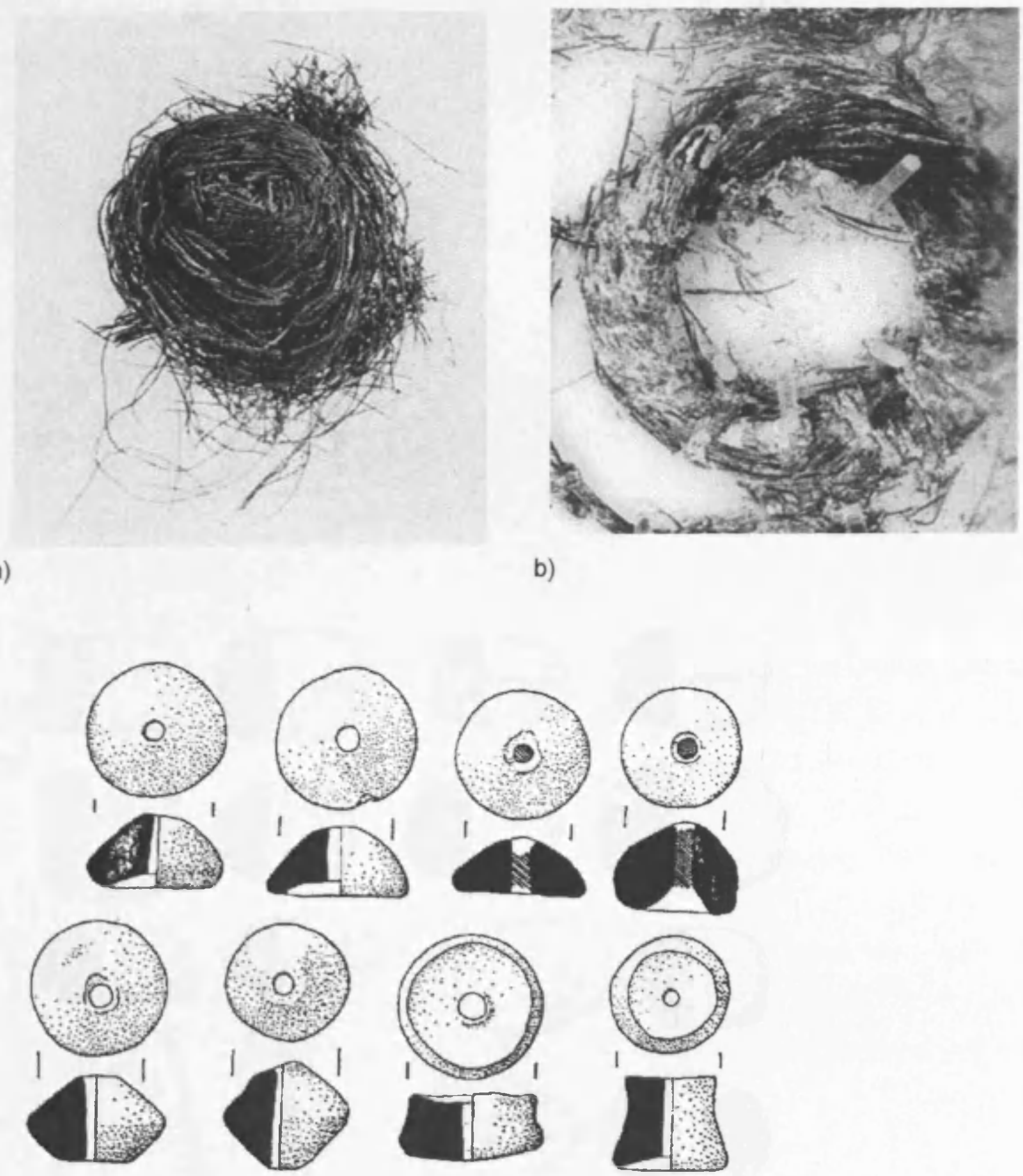
As discussed in Chapter 4 (Threads for cloth: drop spinning), the method of drop spinning with a spindle whorl seems most likely in the Bronze Age, as represented on the tintinnabulum from a woman's tomb at Arsenale Militare, Bologna, dating between the eighth and sixth century BC (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:201-202), Figure 8.3.a..

At Molina di Ledro the majority of thread shows a great consistency; it is two-plied in an S direction, between 0.3-0.7mm in diameter, and made of linen. Only one of the cloths is made of simple s-spun thread. The presence of spindle whorls of an appropriate weight supports the expectation that these threads were spun using this device. The shape of spindle whorls varied, which is possibly to do with spinning and plying different fibres, such as wool. The presence of the whorls at the settlement site suggests that thread was spun in the settlement and the number of spindle whorls suggests that this was a common activity involving a number of people. On this basis it would appear that spinning was a learned technique, with emphasis on conformity. As discussed in Chapter 4, spinning is time-consuming: it can be worked alongside or between other tasks. The fragments of cloth that remain are just a hint at the amount of cloth that probably existed at this site, which would have required huge quantities of spun thread. In terms of techniques and materials, it would appear that many people participated in spinning thread for cloth at Molina di Ledro, and it would have been a recognisable aspect of the village.

Spinning and gender

As discussed in Chapter 4 (section 4.3: spinning and gender), spinning is often associated with women in the Bronze Age. None of these arguments conclusively prove that women spun at Molina di Ledro; however they all point in the same direction and if actually the case there are implications, which will be discussed below.

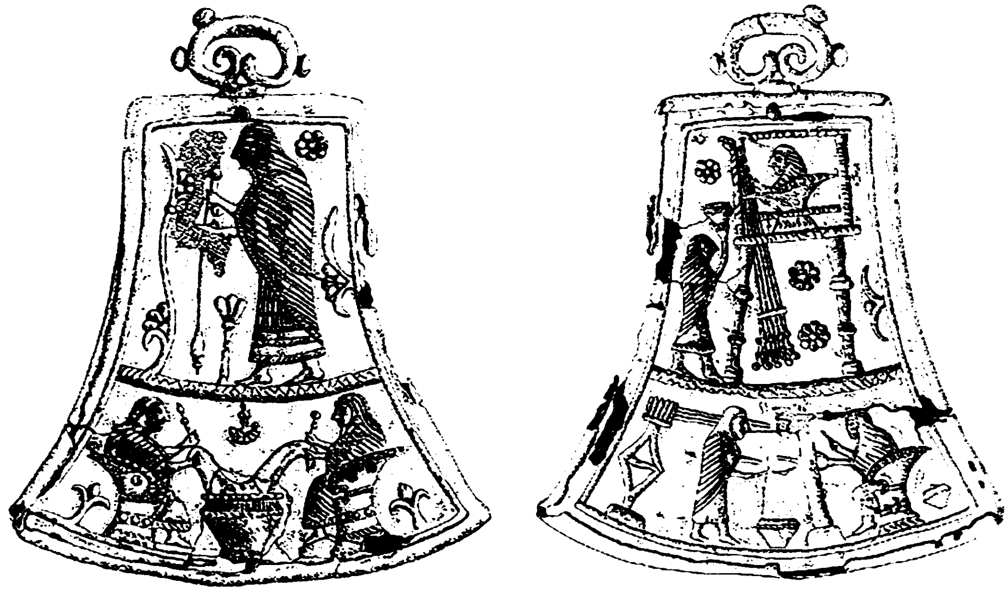
Interestingly, at Molina di Ledro tree bast thread was produced with a different technique than that used for linen; that of drawing out long strips. This kind of thread-making offers an interesting, if enigmatic, contrast in technique and material compared with spun thread. There is evidence of cloth made out of similar strips in the Neolithic (see Chapter 4, Threads for cloth: un-spun fibre strips), but nothing to support this at Molina di Ledro.



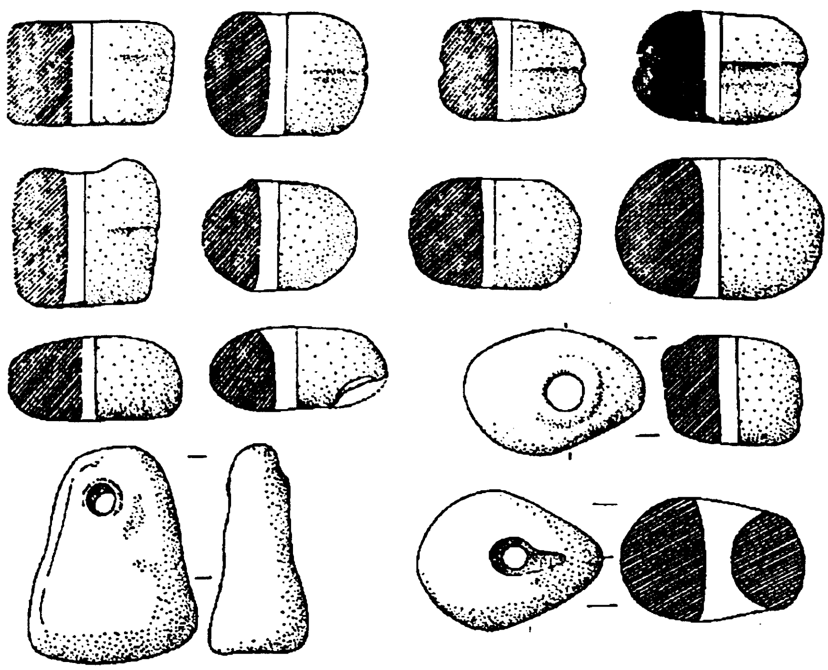
a) b)

c)

Figure 8.2. a) Ball of thread spun and plied linen thread, 6cm max diameter (MOLI-010) (Photograph from Bazzanella et al. 2003:173). b) Ring-shaped bundle of split tree bast threads, MOLI-012 10.7cm max diameter (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003:174). c) Spindle whorls from Molina di Ledro, top left: spindle 4.2cm max diameter x 2.4 high, all others in proportion to this (From Rageth 1974:taf.92).



a)



b)

Figure 8.3. a) Two sides of a tintinnabulum from a woman's tomb, number 5 at Arsenale Militare, Bologna, dating between the eighth and sixth century BC. Top left is the woman spinning, with two women preparing the distaff below, bottom right two women are preparing the warp while top right two women are working a warp-weighted loom (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:202). b) Loom weights from Molina di Ledro, top left: max width 9.3cm x 5.9cm high, all other in proportion (From Rageth 1974:taf.93).

Techniques and materials of cloth construction

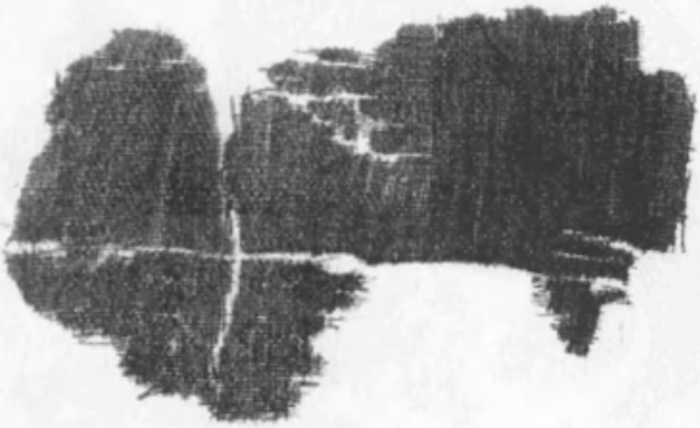
Of the cloth preserved at Molina di Ledro, the main preserved cloth construction type is plain weave, (MOLI-001-008, 013). The narrow woven strips (MOLI-001 and 002) both have the two selvedges intact (therefore complete width) and measure 6.8cm and less than 3cm wide respectively; both are over 2m long (Figure 8.4.a-c). The largest fragment is a loose, plain weave cloth with one simple selvedge (MOLI-003), whose preserved width is 14.2cm; this indicates the minimum width and a much larger piece could be expected. There is variety in the weave density of the cloth fragments; some are tightly woven, creating a dense cloth (for example MOLI-001, 002, 004, 007), while others are loosely woven, creating a partially transparent cloth (MOLI-008) (compare Figures 8.4.d and 8.5.b). The different cloth sizes suggest that they were woven on different types of loom.

As discussed in Chapter 4, in the Bronze Age there is evidence of the warp-weighted loom. Rageth reports more than fifty clay weights at the site (Rageth 1974:178). These roughly cylindrical clay objects with central hole have been interpreted as loom weights (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:156-158). On some there is evidence of thread wear through the central hole, and one weight has remains of plant fibres inside, interpreted as the remains of warp threads from hanging on a loom (Rageth 1974:178, taf.93.7). On others the wear marks are less easily interpreted as they run cross-wise over the central perforation (Rageth 1974:178). There are other perforated clay weights (Rageth 1974:178,Taf.93:22-24), and rounded stones with a central grove, which Rageth suggests could have been a type of hammer or weight (Figure 8.3.b.) (Rageth 1974:189, Taf.109:7-11): in theory, either type could have been used as warp weights.

As there are no spatial plans at Molina di Ledro, there is no evidence that the weights were found in rows; however similar weights have been found near walls in rows and inside houses in Bronze Age settlement sites, including at Fiavé (Bazzanella, Mayr, & Rast-Eicher 2003d:89), as would be expected of a warp-weighted loom in use. There is little doubt that the warp-weighted loom was in use at Molina di Ledro. Other possible weaving tools include wooden weaving knives (Figure 8.6.a.) and a comb which could have been used for beating the warp (Rageth 1974:193,taf.102 1-5).

a)

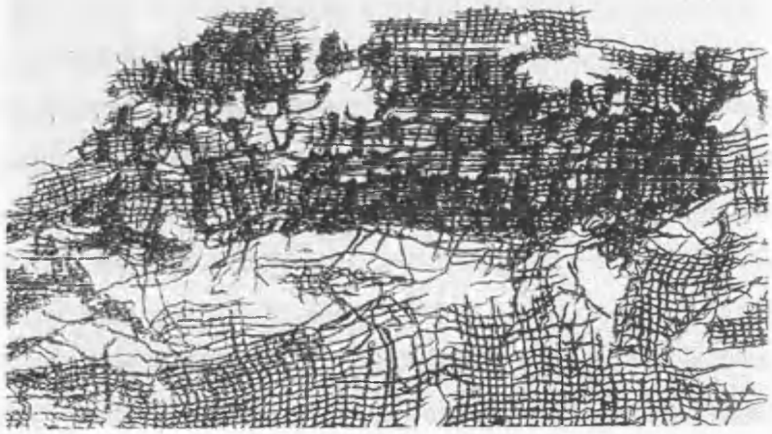
b) c)



d)

Figure 8.4. a) Detail of the narrow woven textile with concentric lozenge weaving decoration, 6.8cm wide x 209.8cm total length of artefact (MOLI-001) (Photograph from Bazzanella & Mayr 1995:115, fig. 6). b & c) Finge and loop end details of the narrow woven textile with fringe and loop 2.2-3cm wide x 204cm length of woven band, plus 10cm fringe and 2cm loop (MOLI-002) (Photograph from Bazzanella & Mayr 1995:117-118, fig. 9&10). d) Plain woven textile, maximum measurements: 11.6cm x 6.3 cm (MOLI-004) (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003:166).

a)



b)

c)

Figure 8.5. a) Plain weave linen cloth with seeds sewn onto the surface, 4cm x 5.4cm (MOLI-006) (Photograph from Bazzanella & Mayr 1995:119). b) Plain weave linen textile with lines of embroidery, 9.5cm x 9.6cm (MOLI-008) (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003:171). c) Fragment of knotless netting with joined or repaired area bottom left, 12.8cm x 16cm (MOLI-009) (Photograph from Bazzanella, Mayr, Moser, & Rast-Eicher 2003: 172).

The warp weighted loom

I have summarised the method of weaving on the warp weighted loom in Chapter 4, section 4.4: Weaving on a warp-weighted loom. This method relates well to the tools and cloth fragments at Molina di Ledro.

The back-strap loom

Known practice of using the warp-weighted loom shows it being used for wide cloth; it seems unlikely that such a set up was used for the narrow strips. Recent experiments to construct an artefact like the narrow strip (MOLI-001), suggests that this could have been made on a back-strap loom with a single heddle; and the pattern picked out by hand (Bazzanella, Belli, & Mayr 2003a:277). (Bazzanella, Belli, & Mayr 2003a:277). It is possible that the back strap loom was used at Molina di Ledro, and some of the wooden artefacts may represent its components (for example, Rageth 1974:193,taf.102). If a back-strap loom was not used, it does at least seem that these pieces were not worked on a warp-weighted loom. In principle, the techniques of weaving using the back-strap loom, or other loom, are much the same as the warp-weighted loom; however the aspect, body position and technique of attaching warps and lifting heddles varies according to each loom.

Knotted netting

The only non-woven piece of cloth is a piece of knotless netting (MOLI-009), Figure 8.5.c. It is worked with single looping (Seiler-Baldinger 1994:11), with small meshes measuring 3mm by 1.5mm. The netting has a repaired or a joining section. Curiously, it is similar in construction to the embroidery on the fragment of woven textile MOLI-008 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:172). This raises the possibility that this could originally have been a similar piece of embroidery but worked on a cloth, such as woven wool, that is not preserved. Either way, it was probably worked with a needle, of which there are several examples at Molina di Ledro. As a knotless net (as it currently appears), each row of the netting would have been formed by looping the thread around the gauge and then passing it through the loop above (Seiler-Baldinger 1994:10, Bazzanella & Mayr 1995b:121).

At Molina di Ledro, the evidence shows that the characteristic linen thread was being made into both woven cloth and knotless netting. For the production of the woven cloth, there were probably at least two different types of loom, one warp-weighted and the other possibly a type of back-strap loom. There may have been a variety of weights for the warp-weighted loom. Although not apparent at Molina di Ledro, it is likely that weaving went on in most of the households, with one if not two people able to weave, and possibly wider cooperation in aspects such as warping up or attaching the heddles. It seems that weaving skills were wide-spread and conformist, showing continuity with earlier periods and wider regions. In addition, there was cloth made with knotless loops and probably worked with a needle. One can only assume that wool cloth was constructed in similar ways. A picture emerges at Molina di Ledro of people working at least two different types of loom as well as working these knotless netting cloth types, all in a standard type of linen thread.

Techniques and materials for decorating cloth

It is surprising that in such a small number of pieces of cloth there are a considerable number of different cloth decorative techniques. One of the narrow woven strips has two sections of lozenge twill pattern at one end (MOLI-001). The pattern is made by altering the passage of the weft through the warp, as described in Chapter 4. An experimental construction of the same weave pattern showed that 14 different rows of pattern are necessary to create this pattern (Bazzanella, Belli, & Mayr 2003a:276). If this was produced by heddles, it would need 14 different set heddles, but due to the small area covered by the pattern, the authors consider that it is more likely that the pattern was worked by adding the weft pattern by hand (Bazzanella, Belli, & Mayr 2003a:277). In this case, the technique is practised during weaving and would not appear significantly different from weaving the other rows, although slower and the weaver would have to count (or otherwise work out) the warp and weft crosses. On the same piece is evidence of a shiny black substance filling the textured parts of the pattern. X-ray analysis of the patina suggests it was a type of resin, applied after the cloth was woven (Bazzanella, Belli, & Mayr 2003a:276).

Colour

The preserved cloth fragments are all charred and black with no indication of colour; however the presences of dye plants in the botanical remains at the site suggest that dyeing could have been practiced (Bazzanella & Mayr 1995a:130-137). This is particularly true of the large number of cornelian cherry (Cornus mas) seeds and elder (Sambucus nigra) seeds in some levels of the site (Dalla Fior 1940, quoted by Bazzanella & Mayr 1995a:130). The wood of the cornelian cherry can be used for brown / olive / yellow colours and the elderberries and leaves can be used for lilac, green and black, while the bark can be used for a yellow / green (Bazzanella & Mayr 1995a:132). The techniques of dyeing can only be assumed and in this case probably would involve dipping the cloth in pots of dye.

Embroidery and embellishment

There are examples of sewn decoration, including a section of embroidery (MOLI-008) (Bazzanella & Mayr 1995b:120) and a number small seed beads sewn on to the surface of MOLI-006 (Figure 8.5.a). These are identified as *Lithospermum officinale* or *Lithospermum purpureo-caeruleum* (Dalla Fior 1940, quoted in Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:168). Both involve sewing on the surface of the cloth, after the cloth was woven. As mentioned above, there are eyed needles at the site (for example Rageth 1974:taf.21.19). The seed beads would appear like little dots, whereas the embroidery is worked in a line.

The evidence for cloth decoration materials and techniques at Molina di Ledro is surprisingly diverse for such a small sample. People applied a range of techniques, added either before or after the cloth was made, including colour, stitching and weave patterns to make cloth appear different, embroidered with lines, textured concentric lozenges or dotted with seed beads. Here the material nature of the decoration is particularly striking in relation to the decoration on other items of material culture, with dots, lines, and rows of zigzags on pottery (Figure 8.6.c.), metal ornaments and daggers (Figure 8.6.b.) (for example Rageth 1974:Taf. 62, 22, 24).

Discussion

In the above section I have brought together the current evidence for the production of the cloth types known from Molina di Ledro. In this discussion I focus on how the evidence relates to the concepts of techniques and materials discussed in the introduction to the case study. In this I consider how the performance of techniques is a means of social identity, the way these relate to other actions, and how this may be part of the creation of cohesion and diversity in social groups.

Techniques and materials: making cloth and making the self

While conforming to a large extent in the tools that were used and the material that they produced (linen, spin direction, thread diameter, plain weave, warp-weighted loom), the intricacies of these tasks would have been performed by individuals and associated with individuals' personalities and techniques. In this way, the practice of the task, which would appear technically similar, may have been a measure of individuals' capabilities and social abilities, and some people were probably more skilled at these techniques than others, or more willing to conform to the expectations made of them. As discussed, the production of spun thread and woven cloth were probably common tasks in the settlement, and most likely associated with women.

If this was the case, then not only is it the case that women were regularly spinning and weaving, but also that they were regularly seen spinning and weaving, a task directly associated with its material outcomes: linen and probably also wool cloth. There is some question as to the nature of this visibility: weaving on a warp-weighted loom is static and associated with being inside a house, presumably visible to others in the house, and working alone or in pairs, whereas spinning is more mobile, potentially in larger groups and could be practiced anywhere, making it visible in a different way, and to different people. Other loom types would have their distinct characteristics too, using contrasting techniques and body positions. This dynamic may be considered a type of performance, although possibly not an intentional one. Performance may be seen as an aspect of visual culture, where the body is a central role of enactment or symbolism (Skeates 2005:38-39), an idea which is also important in the concept of gesture, where corporeal performance is "an embodied discourse of identity formation and maintenance" (Matthews 2004:16). This is not to forget the tangible material results, which may then move out of this performance arena and become the raw materials in another sequence of events.

The conformity of spun thread production contrasts with the diversity in cloth decoration that is hinted at here. The relationship of skill and the techniques that were performed may have been associated with abstract characteristics such as patience, diligence, speed or delicacy: further social meanings in action. These abstractions remain hypothetical. In this way, the split tree bast thread may be deliberately un-spun as a contrary action by those who did not want to be included in a performance of spinning, or the narrow strips spun on a non-warp weighted loom by those who did not want to be associated with such a performance. Hypothetically, these material results may be the result of gender, class or age divisions.

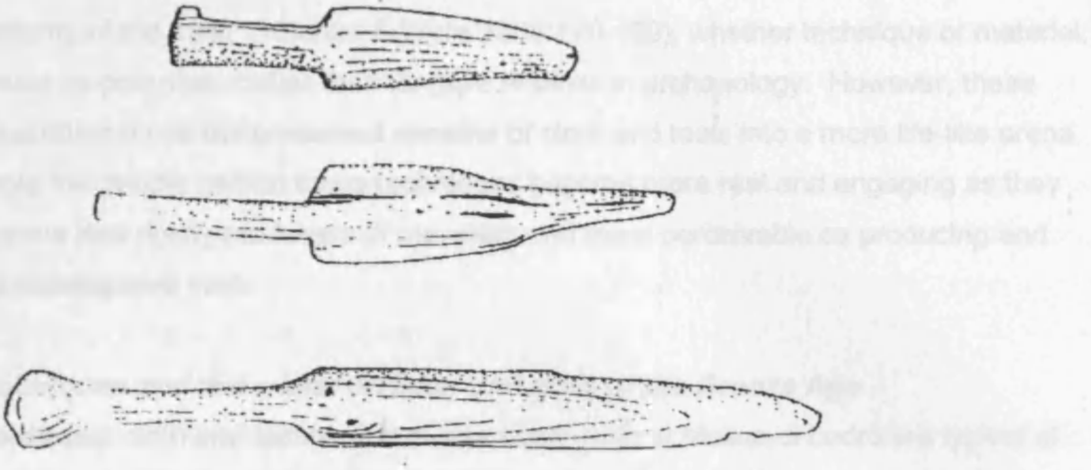
There is also a contrast in the repetition of techniques: a loom is warped only once, yet the weft is passed many hundreds of times in a piece of cloth. As substantial pieces of equipment, looms may have been passed down from one practitioner to another. The events of passing a loom to another member of the family or warping a loom occur less frequently and could have been associated with ceremonies or rituals, large of small. The techniques and performances are no longer visible, but are worth mentioning as cloth is so readily associated with utility in the Bronze Age that ideological aspects of cloth production are rarely discussed.

Techniques and materials: related actions

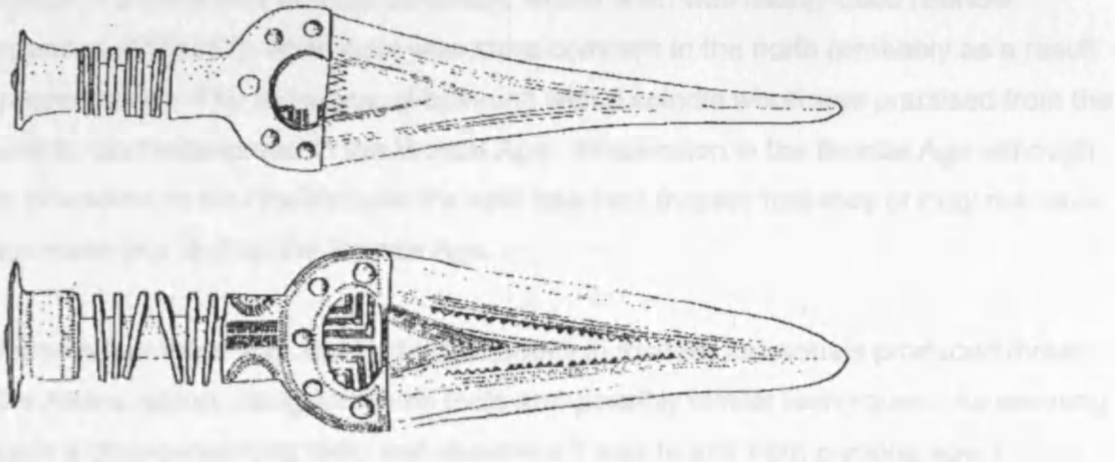
Another aspect of the social context of techniques and materials is the way in which the body techniques (in the sense of Mauss as discussed above) of producing cloth relate to other body techniques practised in the society. At Molina di Ledro people worked bone and wood, bronze and ceramics (Bazzanella, Mayr, Moser, & Rast-Eicher 2003b:148), and there were also techniques of animal husbandry and cultivation (ploughing, sowing, harvesting), processes of dressing (wrapping, pinning), techniques of preparing food (grinding, boiling, baking), eating and drinking (pottery and wooden vessels), and techniques of housing and boat building (erecting posts, wooden joints, tying, carving). There would inevitably have been some cross-over in tasks between the people who worked cloth and these other village tasks.

To consider a technique as an aspect of *habitus* means to consider how such dispositions of the body were applied in other areas of life. For instance, did the beating in of the weft with a wooden weaving knife make any reference to the stabbing techniques of bronze daggers? Could the weaving of cloth relate to the rows of ploughing in the fields? Did spun or split thread relate to tying house beams together? Was warping a loom anything like stringing a bow and was shooting an arrow anything like throwing a shuttle from one side of the weft to another? Were spindle whorls metaphors for wheeled chariots? These are no definite answers to these questions, except an awareness that if a *habitus* exists, then it is likely to cross-fertilise between the boundaries of materials.

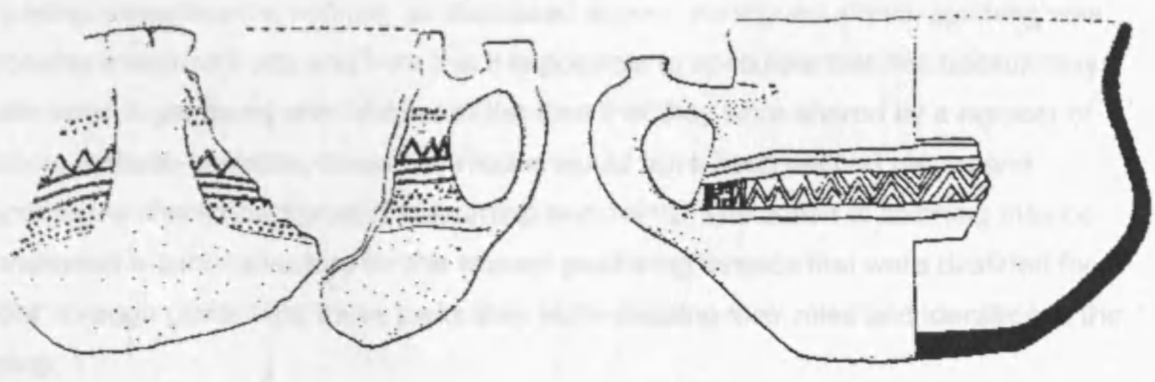
In the decoration of cloth, this cross-fertilisation is apparent; however here it is not the body technique that is translated, but the material results. Pots have knobs and engraved patterns of lines and triangles, and bronze daggers are decorated with bumps, dots, lines and zigzags. This shows the transformation of material effects, in what may be considered a *habitus* of visual culture. Further material relationships may be evident in the form of tools: as for example the related form of wooden weaving knives and metal daggers (Figure 8.6.a.& b.).



a)



b)



c)

Figure 8.6. a) Wooden weaving knives, top: 9.2cm long, middle: 13cm long, bottom: 18.3cm, profile of blade is flat on one side and elliptical on the other (Rageth 1974:taf.102). b) Patterns bronze daggers, top: 24.4cm long, bottom: 24.8cm long, profile of blades thicker in centre, graduated to a fine edge (Rageth 1974:taf.24). c) Examples of patterns on pottery from Molina di Ledro, left: max height 11.4, right: max height 11.7cm (Rageth 1974:taf.41).

The interrelationship of techniques and materials remains open-ended in that these "patterns of the mind" (Küchler & Were 2005:170-199), whether technique or material, remain as potentials rather than tangible realities in archaeology. However, these possibilities move the preserved remains of cloth and tools into a more life-like arena, where the people behind these techniques become more real and engaging as they become less rigidly producers of materials and more perceivable as producing and maintaining their lives.

Techniques and materials: division and unity in the Bronze Age

The thread, cloth and techniques of producing cloth at Molina di Ledro are typical of what is understood about cloth in the Bronze Age. Bender Jørgensen's research concluded that two-ply thread is most common in the Bronze Age of Central Europe (Unetiče, Tumulus and Urnfield Cultures), where linen was mainly used (Bender Jørgensen 1992:117), while wool was more common in the north (probably as a result of preservation). The technique of spinning with a spindle whorl was practised from the Neolithic, and widespread in the Bronze Age. Uncommon in the Bronze Age although with precedent in the Neolithic are the split tree bast threads that may or may not have been made into cloth in the Bronze Age.

It appears that there was significant conformity in the way individuals produced thread in the Alpine region, using the same tools and possibly similar techniques. As spinning is such a time-consuming task, and assuming it was taught from a young age, I suggest that the technique of spinning could be considered a "learned disposition", as Bourdieu describes the *habitus*, as discussed above. As argued above, spinning was probably a woman's job, and from this it is possible to speculate that this *habitus* may have been a gendered one. Added to the idea that they were shared by a number of people in these societies, these techniques would have been second nature and represent a shared background in learning and doing. The action of spinning may be considered a social structure for the women producing threads that were destined for cloth: through performing these tasks they were creating their roles and identities in the group.

Weaving may also be seen as a learned disposition or structure. The plain weave shows little change in structure from the Neolithic examples, and is the main weave type in the Bronze Age. Wide and narrow strips are known from other sites (see Chapter 4). By this time, the warp-weighted loom had been in use for centuries, although probably with cultural variations that are now only visible by the different type of loom weights, from sub-conical (north of the Alps c.4000 BC), sub-conical and cylindrical (VBQ in northern Italy c.5-4000 BC), to round (Horgen culture 3800-2600BC) or crescent shaped (Lagozza 3800-3500 BC) (Bazzanella, Mayr, & Rast-Eicher 2003d:89-92). The frequency of these weights increases throughout the Bronze Age, suggesting that this was an increasingly common method of weaving cloth (Bazzanella, Mayr, & Rast-Eicher 2003d:92). Evidence for the back-strap or similar loom will always be limited as it depends on the preservation of cloth or wood, but this too, is not confined to Molina di Ledro, as discussed above.

Weaving seems to have been *the* way of constructing cloth from threads in the Bronze Age. Twined cloth (closely associated with tree bast) does not completely disappear but is not nearly as significant as in the Neolithic. A tiny fragment from the Early Bronze Age site of Lucone di Polpenazze, Brescia c. 2300-1500 BC (LUCO) shows that this type of cloth was still produced south of the Alps in the Early Bronze Age. Again, the conformity in weaving, the shared loom types, and the skills that were probably developed throughout life, are conformist, both at Molina di Ledro and beyond. What does appear to be different are the types of weights, both within and between sites: are these some of the personal and regional idiosyncrasies that people used to define difference, while maintaining conformity in the production of very similar materials? In this way, sitting at the loom in the home is the aspect of *habitus* of the Bronze Age, along with spinning and plying fine threads. Again, as discussed above, if weaving was a woman's role, it may also be considered part of a woman's *habitus* in the Bronze Age. However, the presence of two different types of loom suggests the possibility that each loom could have been worked by different social groups: whether men and women, different age groups or cultural groups. This raises the possibility of a complex relationship between weaving and gender.

Cloth decoration shows more diversity in the techniques used to produce it and the visual forms that it produced. These techniques were intended to be visual. With predominant conformity in the structure of spun and woven cloth, the decoration appears to be the means of differentiating cloth types, which is known to be an important aspect of cloth. The variety of techniques and visual effects shows scope for creativity and competition between people able to show their worth through their competence in these skills and the social rewards this may have brought.

Through these materials and techniques at Molina di Ledro, it is possible to see that the settlement shared much in common with other settlements of the same period.

This is evident at a material level and at the level of techniques, with shared techniques of making threads and of weaving on different kinds of looms. Within cloth production there was room for creativity, especially in terms of decoration. In this the evidence of Molina di Ledro points to diversity. It is highly likely that the range of techniques also expressed conformity and diversity in social groups and in the gender divided society of the Bronze Age.

Conclusion

Tracing the material and techniques of producing cloth, it is possible to see both as types of visual culture. The techniques are a visual culture of the body and performance, just as the threads and cloth are a visual culture of materials. Neither techniques nor materials are limited to the sphere of cloth, just as people's lives and the learned *habitus* of people at Molina di Ledro would not have been limited to producing cloth. In this way, it is possible to understand the techniques of processing cloth in the wider social context of the *habitus* that was performed through the lives of the inhabitants of Molina di Ledro. As the visual culture of dots and shapes on the cloth is repeated on the pottery and metal work of the village, so too are the techniques associated with rotating and spinning (spindle whorls, reeling thread, wheeled vehicles), working lines back and forth (working the warp and weft, ploughing fields), adding seeds to a surface (sowing crops). Making any hard and fast interpretations from these metaphoric relationships is probably overstepping the bounds of scientific research, but pointing towards such relationships is a means to understanding better the lives of people in the past.

CHAPTER 9

Exploiting the properties of cloth through the use and re-use of cloth in the Bronze Age salt mines of Hallstatt, c.1400 BC

In the previous case studies, I focused on the extended chaîne opératoire of cloth following themes of social context and used these to bring out the wider cultural context of different types of cloth. In this case study I focus on the materiality of cloth and in particuar the appreciation of diversity and similarity of the properties of woven wool textiles and animal skins. This relates to the relationship between cloth types, cloth use and cloth re-use in the extended chaîne opératoire. The Bronze Age contexts of the Hallstatt salt mines include old excavations from the Appoldwerk and Grünerwerk and current excavation of the Christian Tuschwerk, believed to be different working areas of the mine including galleries (Appoldwerk and Grünerwerk) and a gallery and loading bay (Christian Tuschwerk), on the basis of the different material culture. In this case study I focus on the Christian Tuschwerk gallery, which is dated to the Middle to Late Bronze Age (see below), because I was able to examine the skin artefacts and therefore have first-hand knowledge of them. However, I will view this site in the context of the other Bronze Age galleries.

I chose the Hallstatt salt mines to examine the properties of cloth as the excellent preservation environment offers a unique opportunity to study the use of these cloth types in the Bronze Age. The salt inhibits the action of micro-organisms that would otherwise lead to the decay of organic materials, allowing the preservation of a wide range of cloth types, including animal skins and cloth made with plant fibres and wool. The combination of cloth types is therefore particularly diverse. In addition, due to their good preservation, there are whole artefacts that can be associated with their original use and re-use in the mines. As a working environment it is possible to understand some of the functional aspects of cloth, while also, due to the re-use of cloth in the salt mines, there is also evidence for finer cloth types that may originally have been associated with clothing above ground. Although some artefacts are specialised mining equipment, the presence of re-used cloth in the mines is useful in evaluating the role of these cloth types above ground. As in the case study of the Iceman in Chapter

6, the exceptional nature of the preservation environment in the Hallstatt salt mines is potentially misleading as it makes the cloth finds seem exceptional, although it is unlikely that this was the case. Before moving on to the analysis of the chaîne opératoire of the cloth evidence in the salt mines, I want to look more closely at the properties of cloth types in a social context.

The properties of cloth

The properties of materials (colour, texture, thickness, dimensions, strength, durability, flexibility), whether of the raw materials, processed materials or re-used materials, are essential aspects of why specific cloth types are chosen and what they are chosen for (Tite & Sillar 2000:4-7, fig.1., Schiffer & Skibo 1997:30-31). All cloth types have a wide range of properties (see Table 4.4.2 & 4.4.3), not all of which are necessarily exploited at any one time.

To investigate the properties of materials, archaeologists are assisted by an array of visual, chemical and physical tests which they may carry out in the laboratory or access through the results of industrial tests on modern materials and learn from accounts of those who work with the materials (for example Kornreich 2005, Haines 1991, Kellogg 1984:108-109). In terms of the extended chaîne opératoire, the methods of processing an artefact can significantly alter its properties, for example, the dimensions of spun thread affect the density of a woven cloth. However, as developed material culture approaches have readily demonstrated (such as Appadurai 1986, Lechtman 1975, Lemonnier 1993, Schiffer & Skibo 1997, Tite & Sillar 2000), the choices between materials relate in part to these properties but are also significantly culturally based.

Choices between cloth types

The choice of cloth types based on assessments of the properties of raw material and construction methods is well illustrated in Oakes and Riewe's account of Inuit boots (Oakes & Riewe 1996). Before the import and availability through trade of woven clothing to the north American Inuit, skins were the only form of cloth and their individual qualities meant they were used in different ways in different regions. In this example, the skins from each species of animal, including birds, and land and sea mammals, were used for different purposes (Oakes & Riewe 1996:38-48). In addition, the parts of a skin are used for particular items of clothing, for example the body of a caribou skin may be made into boats or stockings, while the legs may be used for mittens, boots, leggings or hats (Oakes & Riewe 1996:40). In addition, the way the skin is processed also affects its final properties. Shaved seal skins are more water resistant than seal skins with the epidermis and hair removed, although soaking in a tub of fat is considered even more effective and skins processed in this way are preferred for hunting in particular terrains (Oakes & Riewe 1996:36-38). This example shows the very detailed relationship between skins, species and use in reference to the properties of the skins. The same can be said of different types of woven textiles.

Despite this, one of the most noticeable problems with relating the properties to the way cloth is used is that what may appear to be the optimal choice of cloth on the basis of properties is not necessarily the one that is chosen. Following the previous example, traditional dry and scraped caribou skin boots used by the Inuit are proven to be the warmest footwear in the cold. Yet, people now wear mass-produced winter footwear, despite its having poor thermal properties (Oakes & Riewe 1996:19,102). This choice is attributed to economic changes which have curtailed the supply of skins for boots because it is no longer viable to hunt certain animals, and technological change, which has made alternative, synthetic footwear readily available (Oakes & Riewe 1996:102). Now boots are made of other types of cloth such as duffle (woven wool), vinyl and commercially tanned skins, sometimes in combination with the traditionally prepared skins (Oakes & Riewe 1996:133). However, the continuity of traditional types is also a significant symbol of group affinity and traditions, and such cloths are made for use in a number of social events (Oakes & Riewe 1996:19). This example shows how properties are not always the first reason for the selection of cloth types, and that social choices based on economic considerations , availability and relevance to the occasion are significant factors.

Properties and the symbolism of cloth types

Because there are shared properties between cloth types, in many instances they can be used interchangeably. This is an important aspect of my definition of cloth. There is a wide diversity of cloth types in prehistory, which opens up the possibility that choices between using one type or another may be led by the symbolic value of cloth types rather than, or as well as, the choice of optimal properties. Cloth types may be symbolically relevant to a group or person's status, gender or ethnic origins, and cloth may symbolise healing, instigate fear, symbolise positions of power or servitude, or be used to symbolise affinity to a particular group or abstract belief such as a religion or philosophy. The tactile qualities of cloth may relate to abstract qualities, where qualities such as soft and hard, smooth or rough, dull or shiny are part of a wider cultural understanding of the appropriate use of cloth as material culture.

An example of the symbolism of cloth types is the description of cloth in the Homeric poems. These texts, the Iliad and Odyssey, were written in ancient Greek and are attributed to the epic poet Homer (Bennet 1997:514, Radice 1973:135-136). The Iliad recounts the Trojan war fought between Sparta and Troy over the abduction of Helen. The Odyssey recounts Odysseus's long and adventurous journey home after the war. Based on literary analysis, these poems are dated to c.800 to 0 BC which equates to the Iron Age, a date which is commonly accepted (for example Bennet 1997:513, Dickinson 1986:21). However, the events described in these poems are anachronistic and are associated with the Mycenaean Bronze Age dated c. 1600-1100 BC. The validity of such text as a source for the Bronze Age is rightly questioned (for example Bennet 1997:511, Dickinson 1986:35). Despite these problems, and making no attempt to solve them myself, I find these texts significant as they show how some of the earliest texts in Europe use cloth as a symbolic medium to represent the characters in the story. As with other historical examples I have cited in this thesis, I am not concerned with the detail of these events in direct relationship to the Middle to Late Bronze Age in the Alpine region, but the principles behind it.

The writer of the poems frequently refers to clothing and other cloth artefacts such as armour and bedding throughout the narrative. The main characters of the stories are gods and goddesses, warriors and aristocracy; the writer dresses them appropriately and puts them in suitable surroundings. In the Odyssey, the poor and destitute are often depicted wearing rags (Rieu 1976:224) and sleeping on hides (Rieu 1976:304), as opposed to the rich, coloured clothing worn by the wealthy (Rieu 1976:294) and the blankets on their beds (Rieu 1976:296). By contrast, the richest characters have stores of fine quality clothing and cloth that they present as gifts. For example, setting out on a journey, Telemachus is depicted in a "shining tunic", with a "great cloak...dressed like a prince (Rieu 1976:231). As a parting gift, Helen gives him a long, richly embroidered, glittering robe, as a dress for his bride (Rieu 1976:233). Throughout the poems clothing is used to distinguish people of different sex: men wear tunics and women wear robes. However, by adding details of the type of cloth, the author adds layers of symbolism that make the reader understand the role of the character more deeply.

Probably the most well-known story related to cloth in the Iliad is of Penelope weaving the shroud of Laertes (her father-in-law) (Hammond 1988:39). This is described as a large, delicate and beautiful work, which shone like the sun or moon (ibid:39, 354). Again here, it is not just the functional properties of cloth to bury the dead (after all, anything could do), but the social relevance of an elaborate cloth that is suitable for a man as rich as Laertes (ibid:40).

These are just a few of many similar instances in the texts. From them, I have shown not only how the use of properties may be specific and relate to raw materials and the way they are processed, but also how properties are only part of the selection of cloth types for a particular use and may sometimes appear counter-intuitive. I have not given an exhaustive account of possible reasons for accepting or rejecting these cloth types (availability, economic considerations, tradition, social risk of unusual clothing), as these inevitably vary according to the particular historical context. With this in mind, I turn to the analysis of the chaîne opératoire of cloth types and its relationship to use and re-use in the Christian Tuschwerk Bronze Age gallery of the Hallstatt salt mines.

Archaeological context of the Bronze Age salt mines

The Hallstatt salt miners exploited a salt deposit of the north-eastern Alps. The first active archaeological research in the mines was conducted by Johann Georg Ramsauer in 1849; excavation of the mines has continued periodically since then, with yearly excavation programmes since 1960 (Barth 1982:31-32, Reschreiter 2005:11-13).

Although there is some evidence to suggest that the salt deposits were exploited in the Neolithic c.5000 BC, the earliest mine galleries date from the Middle Bronze Age, about 1400 BC, with further important galleries belonging to the Early Iron Age (Reschreiter 2005:13). The Christian Tuschwerk is the most recent area to be excavated (Reschreiter 2005:12). Based on dendrochronological dating the gallery dates from 1460 to 1245 BC (Grabner *et al.* 2006:45), equating to the Middle Bronze Age as it is defined in Austria (Kern 2005:9). In other definitions the Late Bronze Age beings around 1300 BC and is associated with the Urnfield tradition. Other Bronze Age mines at Hallstatt include the Appoldwerk and Grünerwerk, dated between 1400-1000 BC (Reschreiter 2005:13, Stadler 1999).

Mining methods

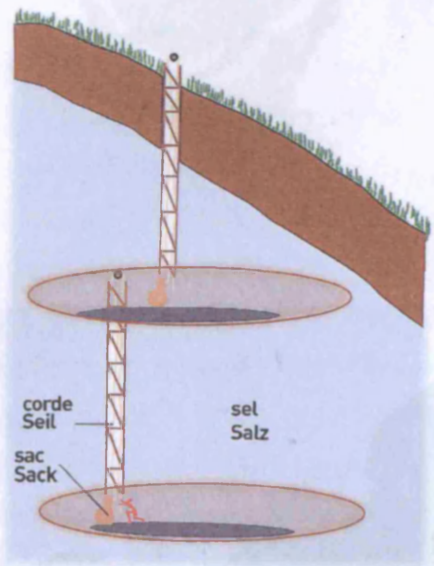
The Bronze Age mines consist of a number of shafts and galleries full of waste that was left behind by the miners, including broken tools, burnt spills and rope along with cloth fragments and artefacts. From this debris, the excavators and researchers have reconstructed the methods used to mine the salt, and the following description is based on these accounts (Barth & Neubauer 1991:21-24, Barth 1994:28-29, Barth 1998:123-

126, Reschreiter 2005:13). The Bronze Age miners excavated the salt with bronze picks with wooden handles; for light they used burning wooden spills held in their teeth. The broken salt pieces were scraped into wooden trough-shaped buckets with wooden scraping tools, then loaded into animal skin containers carried on the back (rucksacks). These were then carried to the surface through the mine galleries and shafts, using a hauling device of thick lime-bast rope and woven wool carrying sacks. To handle the ropes, the miners used hand-leathers, which were roughly circular animal-skin pads tied to the palms of their hands with straps to protect them during rough work, such as handling ropes (Barth 1994:28-29,Taf.5), Figure 9.2.a.

The area of the Christian Tuschwerk that has been excavated is interpreted as a loading bay at the bottom of a shaft with a wooden staircase (Grabner et al. 2006b:46), where the salt was loaded into bags and then carried to the surface (Barth 1994:28, Grömer 2005b:31, Reschreiter 2005:13). In particular, the area includes a large wooden trough bucket, a thick lime bast rope, numerous hand leathers (CHRI-004, CHRI-005, CHRI-008, CHRI-009, CHRI-010, CHRI-019, CHRI-20) (Figure 9.2.b), and woven woollen rags, which are thought to be remains of carrying sacks (Barth 1994:28-29, Reschreiter 2005:13, Grömer 2005b:20) (Figure 9.3 a-c).

Other Bronze Age areas at Hallstatt, including the Appoldwerk and Grünerwerk, are mine galleries and contain slightly different assemblages of cloth artefacts. Four large cow-skin rucksacks were excavated from the Appoldwerk and Grünerwerk (APPO-001, APPO-002,GRUN-002, GRUN-003, LAND-001), together with a conical hat (Barth & Lobisser 2002:15) (GRUN-004), and with spills, wooden pick handles, scraping tools and woven textile fragments (Barth & Neubauer 1991:21-24,Taf2-7). These areas are thought to be part of the galleries of the mines; the working face.

a)



b)

c)

Figure 9.1. Method of exploiting salt in the Bronze Age: a) From left to right: using a metal pick to dislodge rock salt, scraping into a wooden trough bucket, loading into a cow-skin rucksack, emptying the rock salt at a loading bay (Photograph from Hallstatt Catalogue 2004:14).
b) Schematic diagram of the Bronze Age salt mines: gallery shaded grey, loading areas with carrying sack at the bottom of staircases leading to the surface (Photograph from Hallstatt Catalogue 2004:13). c) Cow-skin rucksack, 78cm high (GRUN-003) (Photograph from Hallstatt Catalogue 2004:15).

a.

b.

Figure 9.2. Artefacts from the Christian Tuschwerk: a) A pair of hand-leathers, (CHRI-008, CHRI-009) (Photograph by Susanna Harris). b) Wooden trough bucket; the wooden parts are sewn together with animal skins straps (not visible), a hole in the wood is mended with a dark fur patch (CHRI-007) (Photograph by Susanna Harris).

The cloth artefacts

Skins

Ryder analysed the species and curing method of some of the skins bearing hair or wool (Ryder 1993). Although he refers to all these as Iron Age, some have subsequently been dated to the Bronze Age. From his total sample of animal skins, nearly 90% of the animal species used for skins are domestic, including cattle, goats and sheep; others may include chamois / gemse (*Rupicapra rupicapra*) or steinbock (*Capra ibex*), dog or other small fur-bearing animals (Ryder 1993a:107). The skins do not appear to be vegetable-tanned, but possibly oil-tanned or rawhide (Ryder 1993a:106). This conforms to the expectation that skins of this period were not vegetable-tanned, as discussed in Chapter 4.

Woven textiles

The woven textiles from some of the Bronze Age and Iron Age salt mines were published by Hundt over several decades (Hundt 1959, Hundt 1960, Hundt 1967, Hundt 1987). Most of the Bronze Age finds come from the Grünerwerk and are published in the 1960 article. The textiles from Bronze Age and Iron Age salt mines, including the Christian Tuschwerk, are currently being studied and published by Karina Grömer (Grömer 2005b). In her 2005 article on the site, Grömer counts 37 individual pieces of woven textile from the Christian Tuschwerk, which she describes as follows: the fibres are all single threads, either s-spun or z-spun and in various combinations; the Bronze Age threads for textiles are mainly 1-1.5mm in diameter, some are as fine as 0.3-0.5mm. They are mainly plain weave, with rare examples of twill weave. One of these twill pieces was dyed an olive colour. There is evidence of dense starting borders (using the reps weaving technique), some of which are reinforced with seams and hems. There is evidence that the cloth was fulled, as the surface appears felted. One suggestion is that the coarse woven textiles are the remains of carrying bags (Grömer 2005b:20), although this is open to interpretation. A full fibre analysis has not been carried out, but Grömer's assumes in her summary that the majority are wool, which fits with the finds from the Grunerwerk (Hundt 1960:129-130). Cloth of plant fibres, which cannot be identified more closely than that they are either flax or hemp, are rare in the Bronze Age salt mines. Two pieces of 2/2 twill weave are known from the Grünerwerk (Grömer 2005b:19, Hundt 1960:129-130). There is no evidence of cloth from tree bast, although ropes are made of lime bast (Barth 1998:124). Similarly, there is no evidence of twined cloth, only woven textiles. Lacking a complete publication of the finds from the Hallstatt salt mines, the relative proportion of cloth types is unclear. From my own observation in the archives of the Naturhistorisches Museum Wien, the skins far outnumber the woven textiles and are in general larger.

My analysis of the artefacts from the Christian Tuschwerk is based on two animal skin artefacts published by F.E. Barth (Barth 1994) (CHRI-19 & CHRI-020) and the analysis of thirty seven textiles by Karina Grömer (Grömer 2005b), including six artefacts that are mentioned individually (CHRI-013 to CHRI-018). I examined twelve skin artefacts from a number of unpublished animal skin artefacts from the Christian Tuschwerk in the Vienna Naturhistorisches Museum (CHRI-001 to CHRI-012) (Table 9.1). Over a four-day period I was able to look at the artefacts in the archives and selected twelve artefacts that I was then allowed to handle, measure and examine in detail. The tactile examination made it a particularly suitable case study to discuss the properties of cloth types. This contrasts to the other museum visits where I was able to view artefacts but not handle them, usually because they were charred remains of plant fibres that are fragile and easily damaged. A fieldwork report of eleven of the artefacts from the Christian Tuschwerk is published in the *Papers from the Institute of Archaeology* (Harris 2006). The following analysis will therefore focus on this gallery and consider it in relation to the other Bronze Age cloth finds.

Cloth in the Bronze Age

In relation to other finds from the Bronze Age, the salt mines offer new evidence, particularly of skins; the types of woven cloth correlate well with other Bronze Age cloth types. Bender Jørgensen's work remains the main summary of Bronze Age textiles in Europe. The closest geographical examples to the Austrian finds come from Germany. Based on her research, northern German woven textiles are mainly wool z/s plain weave, the central German woven textiles are mainly wool plain or reps with s/s spun thread or s-spun Z plied thread, the southern German woven textiles are mainly linen tabby or reps with plied thread of either zS / zS or sZ/sZ (Bender Jørgensen 1992:52-53). There are exceptions including twill cloth and cloth with plant fibres in one thread system and wool in the other (Bender Jørgensen 1992:53,117). The Bronze Age textiles from the mines are mainly plain weave with some examples of a twill (Grömer 2005b:28-30), with single ply threads. This correlates with the evidence for Bronze Age woven textiles in Germany as classified by Bender Jørgensen, although lacking the evidence of two-ply threads. There is no evidence of patterned woven textiles. There is little with which to compare the skins in this period.

Artefact	*Cloth type*	*Colour & texture*	*Dimensions & thickness*	*Sewing, seams & edges*	*Use & re-use*
CHRI-001 Composite dark brown flat sheet of fur	Animal skin with fur	Dark brown fur, three pieces sewn together with the nap of the fur laying in the same direction. The hem is turned up with a separate narrow strip.	78cm long x 17.2cm max width, 1.2mm thick	Small regular stitches on all seams and hem, sewing thread 1mm diameter.	Use unknown. The contrast between the fine seams and rough hole with tree root pushed through suggests re-use.
CHRI-002 Torn strap with slit at one end	Animal skin	Skin currently orange-brown colour.	34.5cm long x 1.8-2.4cm wide, 3.25mm thick	No sewing.	Strap for binding? Individual straps were joined together through slits at either end.
CHRI-003 Fragment with torn seam	Animal skin with fur	Reddish-brown fur 4-8mm long.	19.5cm x 5.1cm max width, 2mm thick	Torn seam on one edge, no thread remains, holes measure 2-3mm x 0.5mm.	Evidence of wear around hole, use unclear.
CHRI-004 Fragment of a hand-leather	Animal skin with fur	Light yellow-brown fur 11mm long.	10.8cm x 4.5cm, 1-1.5mm thick	Two layers of skin sew together close to edge with 10-18 mm running stitch long. Sewn with skin strip 4-4.5mm wide and 1mm thick. Possible remains of fringe around thumb area.	Edge fragment of a hand-leather.
CHRI-005 Hand-leather	Animal skin with fur	Yellow-brown fur 2-9mm long.	12cm x 10.2cm, 1mm thick	No sewing.	Hand-leather, roughly circular shape with an off-centre hole for the thumb, narrow skin strip ties. Main area torn.
CHRI-006 Bristly fur sheet	Animal skin with fur	Dark brown to dirty cream colour, fur 5-22 mm long.	76.5cm x 29cm max length, 1.25mm thick	No sewing.	Irregular flat sheet with many tears: use unclear.
CHRI-007 Wooden trough bucket sewn with skin strips and repaired with a fur patch	Animal skin strips, patch with fur	Patch dark brown-black, max fur length 13mm.	Strips from 6-9mm wide x 1-4mm thick. Patch roughly circular 12-19cm diametre, 1.5mm thick.	Skin strips sewn through holes bored in the wood used to join the wooden parts of the container and attach patch. Strip to sew on patch 6-7mm wide, 1-1.5mm thick	Strips of animal skin used to join two pieces of wood and to patch wooden artefact.

Artefact	*Cloth type*	*Colour & texture*	*Dimensions & thickness*	*Sewing, seams & edges*	*Use & re-use*
CHRI-008 and CHRI-009 A pair of hand-leathers	Animal skin with fur	Both matching yellow-brown fur, patchy with a maximum length of 16mm.	CHRI-008 17.2cm x 10cm, thickness of double layer 3mm. Strap c. 36.4cm x 9mm wide. CHRI-009 14.8cm max length x 11.4, double layer 2.25mm thick.	Two layers of roughly circular shaped skin joined with 4-12mm long stitches around edge. Sewing strip 2-3mm wide. Fringe around thumb hole cut 2.5-5mm deep and 1-5mm apart.	Hand-leathers. CHRI-009 evidence of wear on both sides.
CHRI-010 Hand leather	Animal skin with fur	Yellow brown patchy fur, max length 3-4mm: similar colour to CHRI-008 and CHRI-009.	16.2cm x 9.4cm, two layers have different thickness: 1mm and 2mm thick. Strap 0.6-0.8cmwide, 1.5mm thick	Two roughly circular shaped pieces sewn together with running stitches. Stitches 7-11mm long, sewing thread strip of skin 3-4mm wide. .	Hand leather.
CHRI-011 Fragment with three holes	Animal skin with fur	Short yellow-brown hairs, 4-8mm max length, similar colour to CHRI-008, 009 & 010.	14.7cm x 2.9cm max height, 1.5mm thick	No sewing.	Strip of animal skin with fur and three large holes, use unknown.
CHRI-012 Large composite sheet of furs.	Animal skin with fur	Individual furs different colours, from straight dark brown to white and curly.	154.5cm max length x 108cm max wide, 21cm height of hump. Variable thickness	Various seam types: running stitches of minimum 7-10mm long. Fine over stitch 2mm long using 1mm thread.	Large sheet made of numerous animal skin. Additional ties of animal skin and plaited vegetable fibres.
CHRI-013 Fragment of woven textile	Wool, plain weave cloth.	Natural white-brown colour.	11 x 9.5cm. Average of carry sacks: single threads, 1.5-2mm thread diameter, 5 threads per cm in both directions.	Edge reinforced with stitching, double thread used.	Possibly part of a carrying sack, ripped into rags.
CHRI-014 Fragment of woven textile	Wool, plain weave cloth with reps starting border.	Natural white-brown colour.	16 x 7.7cm. Average of carry sacks: single threads, 1.5-2mm thread diameter, 5 threads per cm in both directions.	No sewing.	Possibly part of a carrying sack, ripped into rags.
CHRI-015 Fragment of woven textile	Wool, plain weave cloth, stitching to reinforce edge.	Natural white-brown colour.	12.5 x 9cm. Average of carry sacks: single threads, 1.5-2mm thread diameter, 5 threads per cm in both directions.	Edge reinforced with stitching.	Possibly part of a carrying sack, ripped into rags.

Artefact	*Cloth type*	*Colour & texture*	*Dimensions & thickness*	*Sewing, seams & edges*	*Use & re-use*
CHRI-016 Fragment of woven textile	Wool, plain weave cloth with reps starting border.	Natural white-brown colour.	11 x 6.8cm. Average of carry sacks: single threads, 1.5-2mm thread diameter, 5 threads per cm in both directions.	No sewing.	Possibly part of a carrying sack, ripped into rags.
CHRI-017 Fragment of woven textile	Wool, plain weave cloth with reinforced edge	Natural white-brown colour.	10 x 11.5cm. Average of carry sacks: single threads, 1.5-2mm thread diameter, 5 threads per cm in both directions.	Edge reinforced with stitching.	Possibly part of a carrying sack, ripped into rags.
CHRI-018 Fragment of dyed, twill weave cloth	Wool, twill with paired warp and weft.	Olive colour dye, dye analysis pending.	7 x 4.1cm, 0.3mm thread diameter, 16-20 threads per cm in both directions.	One edge hemmed.	Small rag, unclear use.
CHRI-019 Hand-leather	Animal skin	No given.	16cm diameter	Hand-leather cut from one piece.	Hand-leather
CHRI-020 Hand-leather	Animal skin	No given.	16cm diameter	Thumb hole has fringed edge.	Hand-leather

Table 9.1. Summary of individual animal skin and textile artefacts from the Christian Tuschwerk. Artefacts CHRI-001-CHRI-012 were examined by the author, CHRI-013-018 examined by Karina Gromer (Grömer 2005b), CHRI-019 & CHRI-020 examined by F.E. Barth (Barth 1994:Taf.5). Other woven textiles are published as part the main analysis by Karina Gromer, but not mentioned as individual finds.

Analysis of the chaîne opératoire of cloth in the Christian Tuschwerk

Analysis of the raw material and cloth construction methods has not been carried out for the Christian Tuschwerk. However, it is likely that at least some of the animal fibre artefacts are of sheep's wool and that the method of curing skins is similar to the other Bronze Age finds, discussed above. I shall not examine cloth construction methods in detail but concentrate on the chaîne opératoire of cloth use and re-use, starting with a description of the cloth types in relation to colour and texture, dimensions and thickness, sewing and seams, use and re-use.

Cloth types: colour, texture and weave type

Most of the animal skin artefacts from the Bronze Age salt mines still have their hair or wool (fur) attached; this varies in colour and texture. Apart from being diagnostic of the animal to which it belongs, this affects the appearance of the artefacts. The colours range from dark-brown (CHRI-007, CHRI-001, CHRI-007) to variations of yellow-brown (CHRI-011, CHRI-008 and CHRI-009, CHRI-004), red-brown (CHRI-003) or orange-brown (CHRI-002) and cream (CHRI-012). Some discolouration in the mine may have affected the actual colour, but the variation between artefacts is evident. In terms of texture, in some cases the fur is coarse, noticeably the bristly texture of the irregular-shaped fur (CHRI-006); in other cases it is fine. The direction of fur is sometimes taken into consideration: in the composite sheet of dark-brown fur where several pieces of fur are sewn together (CHRI-001) attention was paid to using pieces with matching colour and to align the fur in the same direction.

The coarse woven textiles interpreted as carrying bags are all recorded as natural white-brown coloured (Figure 9.3 a-c). Grömer refers to these as wool (Grömer 2005b:20). There is one piece of olive coloured, woollen dyed cloth (CHRI-018) (Grömer 2005b:20). As the dye has not penetrated into the fibres Grömer suggests that it was dyed after it had been woven (Grömer 2005b:20). The surface of some of these pieces appears felted, which suggests they were fulled (Grömer 2005b:20). The Bronze Age textiles are mainly plain weave, with only a few examples of twill, and some have reps borders (Grömer 2005b:29). For example, woollen twill with paired warp and weft (CHRI-018), and 2/2 twill of either linen or hemp (GRUN-001, GRUN-009) with reps borders (CHRI-007, CHRI-014, CHRI-016).

Cloth types: dimensions and thickness

The pieces that I examined from the Christian Tuschwerk range in size. There are numerous straps occurring either alone (CHRI-002), as ties on the hand-leathers (CHRI-005), or used for sewing wooden artefacts (CHRI-007) or as narrow strips to sew other skins such as the hand-leathers (CHRI-008, CHRI-009). Small artefacts include the hand-leathers (as before), which measure between 12-17.2cm long and 9.4-14cm wide and would be sufficient to cover the palm of the hands and the inside of the fingers of an adult hand. The largest piece consists of a number of skins sewn together into a sheet measuring 108 x 154.5cm (CHRI-012). Other larger pieces include a dark-brown composite fur artefact with hem (CHRI-001), currently measuring 78x17cm although possibly only part of the original piece. In a more fragmentary state is an irregular flat piece of dark-brown bristly fur (CHRI-006) measuring 76.5x29cm. There are a number of fragments measuring just a few centimetres, with holes, seams and signs of stretching which are usually difficult to determine in use; they were possibly used as rags (CHRI-003, CHRI-011).

The thickness of the skins varies. Some are less than 1.5mm in thickness, such as the composite fur (CHRI-001), 1.2mm thick, and an irregular piece of dark-brown fur of 1.25mm thickness (CHRI-006). These fine skins contrast to the torn strap (CHRI-002), which is 3.25mm thick (Figure 9.3.d.). Some of the hand-leathers are made of two thin skins, between 1-1.5mm thick, sewn together (see below) so that together they are up to 3mm thick (CHRI-008 and CHRI-009).

The woven textiles are all fragments; there are no recognisably complete artefacts. Of the finds illustrated the largest is 12.5 x 9cm (CHRI-015) and the smallest is 7x4.1cm (CHRI-018). Other dimensions are not given; however from an overview of the archive, there are no significantly larger pieces present. Although the thickness of the cloth finds is not given in the analysis, the thickness of threads and thread count is. Based on Grömer's analysis (Grömer 2005b:28-32) of the woven textiles from all the Bronze Age salt mines, the thickness of the textiles can be described as follows. Coarse textiles, with thread diameters of 1mm or over and a thread count of 1-5 per cm, are most common. This is mainly due to the large quantity of textiles interpreted as "carrying bags" found in the Christian Tuschwerk, of which the threads are coarse, from 1.5-2mm, with 5 threads per cm (Grömer 2005b:20). However, there are also medium to medium fine quality textiles from the Bronze Age with thread diameters of 0.3-0.4mm to 0.6-0.9mm and thread counts between 6-10 per cm, although Grömer does not distinguish which mine these were excavated from (Grömer 2005b:28-29, fig 14.). One of these fine woven textiles (CHRI-018) is cited ~~sited~~ individually; this wool cloth in twill weave cloth has fine threads of 0.3mm and a thread count of five per cm.

Artefact construction techniques: sewing, seams and edges

There are a number of sewing techniques used on the skin artefacts; these vary in scale, regularity and technique. The hand-leathers with two layers were sewn together with running stitches around the circumference of the roughly circular hand-pad. Of those examined from the Christian Tuschwerk (CHRI-004, CHRI-008 and CHRI-009, CHRI-010), the stitches are mainly between 8-18mm long and were sewn with strips of animal skin approximately 2-4mm wide. On each piece the stitches vary in size and are roughly executed.

By contrast, some of the leather and fur artefacts show evidence of small and regular stitching. The composite dark-brown fur (CHRI-001), is made of three pieces of fur that are sewn together side by side with fine seams, the stitches being 3-4mm long with thread 1mm in diameter. The piece is hemmed using an additional strip of leather less than one centimetre wide, which was stitched to the bottom edge, then turned over and sewn on to the reverse of the fur. From the fur side, this makes an invisible, even hem with the fur falling over the edge, and would prevent the edge from stretching. As skins do not fray, the edges can be left raw. Another technique that was used on the edge of skin artefacts is small fringes cut approximately 2-4mm deep and 3-5mm apart around the thumbhole of some of the hand-leathers (CHRI-008, CHRI-009). The thumb holes of the hand-leathers are particularly susceptible to tearing (CHRI-005, CHRI-008 and CHRI-009), and the fringes may have been intended to prevent this.

The edges of a number of the woven textiles are reinforced with stitching, (CHRI-013, 015, 017). One is sewn with a single thread (CHRI-015), another with double thread (CHRI-013). On the basis of measurements take from the photograph, the stitches are between 1-1.8cm long. The selvedges of the woven textiles are sometimes worked in reps, a weaving technique that creates a thicker edge (CHRI-014, CHRI-016). The fine olive-colour fragment has a hem (CHRI-18) (Grömer 2005b:20).

a. b.

c. d.

Figure 9.3. Cloth artefacts from the Christian Tuschwerk: a) Plain weave wool cloth with sewn edge, 11x9.5cm, (CHRI-013) (Photographic collection of the Naturhistorisches Museum Wien reproduced in Grömer 2005:21). b) Plain weave wool cloth with reps border, 16x7.7cm, (CHRI-014) (Photographic collection of the Naturhistorisches Museum Wien reproduced in Grömer 2005:21). c) Plain weave wool cloth with reps starting border 11x6.8cm (CHRI-016) (Photograph Photograph of the Naturhistorisches Museum Wien in Grömer 2005:21). d) Torn skin strap, 34cm long x 1.8-2.4cm wide x 3.25cm thick (CHRI-002).

Cloth use and re-use

As already mentioned, a number of the skin artefacts are hand-leathers. These are oval-shaped with an off-centre hole for the thumb and would have been tied to the palm with two narrow skin straps (CHRI-004, CHRI-010, CHRI-005, CHRI-008 and CHRI-009). There are conspicuous signs of wear on the surfaces: sometimes on both sides (CHRI-008 and CHRI-009).

Skin strips of various dimensions, like the ties for the hand-leathers or those used for sewing, are common in the mines for tying and binding tasks. Narrow strips were also used to join pieces of wood using a sewing technique. Holes were bored into the adjoining sides of the wooden parts and the strips were knotted and sewn through the holes, Figure 9.2.b. This technique was used on a wooden trough-bucket (CHRI-007) where the base is attached to the side using this sewing technique. In addition, in a place where the base of the trough has split, it was mended with a roughly circular fur patch 12-19cm in diameter. This was sewn on with large running stitches and 6-7mm wide leather strip following the drilled-hole and strip technique.

The hand-leathers and buckets appear to have been made specifically for mining; however other pieces may have originally been used for other purposes then re-used in the mine. The composite brown fur (CHRI-001) may show evidence of re-use on the basis of the significant contrast between the attentive skill required for matching the fur direction, sewing and hemming compared with the make-shift hole pierced through the skin with a tree-root pushed through like a handle. The sewing on this artefact is most similar to the sewing of the conical hat from the Grünerwerk (GRUN-004), mentioned above. This attention to detail and the fine sewing on these artefacts contrasts with the big stitches used for the carry-sacks or hand-leathers that were made specifically for work in the mine.

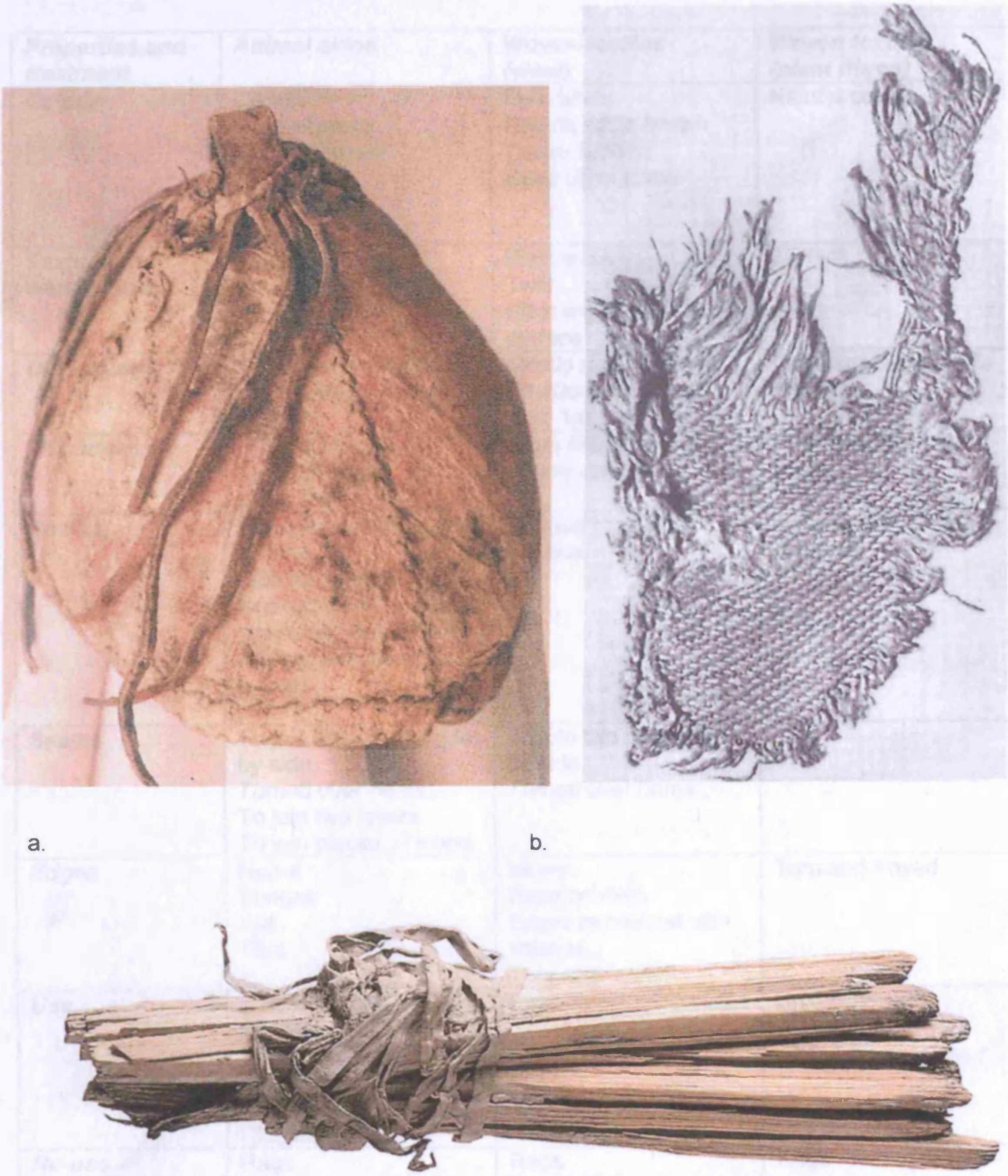
All that remains of the woven textiles in the Christian Tuschwerk are rags. The fine textiles were possibly from old clothing (Reschreiter 2005:13). As mentioned above, groups of coarse plain weave fragments from the Christian Tuschwerk are interpreted as carrying bags or hauling sacks (CHRI-013 to 017) (Grömer 2005b:20). They were found near a wooden ladder leading up from the shaft; this area is interpreted as a loading station, where the mined salt was brought from the mine face to be carried to the surface, probably in woollen bags (Reschreiter 2005:13). The edges of the coarse woven textiles are curved upwards, as if they had been strained due to carrying heavy loads (Reschreiter pers. comm.). However, no whole bags have been found, only torn fragments, which were presumably the remains of bags once they could no longer be used as bags (Reschreiter 2005:13).

Cloth types, use and re-use in the Appoldwerk and Grünerwerk

The Christian Tuschwerk is just one of a number of Bronze Age areas in the mines. Two others are particularly significant: the Appoldwerk and Grünerwerk. As mentioned above, four cow-skin rucksacks came from the Appoldwerk and Grünerwerk (APPO-001, APPO-002, GRUN-002, GRUN-003). Barth provided a detailed description of the construction method (Barth 1992). The rucksacks were made with hour-glass shapes cut from cow-skin. These were sewn together and wooden supports added on two sides, sewn on with skin strips through holes bored in the wood. The tops were doubled over and sewn in place with thick leather strips; a thick skin strap was used for carrying (Barth 1992:122). The conical hat with tassel from the Grünerwerk is sewn with small stitches and fine thread along the seams (GRUN-004); bundles of new spills have been found tied with skin straps, Figure 9.4.c. Skins were used for straps and sewing thread of various dimensions (Barth 1992:123).

The woven textiles are natural coloured, including wool fibres ranging from pure white (GRUN-007) and light yellow-white (GRUN-005, GRUN-007, GRUN-008), to dark brown, and some show evidence of fulling (GRUN-010) (Hundt 1960:148). From the Grünerwerk, only small fragments of woven cloth are known, but show a wide variety of cloth densities (Hundt 1960:127-130); some wool threads are 4mm thick (GRUN-005), while others are less than half a millimetre (GRUN-006) (Hundt 1960:128); the thread counts range accordingly. A large piece of coarse sheep's wool textile measuring 138x100 cm was found in the Appoldwerk (APPO-005); unfortunately this piece has been lost (Barth & Neubauer 1991:23). Another variable is the spin direction of the warp and weft. In some cases the threads are both s-spun (GRUN-005, GRUN-006) or both z-spun (GRUN-009) or one is z-spun and the other s-spun (GRUN-007, GRUN-008). A number of the woven textile artefacts (both plant fibres and wool) from the other Bronze Age mines have stitching (GRUN-001), hemmed edges (GRUN-005, GRUN-007, GRUN-008), and reps edges (APPO-003).

Although the cloth use in the galleries is varied, which as the excavators suggest most probably reflects the tasks carried out in these areas, the cloth types, cloth construction methods, where known, and methods of artefact construction, are consistent with evidence in the Christian Tuschwerk gallery.



a. b. c.

Figure 9.4. Cloth artefacts from the Bronze Age mines: a) Hat from the Grünerwerk with visible stitching and tassels (GRUN-004) (Photograph from Barth & Lobisser 2002:15), b) Twill weave cloth from the Grünerwerk. Made of plant fibres; either linen or hemp, 16x8.5cm (GRUN-001) (Photographic collection of the Naturhistorisches Museum Wien in Grömer 2005:19), c) Spills tied with skin straps (Photograph from Hallstatt Catalogue 2004:18)

Properties and treatment	***Animal skins***	***Woven textiles (wool)***	***Woven textiles (plant fibres)***
Colour	Cream Yellow-brown Orange-brown Red-brown Dark brown Black	Pure white Natural white-brown Yellow-brown Dyed olive green	Natural colour
Texture and weave type	Furry Smooth	Plain weave Twill Plain weave with fulled surface	2/2 twill
Dimensions	From narrow straps to composite pieces over 1.5m	Mostly rags between 10-20cm, one piece over 1m	Only rags between 5-16cm
Thickness	From 1.2mm to 3.25mm single thickness.	From fine to coarse, mainly coarse	From medium fine to coarse.
Sewing	Various types of stitches. Distinction between large stitching with skin straps and small stitches with thread c.1mm.	Various types of stitches	Not currently enough evidence
Seams	To join two pieces side by side. Turned over hems. To join two layers. To join pieces of wood.	To join two pieces side by side. Turned over hems	
Edges	Hems Fringes Cut Torn	Hems Reps borders Edges reinforced with stitches Torn and frayed	Torn and frayed
Use	Hand-leathers Straps Sewing thread To repair wood Containers Clothing	Possibly carrying sacks	Unknown
Re-use	Rags Some of rags possibly re-used from clothing	Rags Some of rags possibly re-used from clothing	Rags

Table 9.2. Summary of properties, use and re-use of the animal skin, woven wool textiles and woven plant fibres textiles in the Christian Tuschwerk, Appoldwerk and Grünerwerk Bronze Age galleries.

Discussion

From the evidence above and in comparison with modern cloth type analysis, I will discuss the possible exploitation of the properties of the cloth types that were used and re-used in the salt mines of the Christian Tuschwerk, Appoldwerk and Grünerwerk.

The exploitation of properties

It appears that many of the cloth types were used in ways that seem appropriate to the qualities of the materials. The skins that were made into hand-leathers would seem to suit the purpose as they are soft on the skin, while hardwearing and resistant to tears when in contact with rough surfaces, such as handling rope. The two layers of hand-leathers are sewn together with large stitches, which doubles the thickness of relatively thin skins and seems to relate to the desirability of a strong, durable surface. The hand-leathers have large stitches and are not hemmed; this takes advantage of the fact that the edges do not to fray when cut and made quickly. These would seem to be suitable properties for the hand-leathers, which are worn out through heavy use and hidden, neat seams were probably not important. The fringes around the thumb hole, as noted above, may have been an attempt to prevent tearing in this vulnerable area, or to stop the hand-leather rubbing on the thumb? In a similar way, the cow-skin rucksacks were worked with large stitches using skin straps; again quick to work, the big stitches would also create a strong surface. Cow-skin was a good choice for items subject to considerable ~~werae~~ wear and tear as the skins are large and durable (Kellogg 1984:108).

The only direct evidence of the use of skins for clothing is the conical hat from the Grünerwerk. However, the fine stitching was also used on the composite brown fur sheet (CHRI-001). I think it is likely that this was originally an item of clothing, or another carefully made item re-used in the salt mines. On this basis, I will consider both of these as artefacts not intended solely for in the mine. Both contrast with the artefacts that were made specifically for mining (the rucksacks and hand-leathers) as they have fine stitching and attention to details that affect appearance. The hat has skin straps added as a tassel and visible seams worked with small, even stitches. The composite fur is also worked in small neat stitches, but it seems that the fur side was the focus of attention. The sheet is made of three pieces of fur sewn together; however, as the fur direction matches, the different pieces are barely noticeable from the fur side. Similarly with the hem: a separate strap is used to turn it up, which would prevent it from stretching out of shape, and has the effect of extending the fur over the edge. In both these cases, while the skins may have been exploited for warmth, durability, and resistance to wear, they are also made with an awareness of the properties of skins, on the one hand to make stitching show up against the smooth skin surface and to create a tassel, and on the other to match the grain of the fur and make the stitches invisible.

The woollen woven textiles of the Christian Tuschwerk are mainly coarse rags; some are fulled and have edges reinforced with stitching or with sturdy reps borders. As noted by Karina Grömer, this would create very strong bags that would be ideal for heavy work in the salt mines (Grömer 2005b:31). Fulling in particular creates a strong and resistant cloth that will not fray, even if it is torn (Grömer 2005b:20). However, there are finer woollen textiles. Some of these are seen as rags torn from clothing or other artefacts used originally outside the mine. As clothing, they were possibly valued for their soft and warm qualities; the use of dye on one piece and the distinctive twill weave (CHRI-018) show that the ability to manipulate the texture of the weave and ability to take dye was also appreciated. The re-use of cloth of both types shows how it was still useful after the original artefact was worn out, broken or otherwise undesirable.

There are other properties of these cloth types that may have been of importance. Both wool and skins are fire resistant, which may well have been useful in a confined environment lit by burning wooden spills. Linen in particular is very flammable, which may be why it is rare in the mines. The use of twill weave is poorly understood in the Bronze Age, and could have been valued for texture or appearance. Some other properties may not have been important in this environment. It might not have mattered that wool is a good insulator or good at taking dyes if it was used to make containers. The natural colours of skins were possibly not relevant for mining equipment, although this was probably a significant aspect of the choice of cloth when used for clothing or other personal items.

Evidence for choices between cloth types in the salt mines

The many similarities between the types of cloth in the salt mines suggest the ongoing close relationship between skins and woven textiles, animal fibres and plant fibres. Although the woven textiles of plant fibres are most difficult to assess as they are so few in number - only two are known from the Grünerwerk Bronze Age salt mines (Grömer 2005b:20, Hundt 1960:129-130) - I will refer to these where appropriate. I shall consider skins as a whole group rather than according to species as a way to contrast skins with woven textiles. Possibly most surprising is the quantity of animal skins in the salt mines and the wide range of ways that they were used. Far from being a minor cloth type in the Bronze Age, it appears that they were very significant. In addition, the range of colours in the fur and attention to detail in the sewing and fur qualities of some of these items suggest that skins and furs were appreciated for their visual appeal. The thickness of all cloth types varies. From my documentation of the Christian Tuschwerk skin artefacts skins range at least from 1.2mm to 3.25mm (see Table 9.2). The thickness of woven cloth also varies, with wool threads from 0.3mm to 4mm and plant fibres between 0.6-1.2mm. In just the same way, the coarse woollen sacks, some with a fulled surface, show that woven textiles were not just used for fine items, or clothing, but also used for heavy duty tasks.

The dimensions of all cloth types range from small to large. Animal skins are directly related to the animals; woven cloth depends on the loom type. The reps weaving borders on the woven textiles suggests they were made on the warp-weighted loom (see Chapter 4), and the largest piece of woven cloth found in the mines measured over one metre. It may be significant that the woven textiles ended up in the mines as the smallest rags, whereas the skins are in general larger. This shows how each group of cloth types had the possibility to range from fine to coarse, large to small, coloured to natural, which means that there is significant variation within these cloth types according to the cloth they produce and the number of potential uses to which they could be put.

All cloth types were worked by sewing, both to join pieces together side by side, or to fasten edges. From this it is apparent that woven textiles and skins could be worked into similar artefacts; for example, sewn to make shaped clothing, containers or covers. In addition, from the evidence in the mines, skins were sewn together to create thicker artefacts, a technique that could also have been used on woven textiles, although not apparent in the Bronze Age mines. One difference is the way seams are finished: the edge of skins are sometimes left as cut, other times cut with fringes or hemmed. Woven textiles are also left cut and then to fray, but in other cases are hemmed.

Skins and woven textiles were used in similar ways. If the interpretation of the coarse woollen carrying sacks is accepted, then it shows how both wool and skins were used to make heavy duty containers. Some of the woven textiles are believed to be rags that were originally clothing, just as some of the skins are probably rags re-used from clothing. This shows how these cloth types existed as clothing and were also re-used as rags. Exactly which type of clothing, however, is unknown. The information from the Bronze Age salt mines shows the diversity of cloth types that were available and the similar ways in which these cloth types were used. The evidence adds a unique dimension to understanding of the relationship between skins and woven cloth in the Middle to Late Bronze Age.

Choices between cloth types in the Bronze Age

The evidence for cloth from the Hallstatt salt mines significantly adds to the understanding of cloth in the Bronze Age. The large quantities of skins in the salt mines suggest that this was not a diminished tradition, but an important technology. In addition, the comparison of properties shows how much different cloth technologies overlapped. The use of skins for specialist tools and finer quality artefacts, possibly clothes, shows that they could be used in similar contexts to woven textiles. This brings into question the way that skins and woven textiles together were a part of the cloth culture of the Bronze Age, offering a range of possible alternatives for clothing and material culture traditions.

From the aspect of production, the properties of cloth may have been associated with particular cloth processing traditions. Through a European wide collection of evidence, Lisa Bender Jørgensen (1992) proposed that there are several geographical distributions of Bronze Age woven textiles corresponding to archaeological traditions that are recognised in other aspects of material culture. The groups she proposes are based on combinations of spin (direction, simple and ply) and weave types (plain, twill, reps), as well as raw materials, with wool dominating in northern Europe and linen in southern Europe (Bender Jørgensen 1992:116-17). Both of these approaches suggest that woven textiles were subject to regional traditions of raw materials, spinning methods and weaving preferences. This is one of the social factors influencing choices between cloth types in the Bronze Age.

Returning to the Homeric poems, mentioned at the beginning of the case study, the writer describes many socially significant reasons behind the choice of cloth types. In these examples, cloth is appreciated for its protection, for covering the body and artefacts. Cloth as clothing is used to symbolise characters, with different garment types according to gender and status associated with cloth type, just as cloth for bedding differs according to people of different status. This shows how many cloth types were actually appropriate for different tasks (beds were slept in and people clothed), but the choices of cloth types were not limited to the physical properties and extended to the socially understood meaning of these cloth types, which the writer persistently uses to symbolise the characters in the text. These examples do not necessarily correlate to the Bronze Age in the Alpine region, but they do show that such symbolic meanings attached to cloth in relation to its physical properties existed from this time in Europe.

Conclusion

Cloth types, whether grouped by raw material or cloth construction method, have multiple properties, some of which are shared with other cloth types, and others which are particular to specific cloth types. One or more of these properties may be important in the selection of a cloth type. In the case of the Hallstatt salt mines, the exploitation of some of these properties is apparent in the evidence for the relationship between cloth types and cloth use. It is highly likely that cow-skins were chosen for heavy-duty mining bags because they are large, tough and durable. Similarly, hand-leathers made from skins would be resistant to wear, but also soft on the skin. Flax or hemp rags may not have been used in the salt mines because they are flammable. The colour of skins may or may not have been important; the insulating properties of cloth may or may not have mattered for the rags. It is apparent that each cloth type has a number of properties, which affect the way it is used. This can best be investigated with whole artefacts, but as these are rare, the exploitation of these properties remains difficult to detect.

Another aspect of these properties that is particularly apparent from the Hallstatt salt mines is how much variety there is between cloth types with similar raw materials or construction methods. So, skins from different species vary from fine to thick, as do woven woollen textiles. Such variety would have made possible a wide range of uses. From the evidence, skins were used for protecting the hands, carrying heavy loads, for large sheets with unknown use, for clothing, for binding straps and sewing thread for cloth and to join wood. Woven textiles were used predominantly for rags, but seem to have come from thick sacks or sheets and clothing. This is significant as it shows how the technology of skins and the technologies of thread-base cloth types shared many properties, as well as having different ones.

Often it is not clear why construction methods diverge and how these affect the properties of the cloth. The diversity of spin direction in the warp and weft of cloth types may be a case in point, are these combinations of thread used intended to affect the properties of the cloth or do they reflect regional spinning traditions? Are different weave types chosen because they affected the elasticity of the cloth, or its density, or its visual appeal? Is the fur left on skins for insulation and colour, or because it made more wind-resistant cloth?

The similarities between cloth types as flexible, thin sheets that can be wrapped, shaped and tied, means that they can all be used to cover, contain, clothe, insulate, wipe and clean or cushion; to tie together, to be sewn into larger sheets or cut into smaller pieces. As there is such interchangability between cloth types, there is scope for different types of cloth to be used for the same purpose. Another dimension of the extended chaîne opératoire that is particularly relevant to this case study is the re-use of cloth. Even when cloth has been worn out, and can no longer be used for its original purpose, it is readily re-used as rags or re-made into other artefacts. The re-used cloth retains evidence of its original use, notably seams, wear marks, colour and thickness. This offers the possibility to understand the biography of the artefact and the way it was used outside the salt mines. Therefore an additional property of cloth, both skins and woven, is its suitability for re-use.

CHAPTER 10

Conclusion: an archaeology of cloth

I embarked on this thesis because I wanted to transform the way cloth is perceived and researched from the Neolithic to Bronze Age in the Alpine region. There is no denying that the current quality of documentation is excellent, but the scarcity of theoretical engagement with cloth has led to a research area of high quality data, but poor quality consideration of it. To achieve my aim, I saw the main need was to focus on the social context of cloth, that is, how cloth was part of people's lives in the past, and this has been the overarching aim of this thesis. In this conclusion, I summarise my results from the data collection and case studies. I then evaluate how useful my methods were in achieving my aim and discuss why I researched and wrote the thesis in its current format and what I hope this thesis has achieved and how others may be able to use it. I re-address issues relating to cloth that have been brought to attention through the research and suggest some future areas of research that have become evident throughout my research.

A question of method

Following the review of current approaches to cloth in prehistory (Chapter 2), I made the case that cloth studies are currently strong in the analysis of cloth types, but poor in theoretical engagement with cloth as material culture in relation to people and societies. To investigate this social context of cloth I needed to create a method to approach the data (Chapter 3). Through wide-ranging reading in social anthropology, I was convinced that there were two main aspects to understanding the social context of cloth.

One aspect is that cloth types exist as materials that have been produced through the acquisition and processing of raw materials followed by the construction of cloth which may then be made into cloth artefacts; these are then used as single items in larger assemblages, and may be re-used. Consequently, any investigation of the social context of cloth needs to consider cloth in each of these stages, as this is how people encounter cloth in society; I called this holistic approach the extended chaîne opératoire. To investigate the extended chaîne opératoire, I found it useful to consider themes of social context: the people (who?), the time and place (where? when? how long?), sequence (in what order?), materials (what?), as well as techniques, tools and skills (how?). The second major aspect of my method was to understand that cloth types are, by definition, a group of materials that are interrelated. For that reason, to understand any cloth type, it is necessary to understand other cloth types that exist at the same time. These co-existing cloth types in a society I have called the cloth culture. Therefore to investigate the social context of cloth I have looked at co-existing cloth types in terms of the extended chaîne opératoire.

Refocusing the evidence

Next was the need to assemble the archaeological evidence for these co-existing cloth types from the Neolithic to Bronze Age, along with the evidence for the way people interacted with cloth at all stages of the extended chaîne opératoire (Chapter 4). To do this, I compared the archaeological evidence for processes of cloth production and cloth use with historical and present day knowledge of these processes around the world and experimental archaeology sources. In some cases it was a matter of using other archaeologists' interpretations of the data, which was particularly true for spinning and weaving where there has been a concentration of work by archaeologists. In other cases it was necessary to find these comparisons myself, particularly in the case of acquiring raw materials and using cloth assemblages.

An important aspect of this chapter was refocusing the evidence of cloth types from old research questions that were aimed at investigating chronology; such as, what is the earliest date for wool? Or, when did wool or linen cloth replace skins as the most important cloth? To my own research questions to investigate which cloth types co-existed in societies? And, what were the cloth cultures at different stages from the Neolithic to Bronze Age? This gave me a basis to question which cloth types existed when and to approach co-existing cloth types according to my method of the extended chaîne opératoire. This chapter sets up the evidence for the case studies in the subsequent chapters.

The case studies

Each case study focuses on selected aspects of the extended chaîne opératoire approached in relation to key sites. I chose these key sites to include a range of periods and evidence; each offers unique research possibilities. This is due to a combination of the nature of the evidence, the preservation conditions, and the quality of the excavation and post excavation reports. Rather than repeating the stages of the extended chaîne opératoire as they are presented in Chapter 4, I focused on selected socially contextual themes of time, place, people, properties and sequence. This allowed me to address the best quality evidence at that site in relation to the most suited themes. The main results are summarised below.

Time and place structures in the production and use of cloth at Hornstaad Hörnle IA, Lake Constance, c. 3900 BC

This small, well-researched Neolithic lake dwelling settlement provided excellent evidence for the relationship between cloth from plant fibres and the surrounding landscape, along with a diverse and well-documented range of fibre processing and cloth construction techniques and a number of examples of the ways cloth was used. Through examining the time and place of the processes in the production and use of cloth, I was able to contrast the extended chaîne opératoires of flax and tree bast. From this, I addressed how these cloth types were part of a wider exploitation of the landscape and a continuous aspect of home life. I considered how cloth related to other aspects of village cycles, such as the seasonal gathering of wild berries or sowing food crops. I also addressed how skills may have developed throughout life and been part of the complex construction of social persona, such as gender, age and forming social networks. I do not address the use of skins in the case study as they are not preserved at Hornstaad Hörnle IA, although undoubtedly they were important cloth resources at this time.

The Iceman from Alto Adige, Italy c.3300BC; sequence in cloth production and use

The evidence of the Iceman from Alto Adige, Italy, again, is excellently preserved including plant fibres and animal skin and has been well researched. With analysis of the raw materials and cloth construction technique, and the rare preservation of a whole cloth assemblage, this allowed me to take a close look at the whole sequence of the extended chaîne opératoire, which was not possible in the other case studies. Through identifying the wide range of processes necessary to produce the cloth assemblage that the Iceman was wearing, I was able to address the significance of preparing clothing and cloth equipment in the societies of the Copper Age. The diversity of tasks and skills necessary point towards the necessity of co-operation and the complexity of the social relationships surrounding the preparation of individuals to fulfil their role in societies. Despite the excellent preservation conditions, the absence of both linen and woollen woven cloth suggests that co-existing cloth types were used in culturally appropriate ways which could have been based in values associated with some of the processes in the extended chaîne opératoire.

People and place in the representation of cloth on the stelae of Sion, Petit-Chasseur in the Swiss Valais, c. 2700-2150 BC

Of quite a different nature are the representations of clothed human figures at the funerary site of Sion, Petit-Chasseur, Switzerland. Here is evidence of the importance of clothing in displaying the social personae of these individuals, whether gender, status, role or the attributes of character, while acting as imposing funerary architecture. Through investigating the role of people (engravers, visitors to the site, the individual depicted) in this case study I address the significance of creating social identity through clothing, not only as a means to display oneself or others, but also as a means to exclude or include. These stone engravings also offer the opportunity to study the place of these decorated cloths in a social landscape, and the place of clothing on the body. Whatever the intended social consequence of these stelae and whichever cloth types they represent, it points us back to the importance of producing cloth. The ability to perform the earlier stages of the extended chaîne opératoire or otherwise obtain such cloth is a necessary preparation of individuals or social groups to participate in these social occasions and dress themselves in a socially relevant way.

Material and techniques in the production of cloth at Molina di Ledro lake dwelling c.2300-1500 BC

The Molina di Ledro lake dwelling is an old excavation and therefore lacks some of the evidence that would be expected of a modern excavation. However, recent analysis of the cloth finds, the importance of the artefacts from this site and particularly the variety of decorative techniques, make it an interesting case study. Here I focused on the significance of the techniques and materials, including the tools used to produce thread and to construct the types of thread-based cloth found at this site. Through this, I address how techniques of spinning and weaving as regularly practised, time-consuming tasks would have been an important aspect of the social personae of the individuals involved in them. I address how women probably carried out the techniques of spinning and some forms of weaving during the Bronze Age, and therefore the significance of such techniques in the creation of gender roles. Looking beyond cloth, I examine the relationship between cloth decoration and the decoration on other surfaces, such as metal and pottery. However, I suggest that the relationship between materials is not confined to the finished product, but extends also to relationships between the techniques of working different materials. Again in this case study, there are issues of conformity and diversity in techniques across Bronze Age Europe.

Exploiting the properties of cloth through the use and re-use of cloth in the Bronze Age salt mines of Hallstatt, c.1400 BC

The Bronze Age galleries of the Hallstatt salt mines offer an opportunity to look at the properties of skins and woven cloth and the relationship between these cloth types. In a comparison of the different cloth types found in the mines, I address the complexity of understanding the role of cloth types, as within each larger category there is wide variation in attributes such as thickness, size and colour of individual pieces of cloth. While some of the ways in which cloth types are used clearly exploits the properties of the cloth, other reasons for the choice of cloth are less obvious. Properties such as flammability, insulation and weight of cloth types may have been important as well as culturally based distinctions, such as regional spinning and weaving techniques. This is one of the rare contexts where there is evidence for the re-use of cloth: such artefact biographies add another layer to the social context of cloth in the extended chaîne opératoire, in particular we can see re-use as an important property of cloth types, both skins and woven textiles. In a wider sense, the evidence also points to the continued important role of skins in the Middle to Late Bronze Age due to the quantity and diverse uses of skins in the salt mines.

Evaluation of my methods

While I was clear about the aim of this research from the beginning, devising a method to achieve the aim was much more problematic.

The extended chaîne opératoire

The first problem was marrying research methods that were usually related to technology with those of current material culture studies, and I came up with the idea of the extended chaîne opératoire. I am sure this should not have been as complicated as I found it, as fundamentally it is not a radical solution. I think the problem is in the way theories and methods have been applied. The result is that production, or what might otherwise be called craft or manufacture by using raw materials to make artefacts, is seen as different to the way in which artefacts are themselves the raw materials of material culture. Once developed, I found the method of the extended chaîne opératoire a very useful device to approach cloth in a holistic manner, as it would have been in people's lives, and therefore to fulfil my aim of investigating the social context.

I found the extended chaîne opératoire particularly useful in uncovering areas of research that had been less well investigated. One fruitful area was the procurement of raw materials, as a means to understand land use and cloth types. Another interesting area to research was the use of cloth artefacts in assemblages, as a means to consider how many artefact assemblages would have included cloth components. This was useful in getting away from the concentration on spinning and weaving and the problem that cloth is almost exclusively associated with clothing in archaeological discussions.

I did have to adapt the extended chaîne opératoire in some instances, as even with such a broad method there were some lines of evidence that fell slightly outside it, namely representation and the re-use of cloth. However, the method is sufficiently flexible to incorporate these aspects of cloth, and allow me a solid foundation in comparing different cloth types.

Comparing cloth types

The thesis starts with a re-definition of cloth, to include animal skins in an area otherwise dominated by fibre and threads. This was essential to achieve my aim to investigate the social context of cloth as the relationship between thread-base cloth and skins is not well understood from the Neolithic to Bronze Age. This use of the word cloth is probably not to everyone's liking; however this inclusive term is useful in investigating the social context of cloth as it brings together a whole range of artefacts, as would be the case in any society, and allowed me a more logical approach to investigating the choice of cloth types that was available to people.

This comparison of cloth types required knowing which cloth types were available, where and when. Although this might seem a rather basic issue, the concentration in archaeology on beginnings and innovations, along with research mainly conducted on single cloth types or cloth technologies, had obscured this information. I found compiling the chronological tables of cloth types in Chapter 4 a revealing exercise for understanding cloth types in the past. This allowed me to discuss co-existing cloth types and cloth cultures. Such an approach brings cloth into line with other areas of archaeological research, where co-existing technologies, such as stone and metal technologies for tools or food acquisition technologies, have long been the subject of comparative enquiry.

Behind this is my own personal persuasion that innovations in cloth are not necessarily about new cloth types having properties that are so much better than what existed before. After all, each generation of humanity has managed with the cloth types they had. To understand choice in cloth types leads back to my method of understanding the social context of cloth through the extended chaîne opératoire, to question why choices were made to fulfil cloth needs in a particular way for each society.

Socially contextual themes

Despite having devised such an all-embracing method as the extended chaîne opératoire, initially I found that it led me to describing technological stages, and still did not quite achieve my aim of investigating the social context. At this point I went back to social theoretical approaches to understand what I had been missing. This brought me back to issues of human interaction and motivations and to asking questions of who, why, where, when, how, what? Through this I developed my themes of time and place, sequence, people, properties, techniques. Methodologically, these were partially successful in the data collection of Chapter 4, and very useful in bringing out the details of the case studies.

The format of the thesis

With such an original subject area, there was no guiding template for the structure of my research, and the thesis evolved and changed several times.

The data analysis

At the beginning of the research I focused on the archaeological evidence that I have written up in Chapter 4. As each section had the potential for expansion, so, I had to make decisions as to what was the most useful information in relation to the archaeological data and the most relevant historical and ethnographic sources for understanding these data. This chapter was difficult to write, as there was really so much that could have been incorporated in it. The whole time available to complete the thesis, including the writing of it, would not have been sufficient to be able to read and evaluate everything that could have been relevant. Some areas, particularly spinning and weaving, are well studied, so I concentrated on the archaeological research alone and had to be selective. Other areas, as indicated above, required a lot of original research in subjects as diverse as farming, sheep herding, skinning carcasses and cloth equipment for hunting or harvesting crops. The risk is that I did not find the best sources, but the gain is that there is something in each area that can be built upon in future research.

The case studies

Each of the case studies brought its own challenges, whether this was to gain permission to view the artefacts, to track down obscure sources, or to read the main texts which were all written in their own unique style and in several languages. However, these were the most rewarding area of the research. I tried to choose the widest variety of case studies possible, to show the range of cloth types, preservation environments and diverse roles of cloth. However, for some time I struggled in writing up these case studies, as they could become repetitive of the evidence I had discussed in Chapter 4. It is only when I decided to make the case studies more site specific, by relating each one to the strongest evidence for socially contextual themes, that they started to sound like real life situations that people lived, albeit thousands of years ago.

One of the problems with the case studies is that, because of their focus on cloth, sometimes it seems as if cloth production and use was the sole focus of these~~s~~ people's lives. This is a warranted criticism in terms of this thesis, but each chapter can be put back into the wider context of the literature on that site. There were several other case studies that I would have liked to investigate. Most particularly, I would have liked to look at a site without preserved cloth or representations of cloth, as this is the most common type of archaeological site and it would have been useful to test my method in such a context.

Re-addressing cloth issues from the Neolithic to Bronze Age

One of the reasons I chose to study cloth in the Alpine region is the range of environments that allow the preservation of cloth and the wide chronological spread of the evidence. Four out of five of the case studies were focused on sites with preserved cloth, while one depended on representational evidence. The detailed study of these sites allowed me to address a number of issues relating to my research questions for cloth from the Neolithic to Bronze Age, but further issues came up throughout researching and writing this thesis that I shall address here.

Animal skins from the Neolithic to Bronze Age

Because skins are both less commonly preserved and less studied than textiles, they have received little critical research in the periods from the Neolithic to Bronze Age. Yet, I found several important issues relating to skins.

Domestic animal skins in the Early Neolithic

One area worth consideration is the horizon of change in skin types from the Early Neolithic in relation to the introduction of domestic animals. The introduction of domestic animals brings with it potential sources of skins. As the treatment of skins need not vary substantially between wild and domestic animals, it seems most likely that domestic animal skins were used from the beginning, just as wild skins had been. While not completely novel, domestic animal skins would have slightly different qualities from the species that were collected from the wild, such as colour and markings, thickness and size. More significantly, wild and domestic animals are considerably different in terms of the extended chaîne opératoire of procurement. Wild skins are hunted by various methods, whereas domestic animal skins are looked after all year round. As far as I am aware, there is no research to understand how domestic animals were exploited for their skins. However, this could be approached by examining the cut marks on animal bones to determine if the animals were skinned in a way that is characteristic of procuring skins. Such techniques are applied to older bone assemblages, notably in the Palaeolithic, where skins are not preserved (Charles 1997). I think this is an interesting horizon of change to understand the availability of new cloth types that came with the introduction of domestic species, just as the introduction of domestic plants (flax) is associated with the availability of new fibres.

Animal skins in the Copper Age and Bronze Age

After the introduction of woven textiles from the Neolithic onwards, animal skins are seen as a cloth type in decline (for example, Rast-Eicher 2005:124-128). On the basis of my research, I believe there are several flaws to this argument. The first is purely a problem of preservation: skins are very rarely preserved in the Alpine lake dwellings, in contrast to the good preservation of plant fibres. This seems to have produced the mistaken conclusion that cloth of plant fibres was most important. However, where there is preservation of skins, namely with the Copper Age Iceman or in the Hallstatt salt mines, they are in quantity more important than cloth from plant fibres. Another problem, which I discussed in Chapter 2, seems to be notion that skins are more basic, primitive and uncivilised than thread based cloth, correspondingly, weaving is somehow more complex, civilised and advanced (Keller 1866:323-335). Skins therefore seem to be older and earlier in a technological sense, and somehow replaced by more advanced technologies.

Because I have considered skins and thread-based cloth together through my method of investigating co-existing cloth types, it seems that the emphasis on woven textiles is overstated, particularly in the Bronze Age, and skins have been ignored. Considering the later textual evidence, Homer provides a scale of cloth types, from skins and rags for the poor, to fine woven cloth and some exotic skins (such as leopard) for the aristocracy, with particular focus on weaving as a respected female occupation, as I discussed briefly in Chapter 9. Yet, the most common image of cloth in the Homeric poems is that of Penelope weaving on a loom. Somehow, this seems to perpetuate the idea that skins were less important although, as I found from a closer look at the text, skins seem to have been a common cloth type. Through my method and theoretical perspective, it seems more fruitful to consider the co-existence of cloth types and the potential of cloth types to carry symbolic values, rather than argue that one type was more important than another.

Plant fibres in the Neolithic

Flax

Another significant issue to re-address is the use of plant fibres in the Neolithic. On the one hand, flax is introduced as a Neolithic founder crop (one of the earliest domestic crops) (Zohary & Hopf 2000:198). Although flax seeds are rare in the early Neolithic, there are examples from between 5500-5000 BC throughout Italy, including in the north (Rottoli 2003:68) and from Linear Bandkeramik (LBK) contexts in central Europe (as summarised in Bogaard 2004:14). It is not possible to be certain that flax fibres were extracted for thread and cloth until the preservation of cloth artefacts in the Alpine lake dwellings c. 4000 BC (Suter 1987:81). However, if this was the case earlier, then another significant question to ask is: why were flax fibres an early domestic crop? Was linen cloth a significant aspect of early farming communities? Did early farmers appear different to hunter-gatherer societies? These questions are significant, as early farming has been seen predominantly from the perspective of food procurement. The addition of cloth to the discussion could add a new dimension to the debate.

Tree bast

On the other hand, tree bast is now recognised as the most important plant fibre for cloth in the Neolithic, to the extent that some researchers call the Neolithic the "tree-bast culture" (Rast 1995:149). Like flax, actual preserved tree bast comes from c.4000 BC in the earliest layers of the Alpine lake dwellings. However, oak, lime and elm that are the most common species exploited for fibres in the Neolithic are indigenous species; they probably had a long history of exploitation before the first preserved examples. What I find significant is that tree bast continued to be exploited throughout the Neolithic. As a forest resource, this adds an important line of evidence to the debate on the Neolithic transition (Biagi 1990, Ammerman & Biagi 2003, Furger 1990, Price 2000). It brings into question whether these indigenous trees were managed for bast, and how this relates to the wider foraging or farming exploitation of resources. In my view, the exploitation of tree bast throughout the Neolithic shows how societies continued to use wild resources as core aspects of their material culture. However, as tree bast and flax co-existed, it brings into question the symbolic significance of these cloth types, especially as tree bast is predominantly used in twining and flax for woven textiles.

A mosaic in the landscape

Through considering the extended chaîne opératoire I have become much more aware of the contrasting exploitation of the landscape needed to acquire the raw materials for cloth. By a mosaic in the landscape I mean to consider the origin of each raw material according to the land requirements, whether a wild animal, a domestic crop or wild plant fibre. This partly overlaps with my comments above about tree bast and flax, but is relevant to all periods. There are some obvious contrasts. Domestic flax, whether grown in gardens or fields (however this is envisaged) is an annual crop that is either harvested each year, or if left to itself, will die back naturally. The plant can grow on a variety of soil types, but some are better than others (see Chapter 4). Tree bast fibres, by contrast, come from trees of several years of age, coppices or branches of much older trees. These trees will grow in the same place, even for many centuries. Historically, sheep and goats, both of which can provided wool, can adapt to a wide range of pastures over the course of their lives; although specific breeds are adapted to different climates and terrain. On the hoof, sheep and goats may have been taken to pasture in a number of places, with seasonal transhumance in the mountains a particular possibility in the Alpine region. Sheep, goats and other domestic animals require looking after throughout the year, which contrasts to the exploitation of wild animals for skins.

It is significant to re-address the way societies exploited the landscape to obtain their sources of cloth. Such arguments add to an understanding of economy, cloth and social change that is usually researched according to food types.

Cloth and gender

The production of cloth, notably woven cloth, from the Neolithic to Bronze Age has been largely associated with women. To a certain extent this is based on the evidence, particularly relating to the later periods of prehistory, where the earliest representations are of women spinning and weaving, as discussed in Chapter 4 and 8. In addition, the classical texts such as the Homeric Poems and Roman writings refer to women spinning and weaving. This corresponds with archaeological evidence, particularly in the Iron Age, of spindle whorls and loom weights found in female graves. This general argument is strengthened by the separate evidence from Murdock's work on the division of labour according to sex, as discussed in Chapters 4 and 8, which compared societies across the world and showed that spinning is carried out by women in 87% of the ninety-one societies studied (Murdock & Provost 1973:table 1, quoted in Costin 1996:121-123). Another influential argument for women spinning and weaving was proposed by Barber in her book "Women's Work: the first 20,000 years" (Barber 1994), where she bases her ideas on the model of the division of labour by Judith Brown, which argues that much of women's work (including spinning and weaving) depends on its compatibility with childcare (Barber 1994:29).

My main objection to these proposals is not that men were also capable of spinning and weaving - exceptions to a rule are always found - but that this debate has somehow managed to make the whole issue of cloth a women's issue. Taking my strategy of considering the extended chaîne opératoire of cloth, it seems much more likely that men and women were responsible for different aspects of the extended chaîne opératoire of spun and woven cloth. In addition, gender roles may have been family based: an account of a female weaver from Trentino, Italy interviewed in 1994 recalls how she learned to weave from her father and had in turn taught her daughter and niece to weave (Mott & Tomasoi 1994: 9). In this case, it seems to be more important that skills are possessed by at least one family member, rather than on the basis of gender. In addition, there may have been specialist spinners and weavers, and these roles may not conform to gender roles at household level. Therefore, even if spinning and weaving were predominantly female activities between the Neolithic and Bronze Ages in the Alpine region, there are likely to have been exceptions. In addition, some form of cooperation between people of different gender is probable for the other stages of cloth production, such as fibre acquisition, and artefact construction, such as making items of clothing and equipment. The complexity of the extended chaîne opératoire of cloth production adds an important aspect about the debate of gender in prehistory, which is that gender cooperation was probably the norm and a means to create gender roles and social relationships.

At another level, while spinning and weaving (by which most authors refer to spinning with a spindle and weaving on a loom) may have been the domain of women, co-existing cloth types are much less well understood in relation to gender roles. This is an area that requires more work, but would help in understanding further the relationship between cloth types.

What do I hope the thesis achieves?

I hope that my thesis has provided a number of new methods of approaching the study of cloth in the past. Through the wide data collection and the application of my methods to individual sites I hope that the thesis provides a means for others to investigate cloth at archaeological sites more imaginatively, and to see cloth as an essential line of evidence in archaeological enquiries. I hope it raises new debates as to the significance of cloth in the past in terms of social practices. I hope that instead of engaging with familiar debates, such as the weight of a spindle whorl and whether men can spin, cloth researchers will debate why people planted flax instead of wheat in their fields, whether twisting and spinning was a female body technique in the Bronze Age, and whether wild animal skins gained special significance once domestic animals were the main food resource. Through such approaches and debates, I hope that this thesis is part of a wider movement into establishing a new archaeology of cloth. This must come from the secure basis of artefact studies, but address theories of material culture that make the past a place of real human beings with complex material lives.

Future areas of research

Besides the application of these methods to more sites, and generally in relation to cloth, there are some quite specific areas of material science research that would significantly contribute to the understanding of cloth from the Neolithic to Bronze Age.

Tree bast

There are now a number of people experimenting with tree bast and researching in this area. It would be useful to take this research a stage further and investigate new sources that may help gain evidence even with the lack of tree bast preservation. This may be through use-wear studies or archaeobotanical evidence of tree species associated with tree bast, possibly through evidence of coppicing or other woodland management strategies.

Animal skins

The study of animal skins could be vastly improved through several research projects. Preserved skins need to be investigated to understand how they were cured. More use-wear studies need to be carried out to understand the tools associated with skins from the Neolithic to Bronze Age following the methodologies established in studies of the Palaeolithic. This would help understand the quantity of skins that were produced and possibly even changes in techniques over time and in different regions. The skins from the Hallstatt salt mines need to be investigated in depth as one of the most promising sources for understanding animal species, cloth construction and artefact use and re-use in the Bronze Age. Another potential source of evidence is from impressions of skins in corrosion products on metal artefacts.

Cloth artefacts and assemblages

Another area of research is to gain a better understanding of the role of cloth artefacts and cloth assemblages on sites without cloth preservation and to be able to compare sites and societies on this basis. There could be a number of methods for investigating this, from understanding equipment that would have had cloth components to investigating use wear of tools. It would be useful to make further historical and ethnographic comparisons of the type, role and quantity of cloth in different societies and make a better estimation of these factors in societies from the Neolithic to Bronze Age.

Cloth research present and future

Textile research has been a specialist area for a number of years. Through the dedicated and high quality research of a number of individuals, this has brought it from a niche specialisation to a popular subject area. Research into animal skins is still in its infancy and as yet needs to achieve this status. These subject areas, which I have called cloth, have important evidence to contribute to understanding societies in the past. As myself and other researchers in archaeology are becoming aware, instead of being relegated to technological appendices, it is time that cloth plays the role it deserves in the study of past peoples and societies. However, the means of doing this has not always been clear. My thesis makes an important contribution to the development of cloth research as I demonstrate how the evidence can be approached in original ways to provide a new understanding of cloth in prehistoric societies.

REFERENCES

References

Abram, S. 2004, *Fauna delle Alpi: Mammiferi*. Nitida Immagine Editrice, Cles, Trento.

Acanfora, M. O. 1956, "Fontanella Mantovana e la Cultura di Remedello: Parte II: La Cultura Remedello", *Bulletino di Paletnolgia Italiana*, vol. X, 85, no. 2, pp. 345-385.

Adams, M. J. 1971, "Work Patterns and Symbolic Structures in a Village Culture, East Sumba, Indonesia", *Southeast Asia, An International Quarterly*, vol. 1, no. 4, pp. 321-334.

Adams, M. J. 1975, "Style in Southeast Asian Materials processing: Some Implications for Ritual and Art," in *Material Culture: Styles, Organisation and Dynamics of Technology*, H. Lechtman & R. S. Merrill, eds., pp. 21-52.

Airoldi, G. 2000, *Il tessuto ordito e trama ad intreccio ortogonale*. Centrocot S.p.A.Editore, Limpomo (Como).

Albert Bakker, J., Kruk, J., Lanting, A. E., & Milisauskas, S. 1999, "The earliest evidence of wheeled vehicles in Europe and the Near East", *Antiquity*, vol. 73, pp. 778-790.

Alfaro, C. 1992, "Two Copper Age Tunics from Lorca, Murcia (Spain)," in *Textiles in European Archaeology: Report from the 4th NESAT Symposium, 1-5th may 1990 in Copenhagen*, vol. 5 L. Bender Jørgensen & E. Munksgaard, eds., Konservatorskolen Det Kongelige Danske Kunstakademi, Copenhagen.

Altorfer, K. & Médard, F. 2000, "Nouvelles découvertes textiles sur le site de Wetzikon-Robenhausen (Zürich, Suisse). Sondages 1999," in *Archéologie des textiles des origines au V siècle, Actes du colloque de Lattes, octobre 1999*, D. Cardon & M. Feugère, eds., Èditions Monique Mergoil, Montagnac, pp. 35-75.

Ammerman, J. & Biagi, P. 2003, *The widening harvest : the Neolithic transition in Europe : looking back, looking forward*. Archaeological Institute of America, Boston.

Anastasiu, R. 1991, "Fusaïoles," in *Hauterive-Champréveyres. Les terres cuites du Bronze final, témoins de la vie quotidienne et religieuse*, R. Anastasiu & F. Bachmann, eds., Editions du Ruou, Saint-Blaise, pp. 15-63.

Anati, E. 1968, *Arte preistorica in Valtellina*. Edizioni del Centro, Capo di Ponte.

Anati, E. 1976, *Evolution and Style in Camunian Rock Art: an inquiry into the formation of European civilisation*. Centro Camuno di Studi Preistorici, Capo di Ponte, Italy.

Anati, E. 1994, *Valcamonica Rock Art: A New History for Europe*. Centro Camuno di Studi Preistorici, Capo di Ponte.

Anderson, S., Carey, L., Cullen, K., Flackett, S., & Grandison, A. 2001, *The Chambers Dictionary*. Chambers Harrap, Edinburgh.

Andersson, E. 1995, "Invisible Crafts", *Archaeological Textiles Newsletter* no. 21, pp. 5-7.

Andrewes, J. 2005, *Bodywork:Dress as Cultural Tool.* Brill, Leiden.

Appadurai, A. 1986, *The social life of things: Commodities in cultural perspective.* Cambridge University Press, Cambridge.

Audouze, F. 1999, "New advances in French prehistory", *Antiquity*, vol. 73, pp. 167-175.

Bagolini, B. 1992, "Il Neolitico nell'Italia settentrionale," in *Italia Preistorica*, A. Guidi & M. Piperno, eds., Laterza, Roma-Bari, pp. 274-305.

Bagolini, B., Barfield, L., & Broglio, A. 1973, "Richerche nell'insediamento neolitico di Fimon-Molino Casarotto", *Rivista di scienze preistoriche*, vol. 28, no. 1, pp. 161-215.

Baioni, M. 2003, "Lagozza di Besate," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, p. 183.

Baioni, M., Borrello, M. A., Feldtkeller, A., & Schlichtherle, H. 2003, "I pesi reniformi e le fusaiole piatte decorate della Cultura della Lagozza. Cronologia, distribuzione geografica e sperimentazioni.," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 99-109.

Banck, J. 1994, "Stichwort: Flechten," in *Reallexikon der Germanischen Altertumskunde*, vol. Band 9, Lieferung 1/2 Walter de Gruyter, Berlin, pp. 175-182.

Banerjee, M. & Miller, D. 2003, *The Sari.* Berg, Oxford, New York.

Barber, E. J. W. 1991, *Prehistoric Textiles. The Development of Cloth in the Neolithic and Bronze Age with Special Reference to the Aegean.* Princeton University Press, Princeton, New Jersey.

Barber, E. J. W. 1994, *Women's Work: The First 20 000 years. Women, Cloth and Societies in Early Times.* W.W. Norton & Co., London, New York.

Barfield, L. 1986, "Chalcolitic Burial in Northern Italy - Problems of Social Interpretation", *Dialoghi di Archeologia*, vol. 4, no. 2, pp. 241-248.

Barfield, L. 1994a, "The Bronze Age of Northern Italy: Recent Work and Social Interpretation," in *Development and Decline In the Mediterranean Bronze Age*, vol. 8 C. Mathers & S. Stoddart, eds., J.R.Collis Publictions, Sheffeild, pp. 129-144.

Barfield, L. 1994b, "The Iceman Reviewed", *Antiquity*, vol. 68, pp. 10-26.

Barfield, L. 1995, "The Context of Statue-menhirs", *Notizie Archeologiche Bergomensi*, vol. 3, pp. 11-20.

Barfield, L. 1998, "Gender issues in north Italian prehistory," in *Gender and Italian Stereotypes: Challenging the Stereotypes*, R. Whitehouse, ed., Accordia Research Institute, London, pp. 143-156.

Barfield, L. & Bagolini, B. 1976, *The Excavations on the Rocca di Rivoli, Verona, 1963 - 1968.* Memorie del Museo Civico di Storia Naturale di Verona.

Barfield, L., Buteux, S., & Bocchio, G. 1995, *Monte Covolo: una montagna e il suo passato*. George Street Press Ltd., Stafford.

Barfield, L. & Chippindale, C. 1997, "Meaning in the Later Prehistoric Rock-Engravings of Mont Bégo, Alpes-maritimes, France", *Proceedings of the Prehistoric Society*, vol. 63, pp. 103-128.

Barnes, R. 1993, "Women as Headhunters. The Making and Meaning of Textiles in a Southeast Asian Context," in *Dress and Gender: Making and Meaning in Cultural Contexts*, vol. 2 R. Barnes & J. B. Eicher, eds., Berg Providence, Oxford, pp. 29-43.

Barnes, R. & Eicher, J. B. 1993, "Introduction," in *Dress and Gender: Making and Meaning in Cultural Contexts*, vol. 2 R. Barnes & J. B. Eicher, eds., Berg Providence, Oxford, pp. 1-7.

Bartel, A. 2004, "Älteste Textilien Bayerns: Neue Funde aus Pestenacker", *Denkmalpflege Informationen*, vol. B 127, no. Marz, p. 9.

Bartel, A. & Schönfeld, G. 2004, "Wohl behütet! Ein "Trachtenhut" der Jundsteinzeir aus Oberbayern", *Denkmalpflege Informationen*, vol. B 124, no. July, pp. 3-4.

Barth, E. F. 1993, *Salzbergwerk Hallstatt: Kernverwässerungswerk 1849.*, 2nd edn, Musealvereines Hallstatt, Hallstatt.

Barth, F. E. 1971, "Funde aus dem Ender-Werk des Salzberges zu Hallstatt Aufsammlung 1899 / 1900", *Mitteilungen der Anthropologischen Gesellschaft in Wien*, vol. 101, pp. 44-51.

Barth, F. E. 1982, "Prehistoric Saltmining at Hallstatt", *Bulletin of the Institute of Archaeology*, vol. 19, pp. 31-43.

Barth, F. E. 1992, "Zu den Tragsäcken aus dem Salzbergwerk Hallstatt", *Archaeologia Austriaca*, vol. 76, pp. 121-127.

Barth, F. E. 1994, "Ein Füllort des 12.Jahrhunderts v. Chr.im Hallstätter Salzberg", *Mitteilungen der Anthropologischen Gesellschaft in Wien*, vol. 123/124, pp. 27-38.

Barth, F. E. 1998, "Bronzezeitliche Salzgewinnung in Hallstatt," in *Mensch und Umwelf in der Bronzezeit Europas: Man and Environment in European Bronze Age*, B. Hänsel, ed., Oetker-Voges Verlag, Keil, pp. 123-128.

Barth, F. E. & Lobisser, W. 2002, *Das EU-Projekt Archaeolice und das archäologische Erbe von Hallstatt*. Naturhistorischen Museum in Wien, Wien.

Barth, F. E. & Neubauer, W. 1991, *Salzbergwerk Hallstatt Appoldwerk Grabund 1879/80*. Salinen Austria im Verlag de Musealvereines Hallstatt, Bad Ischl.

Bartoloni, G., Sestieri, A. M. B., Delpino, M. A. F., Govi, C. M., & Badoni, F. P. 1980, *Materiali dell'età del Bronzo finale e della prima età del Ferro*. Centro Di, Firenze.

Battaglia, R. 1943, "La palafitta del lago di Ledro nel Trentino", *Memorie del Museo di Storia Naturale, Trento*, vol. 7, pp. 1-64.

Bazzanella, M. 1999, "La Tessitura nel Neolitico," in *Settamila anni fa- il primo pane: Ambienti e culture della società Neolitiche.*, A. Pessina & G. Muscio, eds., Comune di Udine, Museo Friulano di Storia Naturale, Udine, pp. 193-204.

Bazzanella, M., Belli, R., & Mayr, A. 2003a, "Analisi sperimentali condotte sulla fascia decorata della palafitta di Molina di Ledro," in *Archeologie Sperimentali. Metodologie ed esperieze fra verifica, riproduzione, comunicazioine e simulazione. Atti del Convegno Comano Terme - Fiavè (Trento, Italy) 13-15 settembre 2001*, P. Bellintani & L. Moser, eds., Trento, Provincia Autonoma di Trento Servizio Beni Cultural Ufficio Beni Archeologici.

Bazzanella, M., Dal Rí, L., Maspero, A., & Tomedi, I. 2005, "Iron Age Textile artefacts from Riesenfemer / Vedretta di Ries (Bolzano / Bozen - Italy)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 151-160.

Bazzanella, M. & Mayr, A. 1995a, "L'uso del colore durante l'età del rame," in *Le Statue Stele di Arco*, A. Pedrotti, ed., Museo Civico di Riva del Garda, Ufficio Beni Archaeologici Della Provincia Autonoma di Trento, Comune di Arco, Comune di Riva del Garda, Trento, pp. 125-139.

Bazzanella, M. & Mayr, A. 1995b, "La Lavorazione delle Fibre Tessili nell'Alto Garda durante l'età del Rame," in *Le Statue Stele di Arco: La statuaria antropomorfa alpina nel III millennio a.C.:abbigliamento, fibre tessili e colore*, Museo Civico di Riva del Garda, Ufficio Beni Archologici della Provincia Autonoma di Trento, Trento, pp. 107-124.

Bazzanella, M., Mayr, A., Moser, L., & Rast-Eicher, A. 2003b, "Schede [Catalogue]," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Servizio Beni Culturali, Trento, pp. 133-289.

Bazzanella, M., Mayr, A., Moser, L., & Rast-Eicher, A. 2003c, *Textiles: intrecci e tessuti dalla preistoria europea.* Provincia Autonoma di Trento, Servizio Beni Culturali, Trento.

Bazzanella, M., Mayr, A., & Rast-Eicher, A. 2003d, "I telai preistorici tra neolitico ed età del Bronzo," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 87-97.

Bazzanella, M. & Mayr, A. 1999, *Tessuti e intrecci dall'insediamento di Lucone di Polpenazze (Polpenazze del Garda, Brescia), con contributi di Romina Belli.*

Bender Jørgensen, L. 1990, "Stone Age textiles in Northern Europe," in *Textiles in Northern Archaeology. NESAT III: Textile Symposium in York, 6-9th May 1987*, P. Walton & J.-P. Wild, eds., Archetype Publications, London, pp. 1-10.

Bender Jørgensen, L. 1992, *North European textiles until AD 1000.* Aarhus University Press, Aarhus.

Bennet, J. 1997, "Homer and the Bronze Age," in *A New Companion to Homer*, I. Morris & B. Powel, eds., Brill, Leiden, pp. 511-535.

Bernabò Brea, L. 1946, *Gli scavi nella caverna delle Arene Candide I.* Istituto di Studi Liguri, Bordighera.

Bernabò Brea, L., Bianchi, P., & Lincetto, S. 2003, "La produzione tessile nell'età del Bronzo. Fusaiole e pesi da talaio nelle terramare emiliane: esempi di studio dai billagi di S. Rosa di Poviglio (RE) e Forno del Gallo a Beneceto (PR)," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 111-120.

Biagi, P. 1989, "An AMS radiocarbon date from grave BSII of teh Copper Age cemetary of Remedello Sotto (Brescia, northern Italy)", *Natura Bresciana*, vol. 26, pp. 299-300.

Biagi, P. 1990, *The neolithisation of the Alpine region*. Museo Civico di Scienze Naturali di Brescia, Brescia.

Billamboz, A. 1998, "Die jungneolithischen Dendrodaten der Pfahlbausiedlungen Südwestdeutschlands als Zeitrahmen für die Einflüsse der Michelsberger Kultur in ihrem südlichen Randgebiet," in *Die Michelsberger Kultur und ihre Randgebiete - Probleme der Entstehung, Chronologie und des Siedlungswesens. Kolloquium Hemmenhofen 21.-23.2.1997*, Materialhefte zur Archäologie, Stuttgart, pp. 159-168.

Billamboz, A. 1990, "Der Holz der Pfahlbausiedlungen Südwestdeutschlands: Jahrringanalyse aus archäodendrologischer Sicht", *Bericht der Römisch-Germanischen Kommission*, vol. 71, pp. 187-206.

Binder, D. 2000, "Mesolithic and Neolithic interaction in southern France and northern Italy: new data and current hypotheses," in *Europe's First Farmers*, T. D. Price, ed., Cambridge University Press, Cambridge, pp. 117-143.

Binford, L. R. 1972, "Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning," in *An Archaeological Perspective*, Seminar Press, New York & London.

Bocksberger, O. J. 1976a, *Le Dolmen MVI. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Catalogue et planches.* Document du Département d'anthropologie de l'Université de Genève 1, Lausanne.

Bocksberger, O. J. 1976b, *Le Dolmen MVI. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Texte.* Document du Département d'anthropologie de l'Université de Genève 1, Lausanne.

Bocksberger, O. J. 1978a, *Horizon Supérieur secteur occidental et tombes bronze ancien: Le site Préhistorique du Petit Chasseur (Sion, Valais). Texte et planches.*, Published by A.Gallay edn, Document du Département d'Anthropologie de l'Université de Genève, Lausanne.

Bocksberger, O. J. 1978b, *Horizon supérieur:secteur occidental et tombes bronze ancien: Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Documents annexes.*, Published by A.Gallay edn, Document du Département d'anthropologie de l'Université de Genève 1, Lausanne.

Bocquet, A. 2003, "I villaggi Neolitici di Charavines," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 281-283.

Bocquet, A. & Berretrot, F. 1989, "Le Travail des Fibres Textiles au Néolithique Rècent à Charavines, (Isère)," in *Tissage, Corderie, Vannerie. IX-Rencontres Internationales* *d'Archéologie et d'Histoire, Antibes, Octobre 1988.*, Éditions APDCA, Juan-les-Pins, pp. 113-139.

Bocquet, A., Brochier, J.-L., Emery-Barbier, A., Lundstrom-Baudais, K., & Orcel, C. V. F. 1987, "A submerged neolithic village: Charavines "LEs Baigneurs" in Lake Paladru, France," in *European wetlands in prehistory*, J. M. Coles & A. J. Lawson, eds., Clarendon, Oxford.

Bocquet, A. 1970a, *Catalogue des collections préhistoriques et protohistoriques: Planches.* Musée dauphinois, Sainte-Marie-d'en-Haut, Grenoble.

Bocquet, A. 1970b, *Catalogue des collections préhistoriques et protohistoriques:Texte.* Musée dauphinois, Sainte-Marie-d'en-Haut, Grenoble.

Bogaard, A. 2004, *Neolithic farming in Central Europe : an archaeobotanical study of crop husbandry practices.* Routledge, London.

Bourdieu, P. 1990, *The Logic of Practice.* Polity Press, Cambridge.

Bourdieu, P. 2003, *Outline of a Theory of Practice.* Cambridge University Press, Cambridge.

Bremmer, J. 1991, "Walking, standing and sitting in ancient Greek culture," in *A Cultural History of Gesture from Antiquity to the Present Day*, J. Bremmer & H. Roodenberg, eds., Polity Press, Cambridge, pp. 15-35.

Broholm, H. C. & Hald, M. 1940, *Costumes of the Bronze Age in Denmark: Contributions to the Archaeaology and Textile history of the Bronze Age.* NYT Nordisk Forlag. Arnold Busck, Copenhagen.

Broholm, H. C. & Hald, M. 1948, *Bronze Age Fashion.* Gyldendalske Boghandel Nordisk Forlag, Copenhagen.

Brombacher, C. & Jacomet, S. 1997, "Ackerbau, Sammelwirtschaft und Umwelt:Ergebnisse archäobotanischer Untersuchungen.," in *Ökonomie und Öologie neolithischer und bronzezeitlicher Ufersiedlungen am Zürichsee*, J. Schilber et al., eds., Monograph Kantonsarchäologie Zürlch, Zürich ?.

Broudy, E. 1979, *The Book of Looms. A History of the Handloom from Ancient Times to the Present.* Van Nostrand Reinhold, New York, London.

Brumfiel, E. M. 1991, "Weaving and Cooking: Women's Production in Aztec Mexico," in *Engendering Archaeology: women and prehistory*, J. M. Gero & M. W. Conkey, eds., Basil Blackwell, Oxford.

Brunello, F. 1973, *The art of dyeing in the history of mankind (Translation by Bernard Hickey).* N. Pozza , Vicenza.

Buckley, C. 1999, "On the Margins: Theorizing the History and Significance of Making and Designing Clothes at Home," in *The Culture of Sewing: Gender, Consumption and Home Dressmaking*, B. Burman, ed., Berg, Oxford, pp. 55-71.

Burnham, D. K. 1980, *Warp and Weft: A Textile Terminology.* Ontario Museum, Toronto.

Butler, C. 2005, *Prehistoric Flintwork.* Tempus, Stroud.

Cannon, J. & Cannon, M. 1994, *Dye Plants and Dyeing.* The Herbert Press. Published in association with The Royal Botanic Gardens, Kew., London.

Caradarelli, A. 1992, "Le età dei metalli nell'Italia settentrionale," in *Italia Preistorica*, A. Guidi & M. Piperno, eds., Laterza, Roma-Bari, pp. 366-419.

Cardon, D. 1998, "Neolithic Textiles, Matting and Cordage from Charavines, Lake of Paladru, France," in *Textiles in European Archaeology: Report from the 6th NESAT Symposium, 7-11th May 1996 in Børas*, L. Bender Jørgensen & C. Rinaldo, eds., Göteborg Univerisity, Department of Archaeology, Sweden, Göteborg, pp. 3-21.

Casini, S. 1994a, "I motivi pettinformi," in *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 109-114.

Casini, S. 1994b, "I pendagli a doppia spiral," in *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 97-108.

Casini, S. 1994c, "Il motivo del "rettangolo frangiato".," in *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 93-96.

Casini, S., De Marinis, R. C., Fedele, F., Fossati, A., & Odone, S. 1994a, "I materiali culturali [Catalogue]," in *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina*, Centro Culturale Nicolò Rezzara, Gorle, pp. 198-217.

Casini, S., De Marinis, R. C., Fedele, F., Fossati, A., & Odone, S. 1994a, *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina.* Centro Culturale Nicolò Rezzara, Gorle.

Casini, S., De Marinis, R. C., Fedele, F., Fossati, A., & Odone, S. 1994b, "Statue stele e massi incisi della Valcamonica [Catalogue]," in *Le Pietre degli Dei. Menhir e stele dell'Età del Rame in Valcamonica e Valtellina*, Centro Culturale Nicolò Rezzara, Gorle, pp. 157-198.

Castelletti, L., Gastiglioni, E., & Rottoli, M. 2000, "L'agricoltura dell'Italia settentrionale dal Neolitico al Medioevo," in *Le Piante Coltivate e La Loro Storia: Dalle Origini al Transgenico in Lombardia nel Centenario della Riscoperta della Genetica di Mendel*, O. Failla & G. Forni, eds., FrancoAngeli, Milano, pp. 33-84.

Cavendish, R. 1983, *Prehistoric England.* Artus Books, London.

Champion, T., Gamble, C., Shennan, S., & Whittle, A. 1984, *Prehistoric Europe.* Academic Press, London.

Charles, R. 1997, "The exploitation of carnivores and other fur-bearing mammals during the North-Western Eropean late Upper Palaeolithic and Mesolithic", *Oxford Journal of Archaeology*, vol. 16, no. 3, pp. 253-277.

Christiansen, C. A. 2004, "A Reanalysis of Fleece Evolution Studies," in *Priceless invention of humanity : textiles*, 50 edn, vol. 1 J. Maik, ed., Lodzkie Towarzystwo Naukowe, Lodz.

Clark, G. & Piggott, S. 1970, *Prehistoric Societies.* Penguin Books, London.

Clark, J. G. D. 1937, "A Bog Find in Northern Hannover", *Proceedings of the Prehistoric Society*, vol. III, pp. 178-179.

Clark, J. G. D. 1952, *Prehistoric Europe: The Economic Basis.* Methuen & Co. Ltd., London.

Collingwood, P. 1987, "The Maker's Hand: A Closer Look At Textile Structures," Bellew Publishing, London.

Cornaggia Castiglioni, O. 1955, "Lo stumentario tessile nella cultura della Lagozza. Contributi alla conoschenza della culture preistoriche deall Valle del Po", *Rivista dell' Antica Provincia e Diocesi di Como*, vol. 136 - 137, pp. 5-31.

Costin, C. L. 1996, "Exploring the Relationship Between Gender and Craft in Complex Societies: Methodological and Theoretical Issues of Gender Attribution," in *Gender and Archaeology*, R. Wright, ed., University of Pennsylvania, Philadelphia, Pennsylvania, pp. 111-142.

Cresswell, R. 1976, "Avant-propos", *Techniques et Culture*, vol. 1, no. 5, p. 6.

Dalla Fior, G. 1940, "Analisi polliniche di torbe e depositi lacustri della Venezia Tridentina", *Memorie del Museo di Storia Naturale, Trento*, vol. 5, pp. 121-176.

De Marinis, R. C. 1995a, "Le statue-stele della Lunigiana", *Notizie Archeologiche Bergomensi*, vol. 3, pp. 195-212.

De Marinis, R. C. 1995b, "Le stele antropomorfe di Aosta", *Notizie Archeologiche Bergomensi*, vol. 3, pp. 213-220.

De Marinis, R. C. 1999, "Chalcolithic Stele-Statues of the Alpine Region," in *Gods and Heroes of the European Bronze Age*, K. Demakopoulou et al., eds., Thames and Hudson, London, pp. 145-152.

De Marinis, R. C. & Brillante, G. 2000, *La mummia del Similaun. Ötzi, L'uomo venuto del Ghiaccio.* Marsilio.

De Marinis, R. C. 1994a, "Il fenomeno delle statue-stele e stele antropomorfe dell'età del Rame in Europa," in *Le pietre degli dei: menhir e stele dell'età del rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 31-58.

De Marinis, R. C. 1994b, "L'età del Rame in Europa: un'epoca di grandi trasformazioni," in *Le pietre degli dei: menhir e stele dell'età del rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 21-30.

De Marinis, R. C. 1994c, "La datazione dello stile III A," in *Le pietre degli dei: menhir e stele dell'età del rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 69-88.

del Lucchese, A. 1997, "The Neolithic burials from Arene Candide cave: the Bernabò Brea-Cardini excavations," in *Arene Candide: A functional and environmental assessment of the Holocene sequence (Excavations Bernabò Brea-Cardini 1940-50)*, vol. Collaborating editors: E. Starnini and B. Voytek R. Maggi, ed., Il Calamo, Roma, pp. 605-609.

Della Casa, P. 2003, "Concepts of Copper Age mobility in the Alps based on Land use, raw materials and a framework of contact", *Preistoria Alpina*, vol. 39, pp. 203-210.

Deschler-Erb, S. & Marti-Grädel, E. 2004, "Vielhaltung und Jagd. Ergebnisse der Untersuchung der handaufgelesenen Tierknochen," in *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3. Umwelt und Wirtschaft*, vol. Band 12 S. Jacomet, U. Leuzinger, & J. Schibler, eds., Kanton Thurgau. Departement für Erziehung und Kultur des Kantons Thurgau, Frauenfeld, pp. 158-252.

Desrosiers, S. 1989, "Des Fragments de Textiles du Néolithique Final Provenant du Lac de Paladru (Charavines, Isère, France)," in *Tissage, Corderie, Vannerie. IX-Rencontres Internationales d'Archéologie et d'Histoire, Antibes, Octobre 1988.*, Éditions APDCA, Juan-les-Pins, pp. 129-137.

Dickinson, O. T. P. K. 1986, "Homer, the Poet of the Dark Age", *Greece and Rome*, vol. 31, no. 1, pp. 20-37.

Dickson, J. H. 2000, "Bryology and the Iceman: Chronology, Ecology and Ethnobotany of the Mosses *Neckera complanata* Hedw. and *N.crispa* Hedw.," in *The Iceman and his Natural Environment: Palaeobotanical Results*, vol. 4 S. Bortenschlager & K. Oeggl, eds., Springer, Wien, pp. 77-87.

Dieckmann, B. 1987, "Ein bemerkenswerter Kupferfund aus der jungneolithischen Seeufersiedlung Hornstaad-Hörnle I am westlichen Bodensee", *Archäologische Nachrichten aus Boden*see, vol. 38 / 39, no. 28, p. 38.

Dieckmann, B. 1991, "Zum Stand der archäologischen Untersuchungen in Hornstaad", *Bericht der Römisch-Germanischen Kommission*, vol. 71, pp. 84-109.

Dobres, M.-A. 1999, "Technology's Links and Chaînes: The Processual Unfolding of Technique and Technician," in *The Social Dynamics of Technology: Practice, Politics and World Views.*, M.-A. Dobres & C. R. Hoffman, eds., Smithsonian Institution Press, Washington and London, pp. 124-146.

Dobres, M.-A. 2000, *Technology and Social Agency: Outlining a Practice Framework for Archaeology.* Blackwell, Oxford.

Douglas, G. W. 1956, *Survey of the Production of hides, skins and rough-tanned leathers in India, Pakistona, Ceyon and Africa.* British Leather Manufacturers' Research Association, Milton Park, Egham, Surrey.

Drooker, P. B. 2000, "Glossary," in *Beyond Cloth and Cordage: Archaeological textile Research in the Americas*, P. B. Drooker & L. D. Webster, eds., University of Utah Press, Salt Lake City, pp. 267-277.

Dunning, C. & Rast-Eicher, A. 1992, "Le vêtement dans la préhistoire", *Helvetia Archaeologica*, vol. 23, pp. 71-80.

Durie, A. J. 1979, *The Scottish Linen Industry in the Eighteenth Century.* John Donald Publishers Ltd., Edinburgh.

Egg, M. 1993, "Die Ausrüstung des Toten", *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 39, pp. 35-100.

Eicher, J. B. & Roach-Higgins, M. 1993, "Definition and Classification of Dress," in *Dress and Gender: Making and Meaning in Cultural Contexts*, vol. 2 R. Barnes & J. B. Eicher, eds., Berg Providence, Oxford, pp. 8-28.

Evans, J. 1984, "Organic residues from Fiavé, Italy," in *Scavi Archeologici nella zona palafitticola di Fiavé-Carera. Parte III, Campagne 1969-1976. Resti Della Cultura Materiale Ceramica*, vol. 2 R. Perini, ed., Servizio Beni Culturali della Provincia Autonoma di Trento, Trento, pp. 1095-1098.

Evans, N. 1985, *The East Anglian Linen Industry: Rural Industry and Local Economy 1500 - 1850.* Gower: The Pasold Research Fund, London.

Farke, H. 1991, "Schnüre Geflechte und Leder aus Höhlen bei Bad Frankenhausen", *Alt-Thüringen*, vol. 26, pp. 123-140.

Fatzer, B. & Leuzinger, U. 2004, *Pfahlbauquartett. 4 Museen präsentieren 150 Jahre Pfahlbau-Archäologie.* TGG Hafen Seen Stieger, Frauenfeld.

Fedele, F. 1988, *L'uomo, le Alpi, la Valcamonica; 20.000 anni al Castello di Breno.* Boario Terme, La Cittadina.

Fedele, F. 1995, *Ossimo 1. Il contesto rituale delle stele calcolitiche e notizie sugli scavi 1988-1995.* La Cittadina, Gianico, Brescia.

Feldtkeller, A. 2004, "Die Textilen von Seekirch-Achwiesen," in *Ökonomischer und ökologischer Wandel am vorgeschichtlichen Federsee*, Landesdenkmalamt Baden-Württemberg, Gaienhofen-Hemmenhofen, pp. 56-70.

Feldtkeller, A. & Schlichtherle, H. 1987, "Jungsteinzeitliche Kleidungsstücke aus Ufersiedlungen des Bodensees", *Archäologische Nachrichten aus Boden*, vol. 38 / 39, pp. 74-84.

Feldtkeller, A. & Schlichtherle, H. 1998, "Textilfunde von Reute-Schorrenried," in *Das Moordorf von Reute: Archäologische Untersuchungen in der jungneolithischen Siedlung Reute-Schorrenried*, M. Mainberger, ed., Teraqua, Staufen i. Br., pp. 269-312.

Flad, M. 1984, *Flachs und Leinen: Vom Flachsanbau, Spinnen und Weben in Oberschwaben und auf der Alb.* Schwäbischer Bauer, Ravensburg.

Fossati, A. 1994, "Gli animali nei massi incisi," in *Le pietre degli dei: menhir e stele dell'età del rame in Valcamonica e Valtellina*, S. Casini, ed., Centro Culturale Nicolò Rezzara, Gorle, pp. 115-126.

Franquemont, E. & Franquemont, C. 1987, "Learning to Weave in Chinchero", *The Textile Museum Journal*, vol. 26, pp. 55-79.

Fraval, A. 1997, *HYPP Zoolology Home Page: Flax, Linseed.* www.inra.fr/Internet/Produits/HYPPZ/CULTURES/6c---068.htm, Date accessed: 16/04/04.

Furger, A. 1990, "Vorwort," in *Die Ersten Bauern : Pfahlbaufunde Europas : Forschungsberichte zur Ausstellung im Schweizerischen Landesmuseum und zum*

Erlebnispark-Ausstellung Pfahlbauland in Zürich : 28. April bis 30. September 1990, M. H. Konzept, ed., Schweizerisches Landesmuseum, Zürich, p. 6.

Gallay, A. 1989a, *Secteur Oriental. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Documents annexes.* Document du Département d'anthropologie de l'Université de Genève, Lausanne.

Gallay, A. 1989b, *Secteur Oriental. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Texte et planches.* Document du Département d'anthropologie de l'Université de Genève, Lausanne.

Gallay, A. 1990, "La Place des Alpes dans la Néolithisation de l'Europe," in *The neolithisation of the Alpine region*, vol. 13 P. Biagi, ed., Museo Civico di Scienze Naturali di Brescia, Brescia, pp. 23-40.

Gallay, A. 1995, "Les steles anthropomorphes du site mégalithique du Petit-Chausseur à Sion (Valais, Suisse)", *Notizie Archeologiche Bergomensi*, vol. 3, pp. 167-194.

Gallay, A. & Chaix, L. 1984a, *Le dolmen MXI. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Documents annexes.* Document du Département d'anthropologie de l'Université de Genève, Lausanne.

Gallay, A. & Chaix, L. 1984b, *Le dolmen MXI. Le Site Préhistorique du Petit-Chasseur (Sion, Valais). Texte et planche.* Document du Département d'anthropologie de l'Université de Genève, Lausanne.

Gell, A. 1992, "The Technology of Enchantment and the Enchantment of Technology," in *Anthropology, Art and Aesthetics*, J. Coote & A. Shelten, eds., Oxford University Press, Oxford, pp. 40-63.

Gell, A. 1998, *Art and agency : towards an anthropological theory.* Clarendon Press, Oxford.

Geraint Jenkins, J. 1974, *Nets and Coracles.* David and Charles (Holdings) Ltd., Newton Abbot London.

Giddens, A. 2003, *The Constitution of Society; Outline of the Theory of Structuration.* Polity Press, Cambridge.

Gillow, J. & Sentance, B. 1999, *World Textiles. A visual guide to traditional techniques.* Thames & Hudson, London.

Gimbutas, M. 1989, *The Language of the Goddess.* Thames and Hudson, London.

Gleba, M. 2004, "Textile Production in Protohistoric Italy: The Use of Implements in Reconstruction a "Missing" Craft," in *Metodi e approcci archeologici: l'industria e il commercio nell'Italia antica / Archaeological Methods and Approaches: Industry and Commerce in Ancient Italy*, E. De Sena & H. Dessales, eds., BAR International Series 1262, pp. 1-11.

Goedecker-Ciolek, R. 1993, "Zur Herstellungstechnik von Kleidung und Ausrüstungsgegenständen," in *Die Gletschermumie vom der Steinzeit aus den Ötztaler Alpen*, M. Egg et al., eds., Jahrbuch des Römisch-Germanischen Zentralmuseums 39.1992, Mainz, pp. 100-113.

Good, I. 2001, "Archaeological Textiles: A Review of Current Research", *Annual Review of Anthropology*, vol. 30, pp. 209-226.

Goodwin, J. 2003, *A Dyer's Manual.*, 2nd edn, Ashmans Publications, Hessle, England.

Grabner, M., Reschreiter, H., Barth, F. E., Klein, A., Geihofer, D., & Wimmer, R. 2006a, "Dendrochronologie in Hallstatt", *Archäologie Österreichs*, vol. 17, no. 1, pp. 40-49.

Grabner, M., Reschreiter, H., Barth, F. E., Klein, A., Geihofer, D., & Wimmer, R. 2006b, "Dendrochronoogie in Hallstatt", *Archäologie Österreichs*, vol. 17, no. 1, pp. 40-49.

Groenman-van Waateringe, W. 1993, "Analysis of the Hides and Skins from the Hauslabjoch," in *Die Gletschermumie vom Ende der Steinzeit aus den Ötztaler Alpen*, M. Egg et al., eds., Jahrbuck des Römisch-Germanishcen Zentralmuseums 39 . 1992, Mainz, pp. 114-128.

Groenman-van Waateringe, W. 1995, "Pollenanalyse als Indikator für das Gerbeverfahren bei den Tierfellen des Mannes vom Tisenjoch," in *Der Mann im Eis: Neue Funde und Ergebnisse*, vol. 2 K. Spindler et al., eds., Springer, Wien, pp. 67-70.

Groenman-van Waateringe, W. & Goedecker-Ciolek, R. 1992, "The equipment made of hide and leather," in *Der Mann im Eis. Band 1: Bericht über das Internationale Symposium 1992 in Innsbruck*, F. Höpfel, W. Platzer, & K. Spindler, eds., Universität Innsbruck, Innsbruck, pp. 410-418.

Grömer, K. & Schierer, I. 2005, *Textile Techniken und die Experimentelle Archäologie.* http://members.aon.at/textile-techniken/VLSS2005/Scriptum_Lehrveranstaltung_ExperimentelleArchaeologie_SS2005.pdf, Date Accessed 10th October 2006.

Grömer, K. 2005a, "Efficiency and technique - Experiments with original spindle whorls (Leistung und Technik - Experimente zum Spinnen mit Originalspinnwirteln)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 107-116.

Grömer, K. 2005b, "The Textiles from the prehistoric Salt-mines at Hallstatt (Die Textilien aus dem prähistorischen Salzbergwerk von Hallstatt)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 17-40.

Guerreschi, G. 1966, "La Lagozza di Besnate e il neolitico superiore padano", *Rivista Archeologica dell'Antica Provincia e Diocesi di Como*, vol. 148 - 149, pp. 5-352.

Haines, B. M. 1991, "Skin Structure and Leather Properties," in *Leather: its compositions and changes with time*, C. Calnan & B. Haines, eds., The Leather Conservation Centre, Northampton, pp. 1-11.

Hald, M. 1980, *Ancient Danish textiles from bogs and burials : a comparative study of costume and Iron Age.*, 2nd ed. edn, The National Museum of Denmark, Copenhagen.

Hallstatt Catalogue 2004, *L'Or Blanc de Hallstatt: Il y a 2500 ans dans les Alpes autrichiennes une mine de sel.* Musée de Bibracte (F), Musée Cantonal d'Archéologie et d'Histoire, Lausanne (CH), Neanderthal Museum (D), Naturhistorichen Museum Wien (AT).

Hammond, M. 1988, *Homer, The Iliad; A New Prose Translation.* Penguin Books, London.

Harding, A. F. 2000, *European Societies in the Bronze Age.* Cambridge University Press, Cambridge.

Harris, S. 2004, "Representations of woven textiles in Alpine Europe during the Copper Age," in *Inhabiting Symbols: symbol and image in the ancient Mediterranean*, E. Herring & J. B. Wilkins, eds., Accordia Research Institute, University of London, London, pp. 43-84.

Harris, S. 2006, "A report on the examination of animal skin artefacts from the Bronze Age salt mines of Hallstatt, Austria", *Papers from the Institute of Archaeology*, vol. 16, pp. 115-122.

Harrison, R. J. 2004, *Symbols and Warriors: Images of the European Bronze Age.* Western Academic and Specialist Press, Bristol.

Hartl, A. & Hofmann-de Keijzer, R. 2005, "Imitating ancient dyeing methods from Hallsatt period - dyeing experiments with weld, indigo and oak bark (Nachempfindung alter Färbemethoden aus der Hallstattzeit - Färbeexperimente mit Färberwau, Indigo und Eichenrinde)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 91-96.

Hauser-Schäublin, B. 1996, "The thrill of the Line, the String, and the Frond, or why the Abelam are a non-cloth culture", *Oceania*, vol. 67, no. 2, pp. 81-106.

Heringa, R. 1993, "Tilling the Cloth and Weaving the Land: Textiles, Land and Regeneration," in *Weaving Patterns of Life: Indonesian Textile Symposium 1991*, M. L. Nabholz-Kartaschoff, R. Barnes, & D. J. Stuart-Fox, eds., Museum of Ethnography Basel, Basel, pp. 155-176.

Hodder, I. 1990, *The Domestication of Europe. Structure and Contingeny in Neolithic Societies.* Basil Blackwell, Oxford.

Hodges, H. 1995, *Artifacts: An Introduction to Early Materials and Technology.*, Second edn, Gerald Duckworth & Co., London.

Hoffmann, M. 1964, *The Warp-Weighted Loom: Studies in the History and Technology and an Ancient Implement.* Universitetsforlaget, Oslo.

Hoffstadt, J. & Maier, U. 1999, "Handelsbeziehungen während des Jungneolithikums im Westlichen Bodenseeruam am Beispiel der Fundplätze Mooshof und Hornstaad Hörnle IA", *Archäologisches Korrespondenzblatt*, vol. 29, pp. 21-34.

Hofmann-de Keijzer, R., van Bommel, M. R., & Joosten, I. 2005, "Dyestuff and element analysis of Textiles from the prehistoric Salt-mines of Hallstatt (Farbstoff- und Elementanalyse an Textilien aus dem prähistorischen Salzbergwerk Hallstatt)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 55-72.

Hosch, S. & Jacomet, S. 2004, "Ackerbau und Sammelwirtschaft. Ergebnisse der Untersuchung von Samen und Früchten," in *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3. Umwelt und Wirtschaft*, vol. Band 12. S. Jacomet, U. Leuzinger, & J.

Schibler, eds., Kanton Thurgau. Departement für Erziehung und Kultur des Kantons Thurgau, Frauenfeld, pp. 112-157.

Hoskins, J. 1993, "Snakes, smells and dismembered brides; Men's and women's textiles in Kodi, West Sumba," in *Weaving patterns of life: Indonesian textile symposium 1991*, M. L. Nabholz-Kartaschoff, R. Barnes, & D. J. Stuart-Fox, eds., Museum of Ethnography, Basel, pp. 229-246.

Hughes, M. & Forrest, M. 1984, *How the Greeks and Romans made cloth.* Schools Council Publications, Cambridge.

Hundt, H.-J. 1959, "Vorgeschichtliche Gewebe aus dem Hallstätter Salzberg", *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 6, pp. 66-100, Tafeln 10-28.

Hundt, H.-J. 1960, "Vorgeschichtliche Gewebe aus dem Hallstätter Salzberg", *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 7, pp. 126-150, Tafeln 12-31.

Hundt, H.-J. 1967, "Vorgeschichtliche Gewebe aus dem Hallstätter Salzberg", *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 14, pp. 38-65, Tafeln 4-28.

Hundt, H.-J. 1987, "Vorgeschichtliche Gewebe aus dem Hallstätter Salzberg", *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 34, pp. 261-286, Tafeln 45-64.

Hundt, H.-J. 1991, "Die Textilien," in *Niederwil, eine Siedlung der Pfyner Kultur: Vol.IV, Holzartefakte und Textilien*, H. T. Waterbolk & v. W. Zeist, eds., Paul Haupt, Stuttgart, pp. 251-272.

Ingold, T. 1990, "Society, Nature and the Concept of Technology", *Archaeological Review from Cambridge*, vol. 9, no. 1, pp. 5-17.

Ingold, T. 1993, "The temporailty of the landscape", *World Archaeology*, vol. 25, no. 2, pp. 152-174.

Ingold, T. 1999, "Foreword," in *The Social Dynamics of Technology: Practice, Politics, and World Views*, M.-A. Dobres & C. R. Hoffman, eds., Smithsonian Institution Press, Washington, London, p. vii-ix.

Jacomet, S. 2005, "Archaeobotany. A vital tool in the investigation of lake-dwellings," in *Living on the Lake in Prehistoric Europe. 150 years of lake-dwelling research*, F. Menotti, ed., Routledge Taylor and Francis Group, Abingdon, pp. 162-177.

Jacomet, S., Leuzinger, U., & Schibler, J. 2004, *Die jungsteinzeitliche Seeufersiedlung Arbon Bleiche 3. Umwelt und Wirtschaft.* Kanton Thurgau. Departement für Erziehung und Kultur des Kantons Thurgau, Frauenfeld.

Jensen, J. 1999, "The Heroes: Life and Death," in *Gods and Heroes of the European Bronze Age*, K. Demakopoulou et al., eds., Thames and Hudson, London, pp. 88-97.

Kapeller, A. 2003, "Sito: Wetzikon-Robenhausen," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 228-229.

Keller, F. 1866, "Manufacture of Vegetable Fibre, Flax etc.," in *The Lake Dwellings of Switzerland and other arts of Europe*, F. Keller, ed., Longmans, Green & Co., London, pp. 323-335.

Kellogg, K. 1984, *Home Tanning and Leathercraft Simplified.* Williamson Publishing Co., Charlotte, Vermont.

Kern, A. 2005, "Hallstatt - eine Einleitung zu einem sehr bemerkenswerten Ort," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 1-10.

Kezich, G., Eulisse, E., & Mott, A. 2002, *Musei degli Usi e Costumi della Gente Trentina: Nuova guida illustrata.* Museo degli Usi e Costumi della Gente Trentina, San Michele all'Adige, Trento.

Klein, R. G. 1973, *Ice-Age Hunters of the Ukraine.* The University of Chicago Press, Chicago and London.

Körber-Grohne, U. 1987, "Textiles, fishing nets, wickerwork and rope from the Neolithic sites of Hornstaad and Wangen on Lake Constance (Bodensee) botanical investigations," P. Walton & J.-P. Wild, eds., Archetype Publications, London.

Körber-Grohne, U. & Feldtkeller, A. 1998, "Pflanzliche Rohmaterialien und Herstellungstechniken der Gewebe, Netze, Gefleche sowie anderer Produckte aus den neolithischen Siedlungen Hornstaad, Wangen, Allensback und Sipplingen am Bodensee," in *Siedlunsarchäologie im Alpenvorland V*, Konrad Theiss Verlag, Stuttgart, pp. 131-189.

Kornreich, E. 2005, *Introduction to Fibres and Fabrics, their Manufacture and Properties.* The National Trade Press Ltd., London.

Krauß, M., Schöbel, G., & Walter, P. 1999, "Das "Hornstaadhaus" im Pfahlbaumuseum Unteruhldingen. Feldversuch und Bewohnung. Ein Zwischenbericht", *Plattform*, vol. 7/8, pp. 70-81.

Küchler, S. & Were, G. 2003, "Clothing and innovation: A Pacific perspective", *Anthropology Today*, vol. 19, no. 2, pp. 3-5.

Küchler, S. & Were, G. 2005, *Pacific Pattern.* Thames & Hudson Ltd, London.

Lechtman, H. 1975, "Style in Technology - Some Early Thoughts," in *Material Culture: Style, Organization, and Dynamics of Technology*, H. Lechtman & R. S. Merrill, eds., West Publishing Co., New York, pp. 3-21.

Leguilloux, M. 2004, "L'identification des tanneries antiques par l'archéologie et l'archéozoologie," in *Metodi e approcci archeologici: l'industria e il commercio nell'Italia antica / Archaeological Methods and Approaches: Industry and Commerce in Ancient Italy*, E. De Sena & H. Dessales, eds., BAR International Series 1262, pp. 38-48.

Leitner, W. 1999, "Ötzi-The Man in the Ice," in *Gods and Heroes of the European Bronze Age*, K. Demakopoulou et al., eds., Thames and Hudson, London, pp. 24-26.

Lemonnier, P. 1986, "The Study of Material Culture Today: Towards an Anthropology of Technical Systems", *Journal of Anthropological Archaeology*, vol. 5, pp. 147-186.

Lemonnier, P. 1993, "Introduction," in *Technological Choices: Transformation in Material Cultures since the Neolithic*, P. Lemonnier, ed., Routledge, London, pp. 1-35.

Leonardi, G., Balista, C., Bianchin, E., & Stabile, G. 1981, "Ripresa deli scavi nella palafitta di Molina di Ledro: Scavi 1980 - Nota preliminare", *Preistoria Alpina*, vol. 15, no. Trento 1979 - 198, pp. 39-55.

Leroi-Gourhan, A. 1993, *Gesture and Speech*. The MIT Press, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Leuzinger, U. 2002, "Textilherstellung," in *Die jungsteinzeitliche Seeufersiedlung Arbon-Bleiche 3: Funde*, 11 edn, A. de Capitani et al., eds., Frauenfeld, pp. 115-134.

Liu, R. K. 1978, "Spindle Whorls Part I: some comments and speculations", *The Bead Journal*, vol. 3, pp. 87-103.

Lucas, G. 2005, *The Archaeology of Time*. Routledge, Abingdon, Oxon.

Lundström-Baudais, K. 1984, "Palaeo-ethnobotanical investigation of plant remains from a Neolithic Lakeshore site in France: Clairvaux, Station III," in *Plants and Ancient Man: Studies in palaeoethnobotany*, W. v. Zeist & W. A. Casparie, eds., A.A.Balkema, Rotterdam & Boston, pp. 293-305.

MacKenzie, M. A. 1991, *Androgynous objects : string bags and gender in central New Guinea*. Harwood Academic Publishers, Chur.

Maggi, R., Starnini, E., & Voytek, B. 1997, "The bone tools from Arene Candide: Bernabò Brea Excavations," in *Arene Candide: A functional and environmental assessment of the Holocene sequence (Excavations Bernabò Brea-Cardini 1940-50)*, vol. Collaborating editors: E. Starnini and B. Voytek R. Maggi, ed., Il Calamo, Roma, pp. 513-520.

Maier, U. 1990, "Botanische Untersuchung in Hornstaad-Hörnle IA. Neue Ergebnisse zu Landwirtschagt und Ernährung einer jungsteinzeitlichen Uferrandsiedlung", *Bericht der Römisch-Germanischen Kommission*, vol. 71, pp. 110-135.

Maier, U. 1999, "Agricultural activities and land use in a Neolithic village around 3900 B.C.: Hornstaad Hörnle I A, Lake Constance, Germany", *Vegetation History and Archaeobotany*, vol. 8, pp. 87-94.

Maier, U. 2001, "Untersuchungen in der neolithischen Ufersiedlung Hornstaad Hörnle IA am Bodensee," in *Siedlungsarchäologie im Alpenvorland VI /Botanische und pedologische Untersuchungen zur Ufersiedlung Hornstaad-Hörnle IA. Ursula Maier und Richard Vogt ; mit einem Beitrag von Matthias Ahrens.*, vol. 74 Konrad Theiss, Stuttgart.

Maier, U. & Vogt, E. 2000, "Reconstructing the Neolithic Landscape at western Lake Constance, Germany", *Archaeology in the Severn Estuary*, vol. 11, pp. 121-130.

Maigrot, Y. 1997, "Tracéology des outils tranchants en os des V et IV millénaires ac.J.-C. en Bassin Parisien. Essai méthodologique et application", *Bulletin de la Société Préhistorique Française*, vol. 94, no. 2, pp. 198-216.

Martell, H. M. 1995, *The Kingfisher Book of the Ancient World. Explore the people and places of the past.* Kingfisher, London.

Marzatico, F. & Tecchiati, U. 2002, "L'età del bronzo in Trentino e Alto Adige / Südtirol," in *XXXIII Riunione Scientifica dell'Istituto Italiano di Preistoria e Protostoria. Preistoria e Protostoria del Trentino Alto Adige / Südtirol*, S. Gimaldi, ed., Istituto Italiano di Preistoric e Protostoria, Firenze, pp. 45-92.

Matthews, S. 2004, *The Instantiated Identity:Critical Approaches to Studying Gesture and Material Culture. Paper presented in "The Materialisation of Social Identities" session at the Theoretical Archaeology Group Conference, University of Glasgow, Scotland, 17th-19th December 2004.* http://www.semioticon.com/virtuals/archaeology/instantiated.pdf, Date accessed: September 2006.

Mauss, M. 1979a, *Sociology and Psychology Essays.* Routledge & Kegan Paul, London, Boston & Henley.

Mauss, M. 1979b, "The notion of body techniques," in *Sociology and Psychology Essays*, M. Mauss, ed., Routledge & Kegan Paul, London, pp. 97-105.

Mautendorfer, H. 2005, "Genähtes aus dem prähistorischen Hallstatt (Sewn Textiels from Prehistoric Hallstatt)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 41-54.

Médard, F. 2000, *L'artisanat textile au Néolithique. L'example du Delley-Portalban II (Suisse) 3272-2462 avant J.-C.* Éditions Monique Mergoil, Montagnac.

Médard, F. 2003, "La produzione di filo nei siti lacustri del Neolitico," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 79-86.

Médard, F. 2005, "Les textiles préhistoriques. Anatomie des écorces et analyse des traitements mis en œuvre pour en extraire la matière textile.," in *WES'04. Wetland Economies and Societies, Proceedings of the international conference Zürich, 10-13 mars 2004*, vol. 3 P. Della Casa & M. Trachsel, eds., University of Zürich, Publication of the Schweizerisches Landesmuseum Zürich, Zürich, pp. 99-104.

Mezzena, F. 1997, "La valle d'Aosta nel Neolithico e nell'enolitico," in *Atti della XXXI riunione scientifica. La Valle d'Aosta nel quadro della preistoria e protostoria dell'arco alpino centro-occidentale*, Istituto Italiano di Preistoria e Protostoria, Firenze, pp. 17-138.

Mezzena, F. 1998, "Le stele antropomorfe nell'area megalitica di Aosta," in *Dei di pietra: La grande statuaria antropomorfa nell'Europa del III millennio a.C. / Dieux de pierre: La grande statuaire anthropomophe in Europe au III millènaire avant J. C.*, F. Ambrosio, ed., Skira editore & Regione Autonoma Valle d'Aosta, Milano, pp. 90-121.

Milisauskas, S. 2002, "Early Neolithic, The First Farmers in Europe, 7000-5500/5000 BC," in *European prehistory: a survey*, S. Milisauskas, ed., Kluwer Academic/Plenum Publishers, New York, pp. 143-192.

Miller, D. 1994, "Artefacts and the meaning of things," in *Companion Encyclopedia of Anthropology*, T. Ingold, ed., Routledge, London, pp. 396-419.

Miller, D. 2005, "Introduction," in *Clothing as Material Culture*, D. Miller, ed., Berg, London, pp. 1-15.

Mithen, S. J. 1998, "The Mesolithic Age," in *Prehistoric Europe: An Illustrated History*, B. Cunliffe, ed., Oxford University Press, Oxford, pp. 79-135.

Moser, F. & Medard, F. "Quelques observations concernant la fabrication expérimentale des étoffes cordées", Saint-Céré, pp. 63-73.

Mott, A. & Tomasoi, R. 1994, *Vecchi mestieri: telai familiari in Trentino.* Museo Tridentino di Scienze Naturali, San Michele all'Adige (TN), Trento.

Mulvaney, J. & Kamminga, J. 1999, *Prehistory of Australia.* Smithsonian Institution Press, Washington.

Murdock, G. 1967, *Ethnographic Atlas.* University of Pittsburgh Press, Pittsburgh.

Murdock, G. & Provost, C. 1973, "Factors in the Division of Labor by Sex: A Cross Cultural Analysis", *Ethnology*, vol. 12, no. 203, p. 225.

Myking, T., Hertzberg, A., & Skrøppa, T. 2005, "History, maufacture and properties of lime bast cordage in Northern Europe", *Forestry*, vol. 78, no. 1.

Needles, H. L. 1981, *Handbook of Textile Fibres, Dyes, and Finishes.* Garland STPM Press, New York & London.

Nicolis, F. 2001, "Some observations on the cultural setting of the Bell Beakers of Northern Italy," in *Bell beakers today : pottery, people, culture, symbols in prehistoric Europe ; proceedings of the International Colloquium, Riva del Garda (Trento, Italy) 11-16 May 1998*, Provincia Autonoma di Trento, Servizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 207-227.

Nilsson, M. P. 1920, *Primitive Time-Reckoning.* Gleerup, Lund.

Nordland, O. 1961, *Primitive Scandinavian textiles in knotless netting.* Oslo University Press.

Oakes, J. & Riewe, R. 1996, *Our Boots : An Inuit Women's Art.* Thames and Hudson, London.

Oeggl, K. 2000, "The diet of the Iceman," in *The Iceman and his Natural Environment: Palaeobotanical Results*, vol. 4 S. Bortenschlager & K. Oeggl, eds., Springer, Wien.

Owen, L. R. 2005, *Distorting the Past. Gender and the Division of Labor in the European Upper Palaeolithic.* Tübingen, Kerns Verlag.

Pain, S. 2001, ""Arrow points to foul play in ancient iceman's death"", *New Scientist*, vol. 16th July.

Pawlik, A. F. 1998, "Die mikroskopische Gerauchsspurenanalyse der Silexwerkzeuge aus Reute-Schorrenried," in *Das Moordorf von Reute: Archäologische Untersuchungen in der jungneolithischen Siedlung Reute-Schorrenried*, M. Mainberge, ed., Teraqua CAP, Staufen, pp. 185-198.

Pearce, M. 2000, "What this awl means; understanding the earliest Italian metalwork," in *Ancient Italy in its Mediterranean Setting, Studies in Honour of Ellen Macnamara*, D. Ridgway et al., eds., Accordia Research Institute, London, pp. 67-73.

Pedley, H. 1992, *Aboriginal life in the rainforest.* Peninsula Region, Cairns, Queensland.

Pedrotti, A. 1998, "Gli elementi d'abbigliamento e d'ornamento nelle statue stele dell'arco alpino", *Archéologie en Languedoc*, vol. 22, pp. 299-315.

Pedrotti, A. 2000a, "Il Neolitico," in *La preistoria e la protostoria*, vol. I M. Lanzinger, F. Marzatico, & A. Pedrotti, eds., Il Mulino, Bologna, pp. 119-181.

Pedrotti, A. 2000b, "L'età del Rame," in *La preistoria e la protostoria*, vol. I M. Lanzinger, F. Marzatico, & A. Pedrotti, eds., Il Mulino, Bologna, pp. 183-254.

Pedrotti, A. 1995, "Le statue stele di Arco nel constesto dell'età del Rame nella Piana Benacense," in *Le Statue Stele di Arco: La statuaria antropomorfa alpina nel III millennio a.C.:abbigliamento, fibre tessili e colore*, A. Pedrotti, ed., Museo Civico di Riva del Garda, Ufficio Beni Archologici della Provincia Autonoma di Trento, Trento, pp. 41-69.

Perini, R. 2000, "L'età del Bronzo Antico e Medio," in *La preistoria e la protostoria*, vol. I M. Lanzinger, F. Marzatico, & A. Pedrotti, eds., Il Mulino, Bologna, pp. 287-335.

Perini, R. 1970, "Una decorazione sul tessuto dalla palafitta di Ledro", *Natura Alpina*, vol. XXI, no. 1, pp. 28-32.

Pétrequin, P. 1993, "North Wind, South Wind: Neolithic technical choices in the Jura Mountains, 3700-2400 BC," in *Technological Choices: Transformation in Material Cultures since the Neolithic*, P. Lemonnier, ed., Routledge, London, New York, pp. 36-76.

Pfeifer, K. & Oeggl, K. 2000, "Analysis of the bast used by the Iceman as binding material," in *The Iceman and his natural environement: Palaeobotanical Results*, vol. 4 S. Bortenschlager & K. Oeggl, eds., Springer, Wein.

Picton, J. & Mack, J. 1999, *African Textiles.*, 2 edn, British Museum Press, London.

Pitts, M. 1979, "Hides and antlers: a new look at the gatherer-hunter site at Starr Carr, North Yorkshire, England", *World Archaeology*, vol. 11, no. 1, pp. 32-42.

Price, T. D. 2000, "Europe's first farmers: an introduction," in *Europe's first farmers*, T. D. Price, ed., Cambridge University press, Cambridge, pp. 1-18.

Puliti, M. 1987, *Le Fibre Tessili Naturali-Artificiali-Sintetiche: Nozioni Elementari ad Uso degli Istituti Statali d'Arte.* B.Pochini, Firenze.

Radice, B. 1973, *Who's Who in the Ancient World: A handbook to the Survivors of the Greek and Roman Classics.* Penguin Books, London.

Rageth, J. 1974, *Der Lago di Ledro im Trentino und seine Beziehungen zu den alpinen und mitteleuropäischen Kulturen.* Sonderdruck aus Bericht der Römisch-Germanischen Kommission, Berlin.

Ramseyer, D. 2000, "Les armes de chasse néolithiques des stations lacustres et palustres suisse", *Anthropologie et Préhistoire*, vol. 111, no. 130, p. 142.

Rast, A. 1995, "Le vêtement néolithique," in *Dans les Alpes, à l'aube du metal. Archéologie et bande dessinée. Ouvrage publié à l'occasion del'exposition: Le Soleil des Morts*, A. Gallay, ed., Sion, Musée cantonal d'archéologie et bibliothèque municipale, Sion, pp. 149-153.

Rast, A. 1990a, "Die verarbeitung von Bast," in *Die ersten Bauem*, Schweizerisches Landesmuseum Zürich, Zürich, pp. 119-122.

Rast, A. 1990b, "Jungsteinzeitliche Kleidung," in *Die ersten Bauem*, Schweizerisches Landesmuseum Zürich, Zürich, pp. 123-126.

Rast-Eicher, A. 1992a, "Die Entwicklung der Webstühle vom Neolithikum bis zum Mittelalter", *Helvetia Archaeologica*, vol. 23, pp. 56-70.

Rast-Eicher, A. 1992b, "Neolitische Textilien in Raum Zürich," in *Archaeological Textiles in Northem Europe: Report from the 4th NESAT Symposium, 1-5th May 1990 in Copenhagen*, vol. 5 L. Bender Jørgensen & E. Munksgaard, eds., Konservatorskolen Det Kongelige Danske Kunstakademi, Copenhagen, pp. 9-19.

Rast-Eicher, A. 1995, "Tissus et vanneries," in *SPM III, Neolithikum, Néolithique, Neolitico*, Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, Basel, pp. 169-173.

Rast-Eicher, A. 1997, "Die Textilien," in *Ökonomie und Ökologie neolithischer und bronzezeitlicher Ufersiedlungen am Zürichsee : Ergebnisse der Ausgrabungen Mozartstrasse, Kanalisationssanierung Seefeld, AKAD/Pressehaus und Mythenschloss in Zürich*, J. Schibler et al., eds., Direktion der Öffentlichen Bauten des Kantons Zürich, Hochbauamt, Abt. Kantonsarchäologie, Zürich, pp. 300-328.

Rast-Eicher, A. 2003a, "Determinazione delle fibre," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 47-53.

Rast-Eicher, A. 2003b, "Geflechte und Gewebe," in *Die jungneolithische Siedlung Port-Stüdeli*, H. Zwahlen, ed., Wien, Haupt Verlag, pp. 59-60.

Rast-Eicher, A. 2005, "Bast before Wool: the first textiles," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 117-131.

Rast-Eicher, A. & Reinhard, J. 1998, "Textile et vannerie," Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, Basel, pp. 285-291.

Reinhard, J. 1992, "Etoffes cordées et métiers à pierres", *Helvetia Archaeologica*, vol. 23, pp. 51-55.

Reinhard, J. & Pillonel, D. 1989, "Le Village Bronze Final d'Hauterive-Champréveyres (Lac de Neuchâtel-Suisse), Liens, Cordages et Fils," in *Tissage, corderie, vannerie : approches archéologiques, ethnologiques : IXe rencontres internationales d'archéologie et d'histoire d'Antibes, Octobre 1988*, APDCA, Juan-les-Pins, pp. 141-148.

Renfrew, C. 1993, "Trade Beyond the Material," in *Trade and exchange in prehistoric Europe : proceedings of a conference held at the University of Bristol, April 1992*, C.

Scarre & F. Healy, eds., Oxbow Books in association with the Prehistoric Society and the Société préhistorique française, Oxford, pp. 5-16.

Renfrew, J. 1973, *Palaeoethnobotany: The prehistoirc food plants of the Near East and Europe.* Methuen & Co.Ltd, London.

Reschreiter, H. 2005, "Die prähistorischen Salzbergbaue in Hallstatt und ihre Textilreste (The prehistoric Salt-mines at Hallstatt and its Textile remains)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 11-16.

Richards, M. 2004, *Deerskins into buckskins : how to tan with brains, soap or eggs.*, 2nd edn, Backcountry Publishing, Cave Junction, Oregon.

Riedel, A. 1976, "La Fauna del villaggio preistorico di Ledro. Archeo-zoologia e paleoeconomia", *Studi Trentini di Scienze Naturali*, vol. 53, pp. 1-20.

Riedel, A. 1996, "Archaeozoological investigations in North-eastern Italy: the exploitation of animals since the Neolithic", *Preistoria Alpina*, vol. 30 (1994), pp. 43-94.

Riedel, A. & Tecchiati, U. 2001, "Settlements and economy in the Bronze and Iron Age in Trentino-South Tyrol. Notes for an archaeozoological model", *Preistoria Alpina*, vol. 35 (1999), pp. 105-113.

Riedel, A. & Tecchiati, U. 2003, "La capra e la pecora in Italia tra il Neolitico e l'età del Bronzo," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 73-78.

Rieu, E. V. 1976, *Homer: The Odyssey.* Penguin Books, Harmondsworth, Middlesex.

Robb, J. 1994, "Gender Contraditions, Moral Coalitions, and Inequality in Prehistoric Italy", *Journal of European Archaeology*, vol. 2, no. 1, pp. 20-49.

Rösch, M. 1996, "New approaches to prehistoric land-use reconstruction in south-western Germany", *Vegetation History and Archaeobotany*, vol. 5, no. 65, p. 79.

Rösch, M., Ehrmann, O., Herrmann, L., Schulz, E., Bogenrieder, A., Goldammer, J. P., Hall, M., Page, H., & Schier, W. 2002, "An experimental approach to Neolithic shifting cultivation", *Vegetation History and Archaeobotany*, vol. 11, pp. 143-154.

Rottoli, M. 2003, "Il Lino," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 65-71.

Rovine, V. L. 2001, *Bogolan, Shaping Culture through Cloth in Contemporary Mali.* Smithsonian Institution Press, Washington & London.

Ruoff, E. 1981, "Stein-und Bronzezeitliche Textilfunde aus dem Kanton Zürich", *Helvetia Archaeologica*, vol. 45/48, no. 12, pp. 252-264.

Ryder, M. L. 1969, "Changes in the fleece of sheep following domestication (with a note on the coat of cattle)," in *The domestication and exploitation of plants and animals*, P. Ucko & G. W. Dimbleby, eds., Gerald Duckworth & Co, London, pp. 495-521.

Ryder, M. L. 1983, *Sheep and Man.* Gerald Duckworth & Co. Ltd., London.

Ryder, M. L. 1984, "Sheep representations, written records and wool measurements," in *Animals and Archaeology: 3. Early Herders and their Flocks*, J. Clutton-Brock & C. Grigson, eds., British Archaeological Reports, Oxford, pp. 69-82.

Ryder, M. L. 1993a, "Skin and wool remains from Hallstatt", *Circea*, vol. 10, no. 2, pp. 69-78.

Ryder, M. L. 1993b, "Wool at Danebury: a speculation using evidence from elsewhere", *Oxford Journal of Archaeology*, vol. 12, pp. 305-320.

Ryder, M. L. & Stephenson, S. K. 1968, *Wool Growth.* Academic Press, London.

Schibler, J. 2005, "Bones as the key for reconstructing the environment, nutrition and economy of the lake-dwelling societies," in *Living on the Lake in Prehistoric Europe. 150 years of lake-dwelling research*, F. Menotti, ed., Routledge Taylor and Francis Group, Abingdon, pp. 144-161.

Schierer, I. 1987, "Ein Webstuhlbefund aus Gars-Thunau Rekonstruktionsversuch und Funktionsanalyse," 71 edn, H. Friesingere & H. Kerchler, eds., Franz Deuticke, Wien, pp. 29-87.

Schierer, I. 2005a, "Experiments with the warp-weighted loom of Gars-Thunau, Austria (Ein Webstuhlbefund aus gars-Thunau, Österreich - Rekonstruktionsversuch und Funktionsanalyse)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 101-105.

Schierer, I. 2005b, "Experiments with Weaving and Weaving Tools - Basic considerations after 20 years of work (Webversuche und Experimente mit Webstühlen)," in *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*, P. Bichler et al., eds., Archaeopress, Oxford, pp. 97-100.

Schiffer, M. B. & Skibo, J. M. 1997, "The Explanation of Artifact Variability", *American Antiquity*, vol. 62, no. 1, pp. 27-50.

Schlichtherle, H. 1988, "Neolithicsche Schmuckperlen aus Samen Fruchtsteinen," in *Der Prähistorische Mensch und seine Umwelt. Festschrift für Udelgard Körber-Grohne*, Stuttgart, pp. 199-203.

Schlichtherle, H. 1990, *Siedlungsarchäologie im Alpenvorland I: Die Sondagen 1973-1978 in den Ufersiedlung Hornstaad-Hörnle I.* Konrad Theiss Verlag, Stuttgart.

Schlichtherle, H. 1997, "Pfahlbauten rund um die Alpen," in *Pfahlbauten rund um die Alpen*, H. Schlichtherle, ed., Theiss, Stuttgart, pp. 7-14.

Schlichtherle, H. 2004a, "Große Häuser - kleine Häuser. Archäologische Befunde zum Siedlungswandel am neolithischen Federsee," in *Ökonomischer und ökologischer Wandel am vorgeschichtlichen Federsee*, vol. Hemmenhofener Skripte 5 Landesdenkmalamt Baden-Württemberg, Gaienhofen-Hemmenhofen, pp. 13-55.

Schlichtherle, H. 2004b, "Lake-Dwellings in south-western Germany," in *Living on the Lake in Prehistoric Europe. 150 years of lake-dwelling research*, F. Menotti, ed., Routledge Taylor and Francis Group, Abingdon, pp. 22-35.

Schlichtherle, H. & Wahlster, B. 1986, *Archäologie in Seen und Mooren: Den Pfahlbauten auf der Spur.* Konrad Theiss Verlag, Stuttgart.

Schneider, J. 1987, "The Anthropology of Cloth", *Annual Review of Anthropology*, vol. 16, pp. 409-448.

Schneider, J. & Weiner, A. B. 1989a, *Cloth and Human Experience.* Smithsonian Institution Press, Washington & London.

Schneider, J. & Weiner, A. B. 1989b, "Introduction," in *Cloth and Human Experience*, A. B. Weiner & J. Schneider, eds., Smithsonian Institution Press, Washington & London, pp. 1-29.

Schumacher-Matthäus, G. 1985, *Studien zu bronzezeitlichen Schmucktrachten im Karpatenbecken. Ein Beitrag zur Deutung der Hortfunde im Karpatenbecken.* Zabern, Mainz.

Schwarz, A. 1947, "Early Forms of the Reel", *Ciba Review*, vol. 59, pp. 2130-2133.

Seiler-Baldinger, A. 1991, *Systematik der textilen Techniken.* Basler Beiträge zur Ethnologie 32, Basel.

Seiler-Baldinger, A. 1994, *Textiles: A Classification of Techniques.* Smithsonian Institute Press, Washington, D.C.

Seiler-Baldinger, A. 2003, "Reperti tessili ingannevoli," in *Textiles: intrecci e tessuti dalla preistoria europea*, M. Bazzanella et al., eds., Provincia Autonoma di Trento, Sevizio Beni Culturali, Ufficio Beni Archeologici, Trento, pp. 55-63.

Sherratt, A. 1981, "Plough and pastoralism: aspects of the secondary products revolution," in *Patterns of the Past*, I. Hodder, G. Isaac, & N. Hammon, eds., Cambrige University Press, Cambridge, pp. 261-305.

Sherratt, A. 1983, "The Secondary Exploitation of Animals in the Old World", *World Archaeology*, vol. 15, no. 1, pp. 90-104.

Sherratt, A. 1998, "The Emergence of Élites: Early Bronze Age Europe, 2500 - 1300 BC," in *Prehistoric Europe: An Illustrated History*, B. Cunliffe, ed., Oxford University Press, Oxford, pp. 244-276.

Shishlina, N. I., Orfinskaya, O. V., & Golikov, V. P. 2003, "Bronze Age Textiles from the North Caucasus: New Evidence of Fourth Millennium BC Fibres and Fabrics", *Oxford Journal of Archaeology*, vol. 22, no. 4, pp. 331-344.

Sigaut, F. 1999, "Technology," in *Companion Encyclopedia of Anthropology*, T. Ingold, ed., Routledge, London, pp. 420-459.

Simoncini, E. 1933, *Cuoi e Pelli Industriali.* S.I.E.M. - Stabilimento Industrie Edioriali Meridionali, Napoli.

Skeates, R. 1994, "A radiocarbon date-list for prehistoric Italy (c. 46,400 BP - 2450 BP / 400 cal. BC)," R. Skeates & R. Whitehouse, eds., Accordia Research Centre, University of London, pp. 147-288.

Skeates, R. 2005, *Visual Culture and Archaeology. Art and Social Life in Prehistoric South-East Italy.* Duckworth, London.

Soffer, O. 2000, "Gravettian technologies in social contexts," in *Hunters of the Golden Age: The mid upper palaeolithic of Eurasia 30,000 - 20, 000 BP*, W. Roebroeks et al., eds., University of Leiden, pp. 59-75.

Soffer, O. 2004, "Recovering Perishable Technologies through Use Wear on Tools: Preliminary Evidence fro Upper Paleolithic Weaving and Net Making", *Current Anthropology*, vol. 45, no. 3, pp. 407-415.

Soffer, O., Adovasio, J. M., & Hyland, D. C. 2001, "Perishable Technologies and Invisible People: Nets, Baskets and "Venus" wear ca. 26 000 BP," in *Enduring Records: The Environmental and Cultural Heritage of Wetlands*, B. A. Purdy, ed., Oxbow Books, Oxford, pp. 233-245.

Sørensen, M. L. 1997, "Reading dress: the construction of social categories and identities in Bronze Age Europe", *Journal of European Archaeology*, vol. 5, no. 1, pp. 93-114.

Spindler, K. 1995, *The Man in the Ice; The preserved body of a Neolithic man reveals the secrets of the Stone Age.* Phoenix, Orion Books, London.

Spindler, K. 2003, "Transhumanz", *Preistoria Alpina*, vol. 39, pp. 219-225.

Stadler, P. 1999, "Aktueller Stand der Absolutdatierung der verschiedenen Gruppen des urgeschichglichen Bergbaus und eines Blockbaus in Hallstatt aufgrund von 14C-Daten", *Annal Naturhistorische Museum Wien*, vol. 101, no. A, pp. 69-80.

Stöckli, W. E. 1990, "Der Beginn des Neolithikums in der Schwiez," in *Die Ersten Bauern : Pfahlbaufunde Europas : Forschungsberichte zur Ausstellung im Schweizerischen Landesmuseum und zum Erlebnispark-Ausstellung Pfahlbauland in Zürich : 28. April bis 30. September 1990*, M. Höneisen, ed., Schweizerisches Landesmuseum, Zürich, pp. 53-60.

Suter, P. 1987, *Zürich "Kleiner Hafner" : Tauchgrabungen, 1981-1984.* Kommissionsverlag O. Füssli, Zürich.

Thomas, J. 1991, *Understanding the Neolithic: A revised second edition of Rethinking the Neolithic.* Routledge, London.

Thomas, N. 1995, *Oceanic Art.* Thames and Hudson, London.

Thomas, S. 1983, "Leathermaking in the Middle Ages", R. Thompson & J. A. Beswick, eds., Northampton, pp. 1-10.

Thomson, R. 1998, "Leather Working Processes," in *Leather and Fur: Aspects of Early Medieval Trade and Technology*, E. Cameron, ed., Archetype Publications for the Archaeological Leather Group, London, pp. 1-9.

Tite, M. S. & Sillar, B. 2000, "The Challenge of "Technological Choices" for Materials Science Approaches in Archaeology", *Archaeometry*, vol. 42, no. 1, pp. 2-20.

Tomasi, G. 1982, "The lake-dwellings of Lake Ledro", *Natura Alpina*, vol. 33, no. 29, pp. 1-38.

Treherne, P. 1995, "The Warrior's Beauty: The Masculine Body and Self-Identity in Bronze-Age Europe", *Journal of European Archaeology*, vol. 3, no. 1, pp. 105-144.

Troeng, J. 1993, *Worldwide Chronology of Fifty-three Prehistoric Innovations.* Almqvist & Wiksell International, Stockholm.

van der Leeuw, S. 1993, "Giving the potter a choice," in *Technological Choices: Transformation in Material Cultures since the Neolithic*, P. Lemonnier, ed., Routledge, London.

van Velthem, L. 2001, "The Woven Universe: Carib Basketry," in *Unknown Amazon*, C. McEwan, C. Barreto, & E. Neves, eds., The British Museum Press, London, pp. 198-213.

Velásquez Nimatuj, I. A. 2003, "Ways of Exclusion: Maya Dress and Racism in Contemporary Guatemala," in *"With Their hands and Their Eyes." Maya Textiles, Mirrors of a Worldview*, M. Holsbeke & J. Montoya, eds., Etnografisch Museum Antwerpen, Anwerp?, pp. 157-164.

Vogt, E. 1937, *Geflechte und Gewebe der Steinzeit.* E. Birkhäuser & Cie., Basel.

Vogt, R. 1990, "Pedologische Untersuchungen im Umfeld der neolithischen Ufersiedlungen Hornstaad-Hörnle", *Bericht der Römisch-Germanischen Kommission*, vol. 71, no. 136, p. 144.

Vogt, R. 2001, "Bodengesellschaften im Umfeld der neolithischen Uferseidlungen von Hornstaad-Hörnle IA am Bodensee-Untersee," in *Siedlungsarchäologie im Alpenvorland VI /Botanische und pedologische Untersuchungen zur Ufersiedlung Hornstaad-Hörnle IA. Ursula Maier und Richard Vogt ; mit einem Beitrag von Matthias Ahrens.*, vol. 74 Konrad Theiss, Stuttgart, pp. 405-456.

von Kokabi, M. 1990, "Ergebnisse der osteologischen Untersuchung,en an den Knochenfunden von Hornstaad im Vergleich au anderen Feuchtbodenfundkomplexen Südestdeutschlands", *Bericht der Römisch-Germanischen Kommission*, vol. 71, pp. 145-160.

Walton, P. & Eastwood, G. 1988, *A Brief Guide to the Cataloguing of Archaeological Textiles.*, 4 edn, Institute of Archaeology, London.

Weir, S. 1970, *Spinning and Weaving in Palestine.* The British Museum, London.

Wels-Weyrauch, U. "Mittelbronzezeitliche Frauentrachten in Süddeutschland", in *Dynamique du Bronze Moyen en Europe Occidentale*, Actes du 113e Congres national des Sociétés savantes, Strasbourg, pp. 117-134.

White, B. M. 1999, "The Woman Who Married a Beaver: Trade Patterns and Gendder Roles in the Ojibwa Fur Trade.", *Ethnohistory*, vol. 46, no. 1, pp. 109-147.

White, L. Jr. 1940, "Technology and invention in the Middle Ages", *Speculum*, vol. 15, no. 2, pp. 141-159.

Whitehouse, R. D. 1992, "Characteristics of the cult caves," in *Underground Religion: Cult and Culture in Prehistoric Italy*, Accordia Research Centre, University of London, London, pp. 61-86.

Whitehouse, R. D. 2001, "Exploring Gender in Prehistoric Italy", *Papers of the British School of Rome*, vol. 69.

Whittle, A. 1996, *Europe in the Neolithic: The creation of new worlds.* Cambridge University Press, Cambridge.

Wild, J.-P. 1988, *Textiles in Archaeology.* Shire Publications Ltd., Princes Risborough.

Wincott Heckett, E. 1998, "A Late Bronze Age Horsehair Ornament from Cromaghs, Armoy in Ireland," in *Textiles in European Archaeology. Report from the 6th NESAT symposium, 7-11th May 1996 in Borås.*, vol. Volume 1 L. Bender Jørgensen & C. Rinalso, eds., Göteborg University, Sweden, Göteborg, pp. 29-38.

Winiger, J. 1981, *Feldmeilen Vorderfeld : der Übergang von der Pfyner zur Horgener Kultur.* Verlag Huber & Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, Frauenfeld and Basel.

Winiger, J. 1995, "Die Bekleidung des Eismannes und die Anfänge der Weberei nördlich der Alpen," in *Der Mann im Eis, Neue Funde und Ergebnisse*, vol. 2 K. Spindler et al., eds., Springer-Verlag, Wein, pp. 119-188.

Winiger, J. 1998, *Ethnoarchäologische Studien zum Neolithikum Südwesteuropas.* BAR International Series 701.

Wobst, M. 1977, '"Stylistic behaviour and information exchange"', *University of Michigan, Museum of Anthropology Anthropological Papers*, vol. 61, pp. 317-342.

Wood, J. 1999, "Making the Iceman's Outfit", *British Archaeology*, vol. November 1999, no. 49.

Wood, J. 2004, "Possible use of fire-cracked stones in ceramic production and recent research on the "Otzi" grass cloak," in *The Use of Living Space in Prehistory: Papers from a session held at the European Association of Archaeologists Sixth Annual Meeting in Lisbon 2000*, O. V. Smyntyna, ed., Archaeopress, Oxford, pp. 119-121.

Woodward, S. 2005, "Looking Good: Feeling Right - Aesthetics of the Self," in *Clothing as Material Culture*, D. Miller, ed., Berg, London, pp. 21-41.

Wulfhorst, B. 2001, *Processi di lavorazione dei prodotti tessili.*, Italian Edition edn, Tecniche Nuovè, Milan.

Wyss, R. 1990, "Ein Netzbeutel zur Thematik des Fernhandels," in *Pfahlbaufunde Europas: Forschungsberichte zur Ausstellung im Schweizerischen Landesmuseum und zum Erlebnispark / Ausstellung Pfahlbauland in Zürich*, Schweizerisches Landesmuseum Zürich, Zürich, pp. 131-133.

Zidda, G. 1997, "Aspetti iconografici delle stele antropomorfe di Aosta," La valle d'Aosta nel quadro della preistoria e protostoria dell'arco alpino centro-occidentale edn, Istituto Italiano di Preistoria e Protostoria, p. 225.

Zidda, G. 1998a, "Aosta Stele 30," in *Dei di pietra: La grande statuaria antropomorfa nell'Europa del III millennio a.C. / Dieux de pierre: La grande statuaire anthropomophe in Europe au III millènaire avant J. C.*, F. Ambrosio, ed., Skira editore & Regione Autonoma Valle d'Aosta, Milano, pp. 170-171.

Zidda, G. 1998b, "Aosta, Stele n. 13," in *Dei di pietra: La grande statuaria antropomorfa nell'Europa del III millennio a.C. / Dieux de pierre: La grande statuaire anthropomophe in Europe au III millènaire avant J. C.*, F. Ambrosio, ed., Skira editore & Regione Autonoma Valle d'Aosta, Milano, pp. 166-167.

Zidda, G. 1998c, "Saint-Sernin," in *Dei di pietra: La grande statuaria antropomorfa nell'Europa del III millennio a.C. / Dieux de pierre: La grande statuaire anthropomophe in Europe au III millènaire avant J. C.*, F. Ambrosio, ed., Skira editore & Regione Autonoma Valle d'Aosta, Milano, pp. 192-193.

Zohary, D. 1989, "Domestication of the Southwest Asian Neolithic crop assemblage of cereals, pulses, and flax: the evidence from the living plants," in *Foraging and Farming: The evolution of plant exploitation*, D. R. Harris & G. C. Hillman, eds., Unwin Hyman, London, pp. 358-373.

Zohary, D. & Hopf, M. 2000, *Domestication of Plants in the Old World.* Oxford University Press, New York & Oxford.

APPENDIX 1

Glossary

Active element / active thread system

Thread or threads that are twisted, knotted or looped in place by the artisan during the cloth construction process (as opposed to passive element / threads).

Animal skins

Skins that have been removed from the animal, prepared and treated for use as cloth.

Bast fibres

Fibres extracted from the stem cells of a woody plant. More specifically, these are the phloem cells, which need to be extracted from the surrounding stem before they are used as fibres.

Bast strip

Raw strips removed from the inner bark of woody plants. The strip can be used in its entirety, or the fibres may be extracted (see bast fibres).

Bracking

Process of breaking the woody part of a plant stem, usually with a wooden beating tool, to extract the fibres. Bracking usually follows retting and precedes scutching.

Cloth

Flexible, thin sheets of material that can be folded, shaped, wrapped and tied.

Cloth Culture

The full range of co-existing cloth types that are used by a society.

Clothes

Garments worn on the body made from cloth.

Costume

Items of clothing worn together.

Extended chaîne opératoire

The processes of production and use of material culture.

Fibre

A filament or thread-like cell of animal, vegetable or mineral origin, natural or synthetic (The Chambers Dictionary: Anderson et al. 2001).

Fulling

Processing of agitating and rubbing a woven wool textile until the wool forms a mesh.

Fur

Animal skin with the hair or wool attached.

Hand-spinning

Fibres twisted into thread on a surface, such as the thigh, with new elements continually added, most suitable for long fibres (Seiler-Baldinger 1994:2). May also be referred to as hand-twisting or hand-spinning (Drooker 2000:274).

Heckling

Combing process carried out on plant fibres to divide the fibres and remove any remaining stem fragments. This usually follows bracking and scutching processes in the final stage of preparing fibres for spinning.

Heddle

Device used to pick up the required number of warp threads to create a shed. Depending on the weave construction there may be only one or multiple heddles.

Leather

Animal skins preserved using tannin as a curing agent.

Loom

Structure or frame used to secure the threads during cloth production; commonly the loom holds the warps parallel and under tension. It may be fitted with a heddle to open the shed.

Mineral replaced cloth

Minerals salts on the surface of a metal object that have taken the shape of cloth during oxidisation or other corrosion process.

Passive element / passive thread system

Thread or set of threads that remain inactive during the cloth construction process and are wrapped, looped or knotted with the active elements.

Pile

Loops or tufts attached to the cloth surface either during or after construction (see Appendix 2)

Plain weave / tabby weave

Form of weave, produced by interlacing the warp and weft with the technique of one over, one under, alternating each row (see Appendix 2).

Plied thread

Two or more threads twisted together, referred to as two-ply (2-ply) when two threads are used, three-ply (3-ply) when three threads are used etc. If the plied thread is made of spun fibres, the twist direction of both the single-spun threads and ply may be recorded together, for example, two s-spun threads plied together in a Z direction would be s2Z (see Appendix 2).

Reps

Plain weaves where the thread counts are substantially different; usually one thread count is double the other. If the warp has the highest count it will be called warp-faced, if the weft, it is called weft-faced. Reps are often used for selvedges (see Appendix 2).

Retting

Controlled rotting process of plant fibres. The unwanted parts of the stem decay leaving the fibres and woody stem. The fibres are then treated further by bracking, scutching and heckling before they are ready for spinning.

Scutching

Process of scraping plant fibres to remove the wooden stem fragments from the fibres. The stems are scraped with a blunt tool, probably wood. The fibres are then ready for heckling.

Shed

Space created between two sets of threads for the warp to pass through.

Simple thread / single thread

A thread that has not been plied (see Appendix 2).

Shed

The open space produced by separating the different warps into those that the weft will pass above and those that it will pass below. The shed may be changed by the used of a heddle.

Spin direction

Direction that the fibres are spun, twisted or plied to produce a thread.
This can be either in an anticlockwise direction, referred to as s-spun or a clockwise direction referred to as z-spun; the s and z refer to the visual appearance of the thread twists when spun. When simple fibres are spun, the convention is to use a small letter s or z, hence s-spun or z-spun, when two or more threads are plied a capital S or Z are used. To indicate the number of

threads in a ply the number is written before the S or Z. Hence, two s-spun threads that are Z-plied are referred to as s2Z. To refer to the spin direction of both warp and weft, the warp is written first then the weft. Therefore if both warp and weft were s2Z, they would be represented by s2Z/s2Z.

Spinning

"Spinning, technically speaking, involves both twisting and drawing out (*or drafting*) the fibres of the raw material into a thread." (Barber 1991: 41).

Splicing

Method of producing thread, whereby the ends of individual fibres are twisted together to form a continuous thread. To make it stronger, several of the spliced fibres are then plied together in such a way that the joins come at different places (Barber 1991:47-48).

S-ply

See spin direction.

S-spin

See spin direction.

Supplementary wefts or warp

The technique of adding extra weft or warp threads into the thread-based cloth. These are not structurally necessary and are used to create decorative effects (see Appendix 2).

Textile

A woven cloth; it is used by archaeologists in particular to refer to the use of spun thread in both warp and weft, usually with threads less than 2mm diameter, to construct a dense, flexible cloth that would have been woven on a loom, such as the warp-weighted loom.

Thread

A fine line of any substance. It may be composed of many fibres twisted together, a single strip or several threads twisted together. Thread is often used interchangeably with the term "yarn".

Thread count

Number of threads per cm of cloth. If there are two thread systems, both are measured, if the warp is known then the warp measurement will be given first, followed by the weft, for example 12/13 per cm would mean 12 warp threads and 13 weft threads per cm^2 of cloth.

Thread diameter

Cross-wise measurement of a thread.

Thread-based cloth.

All types of cloth constructed from threads, including woven cloth, netting, knotless netting etc.

Twill

Weave structure where the threads pass over a combination of one and two, alternating in each row, creating a number of diagonal structure variations (see Appendix 2).

Twining

Method of constructing cloth with two sets of parallel threads at right angles. One set remains passive while the active threads are twisted around them (see Appendix 2).

Warp

Parallel threads attached to a loom, interlaced into cloth with a second, perpendicular thread system, referred to as a weft.

Weave

Weaving involves two sets of threads intersecting at right angles passing under and over each other. The term "weaving", is most commonly used by archaeologists to refer to textiles that are woven with fine, spun thread in both warp and weft, to construct a dense, flexible cloth on a loom.

Weaving knife

Tool used to beat the weft into the warp after the weft has been placed through the shed. Weaving knives are shaped like knives and have fine edges, but they are not sharp.

Weft

Thread or threads that bind the warp.

Yarn

See thread.

Z-ply

See spin direction.

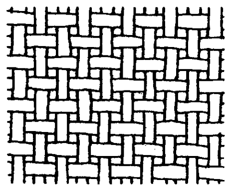
Z-spin

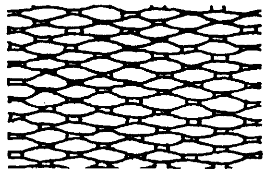
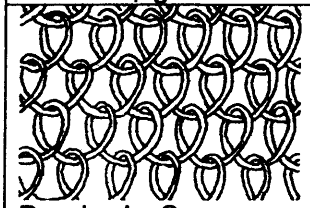
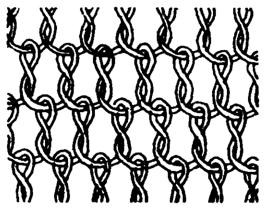
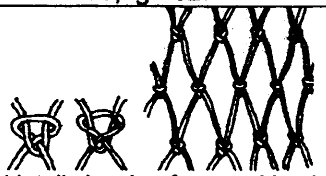
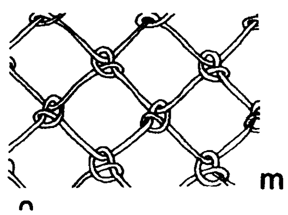
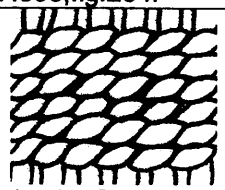
See spin direction.

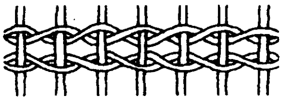
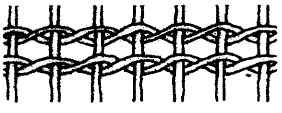
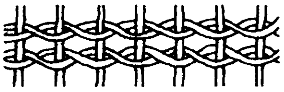
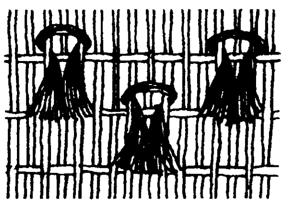
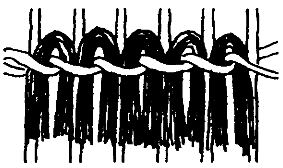
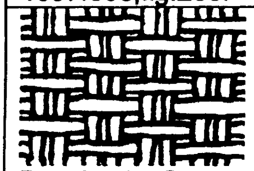
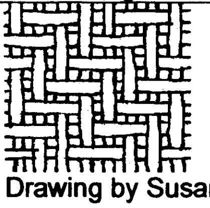
APPENDIX 2

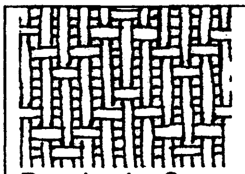
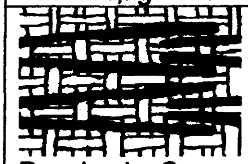
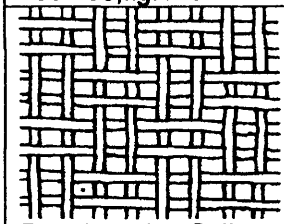
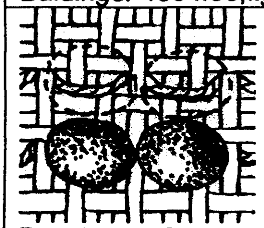
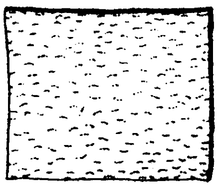
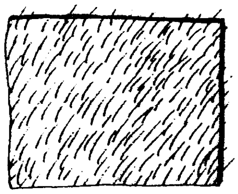
Terminology of thread and cloth construction types

The following technical terms are those commonly found in the literature relating to cloth from the Neolithic to Bronze Age in the Alpine region. Abbreviations: Engl (English), F (French), I (Italian), D (German).

 Drawing by Susanna Harris	*Engl:* s-spun (Bender Jørgensen 1992:117), S direction of twisting thread (Barber 1991:66). *F:* Simple, tors s (Desrosiers 1989:130), fil simple (Médard 2003:80). *I:* Torsione s (Bazzanella et al. 2003:170), filati semplici, torsione Z (Médard 2003:80). *D:* s-Drall (Leuzinger 2002:119), Drehrichtung s (meaning twist s) (Seiler-Baldinger 1994:4).
 Drawing by Susanna Harris	*Engl:* z-spun (Bender Jørgensen 1992), Z direction of twisting thread (Barber 1991:66). *F:* Simple, tors z (Desrosiers 1989:130), fil simple (Médard 2003:80). *I:* Torsione z (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:184), filati semplici, torsione Z (Médard 2003:80). *D:* z-Drall (Leuzinger 2002:123) Drehrichtung z (meaning twist s) (Seiler-Baldinger 1994:4).
 Drawing by Susanna Harris	*Engl:* S-ply / S-plied (Bender Jørgensen 1992). *F:* Fil retors (Médard 2003:80). *I:*Filo ritorto (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:170). *D:* S-Zwirn (Leuzinger 2002:134). S-Drehung (Farke 1991:124), linksgedreht (Vogt 1937:49), Fadendrehrichtung S (Rast-Eicher 1997:305).
 Drawing by Susanna Harris	*Engl*: Z-ply / Z-plied (Bender Jørgensen 1992). *F*: Fil retors (Médard 2003:80). *I*: Filo ritorto (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:184) *D*: Z-Zwirn (Leuzinger 2002). Z-Drehung (Farke 1991:124), rechtsgedreht (Vogt 1937:49) Fadendrehrichtung Z (Rast-Eicher 1997:305).
 Drawing by Susanna Harris after Rast-Eicher 1997:307,fig.290.	*Engl*: Plain weave (Barber 1991:127), Balanced Plain weave (Barber 1991:128), Plain or tabby weave (Cardon 1998:17). *F*: Toile (Burnham 1980:138). *I*: Tela (Bazzanella 1999:201). *D*: Leinengewebe (Vogt 1937:64), Gewebe mit Leinwandbindung (Rast-Eicher 1997:309).

 Drawing by Susanna Harris after Rast-Eicher 1997:309,fig.298.	*Engl*: Weft or warp faced plain weave (Barber 1991:128). *I*: Reps di ordito (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:233). *D*: Leinwandbindiges Gewebe mit Ripseffekt (Farke 1991:134), Repsbindung (Rast-Eicher 1997:309). Reps: Schussreps / Kettenreps (Grömer & Schierer 2005:25)
 Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.281.	*Engl*: Knotless netting (Cardon 1998:17), simple looping with S crossing (Seiler-Baldinger 1994:11). *I*: Intreccio a maglie semplici inanellate (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:222). *D*: Knotenlose Netz (Vogt 1937:56), einfach verschlungener Maschenstoff (Rast-Eicher 1997:305).
 Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.282.	*Engl*: Knotless netting (Cardon 1998:17), twisted looping with S-crossing (Seiler-Baldinger 1994:12). *F*: Réseau bouclé aven une torsion S d'un tour (Desrosiers 1989:130). *D*: Variant des knotenlosen Netzgeflechtes (Vogt 1937:34), zweifach verschlungenen Maschenstoffe (Rast-Eicher 1997:305), Mehrfaches Verschlingen (Seiler-Baldinger 1994:12).
 (detail showing front and back of knot). Drawing by Susanna Harris after Körber-Grohne & Feldtkeller 1998:136.	*Engl*: fishing net (Gillow & Sentance 1999:44). *I*:Intreccio a maglie semplici inanellate (Bazzanella & Mayr 1999:172) Intreccio a maglie con nodo semplice (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:221). *D*: Filetknoten (Feldtkeller & Schlichtherle 1998:136).
 Drawing by Susanna Harris after Rast-Eicher 1997:306,fig.284.	*Engl:* Knotted Net (Cardon 1998:17), Lake dwelling knot (Wild 1988:49,fig.38b). *F*: filet noué (Rast-Eicher 1995:171). *I*: intreccio con nodo da pescatore (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:237), rete da pesca a nodi delle palafitte (Rast-Eicher 1995:171). *D*: Pfahlbau Netzknoten (Vogt 1937:35, Körber-Grohne & Feldtkeller 1998:136), verknoteter Maschenstoff (Rast-Eicher 1997:305).
 Drawing by Susanna Harris	*Engl*: Weft twining, closed (Cardon 1998:17). *I*: Intreccio a trama ritorta (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:217). *D*: Kettenstoffe (Rast-Eicher 1997:319), dichtes Zwirngeflecht (Vogt 1937:16).

 Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.294.	*Engl*: Weft twining, countered (Cardon 1998:17). *F*: Vanneries cordée (Desrosiers 1989:134) *D*: Zwirngeflechte mit paarweiser Verzwirnung (Varient B) (Vogt 1937:15).
 Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.293.	*Engl*: Weft-twining open stitch slant S(Cardon 1998:17), Weft twining with paired weft (Barber 1991:128). *I*: Intreccio semplice (Bazzanella & Mayr 1999:71), intreccio con struttura a trama ritorta (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:239). D: S-gedrehte Zwirnbindung (Rast-Eicher 1997:305), Kettenstoff mit S-Zwirnbindung (Rast-Eicher 1997:308), Zwirngeflechte / einfache Zwirnbindung (Vogt 1937:13).
 Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.292.	*Engl*: Weft-twining open stitch slant Z (Cardon 1998:17). *D*: Z-gedrehten Zwirnbindung (Rast-Eicher 1997:305), Kettenstoffe mit Z-Zwirnbindung (Rast-Eicher 1997:308).
 Drawing by Susanna Harris after Rast-Eicher 1997:309,fig.299.	*Engl*: Weft-wrapping cut pile on plain weave ground (Cardon 1998:17), *F*: tissu avec mèches repérées (Desrosiers 1989:132). *I*: Tappeto annodato (Burnham 1980:78). *D*: Gewebes mit eingehängtem Flor (Rast-Eicher 1997:309).
 Drawing by Susanna Harris after Rast-Eicher 1997:308,fig.296.	*Engl*: Twining with pile, stitch slant in Z or S (Cardon 1998:17). *F*: Vanneries cordées avec mèches (Desrosiers 1989:134) *I*: Intreccio con struttura a trama ritorta con inserimenti di ciuffi di fibra (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:249). *D*: Kettenstoff mit Zwirnbindung und Flor, ein Flor-Noppenende pro Zwirndrehung (Rast-Eicher 1997:308).
 Drawing by Susanna Harris after Vogt 1937:51,fig.82.	*Engl*: Ribbed border (Barber 1991:134), half-basket weave (Bender Jørgensen 1992:12). *D*: Ripsbindung (Grömer & Schierer 2005:26), Halbpanama (Grömer & Schierer 2005:25).
 Drawing by Susanna Harris after Seiler-Baldinger 1994:90,fig.158a	*Engl*: 2/2 twill, plain twill, diagonal twill (Bender Jørgensen 1992:14). *F*: Sergé (Burnham 1980:154). *It*: Saia 2/2 (Bazzanella & Mayr 1999:181), spina (Burnham 1980:154). *D*: Köper 2/2 (Grömer 2005:31), Köperbindung (Burnham 1980:154).

 Drawing by Susanna Harris after Seiler-Baldinger 1994:91,fig.161a.	*Engl*: Chevron twill (Seiler-Baldinger 1994:92), 2/2 chevron twill (Bender Jørgensen 1992:14). *D*: Fischgratköper (Grömer 2005:31)
 Drawing by Susanna Harris after Vogt 1937:80,fig.120.	*Engl*: Brocade made with supplementary wefts (Barber 1991:138-140). *F*: toile brochée (Desrosiers 1989:134). *I*:Tela broccato (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:227). *D*: Broschierter Stoffes (Vogt 1937:76), Brokat (Burnham 1980:14), broschierten Gewebes (Rast-Eicher 1997:309).
 Drawing after Seiler-Baldinger 1994:88,fig.153.	*Engl*: Basket weave (Barber 1991:127), plain weave with paired warps and wefts 2/2 (Seiler-Baldinger 1994:88). *D*: Würfelbindungen (Seiler-Baldinger 1991:97), Panama (Grömer 2005:31).
 Drawing by Susanna Harris after Vogt 1937:37,fig.62.	*Engl*: Plain weave with beads embroidered on surface *F*: toile, noyaux de fruit cousus sur la surface (Desrosiers 1989:134). *I*: Tessuto ornato con semi vegetali (Bazzanella & Mayr 1995:119). *D*: Geweben mit Perlenstickerei (Rast-Eicher 1997:310).
 Drawing by Susanna Harris	*Engl*: Leather, animal skin, depilated animal skin *F*: Cuir *I*: Pelle (Bazzanella & Mayr 1995:111), cuoio *D*: Leder
 Drawing by Susanna Harris	*Engl*: Fleece (when referring to sheep), fur. *F*: Fourrure (f) *I*: Pelle (Bazzanella & Mayr 1995:111), pelame. *D*: Fell

APPENDIX 3

List of cloth artefacts and related finds

The sites and archives are listed as follows:
Site code, Site name, location
Archive: Archive where cloth artefacts are stored
Site: Site context, preservation environment, date and cultural group
Cloth: Summary of cloth artefacts
Other: Other related artefacts
Ref: Bibliographic sources
Artefact reference
Four-letter site code and cloth artefact number (reference; original archive number where known).
Description
Woven cloth details listed as: spin direction of simple thread (small letter), number of plied threads, spin direction of plied thread (capital), i.e. 2Z, warp / weft, thread count per cm, warp / weft, thread diameter in mm.

(APPO-) Appoldwerk Gallery, Hallstatt salt mines, Upper Austria, Austria *Archive*: Vienna Naturhistorisches Museum *Site:* Galleries of a salt mine. Salt preservation. Appoldwerk (APPO) 1650-900 cal. BC (2-sigma), Middle to Late Bronze Age. *Cloth:* Animal skins, wool and linen, skin hat, carry sacks, straps, hand leathers, wool and linen plain weave and twill textiles. *Other*: Animal skin strips used to sew wooden artefacts. *Ref*: Barth 1992, Barth 1982, Barth 1994, Barth & Neubauer 1991, Grömer 2005, Ryder 1993, Reschreiter 2005.	
APPO-001 (Barth 1992:122;4.845 a)	Rucksack of cow skin and wood, 75cm high, 21x36cm top opening, hair attached, hourglass-shaped skin sewn with strips of skin with wooden supports.
APPO-002 (Barth 1992:122;4.845 b)	Rucksack of cow skin and wood, 75cm high, 20x36cm top opening, orange / brown colour of cow skin, sewing construction.
APPO-003 (Barth & Neubauer 1991:22-24)	Plain weave wool cloth with reps border, 10.5x1.5cm, s-spun, 0.5mm, found inside carry sack along with fire-sticks, stones and two threads.

APPO-004 (Barth & Neubauer 1991:22-24)	Two wool threads, 8 and 12 cm, s-spun, 0.1 and 0.2mm, light greenish colour, found with APPO-003.
APPO-005 (Barth & Neubauer 1991:23;4.844)	Coarse sheep's wool cloth, 138x100cm, now lost
(ARBO-) Arbon-Bleiche 3, Thurgau, Switzerland *Archive:* Museum für Archäologie, Frauenfeld. *Site:* Lake dwelling with house structures. Single occupation layer. Waterlogged preservation. Dendro dates: 3384-3370 BC, Pfyn / Horgen transition. *Cloth:* Fine spun lime (?) thread on a spindle whorl, twining with starting borders, tubular twined container with plaited weft, plain weave cloth. *Other:* 409 spindle whorls and 24 loom weights *Ref:* Leuzinger 2002	
ARBO-001 (Leuzinger 2002:115-134; 95.01.7837)	Hazel spindle with 21gm clay whorl, thread z-spun, 0.7mm, probably lime bast.
ARBO-002 (Leuzinger 2002:132; 95.01.10658.1)	Lime bast twining with starting border, size 59 x 60cm, z/2Z, diam. 3mm/3mm, count 94 warps over 59cm,
ARBO-003 (Leuzinger 2002: 132-3; 95.01.8565.1)	Twining with starting border, 19.5cm long, lime bast, z/2Z, 8mm/3-4mm, 16 warps over 19.5cm.
ARBO-004 (Leuzinger 2002:131-132; 95.01.9587.1)	Tubular container, 13cm high, twining with plaited wefts, s2Z/s 3xplait, 3mm/10mm.
ARBO-005 (Leuzinger 2002:133, 95.01.7942.1	Plain weave basketry, flat lime bast strips, 7-14mm each.
ARBO-006 (Leuzinger 2002:134; 93.01.1764.1)	Four fragments of plain weave, linen, z2S/zz2S, 0.7mm/0.7mm, count 10/10 threads/cm.
ARBO-007 (Leuzinger 2002:133 ; 95.01.5759.1)	Lime bast basketry with hazel wood frame. 67x40cm.

<table>
<tr><td>ARBO-008
(Leuzinger 2002:134, 94.01.5029.1
94.01.5031.1)</td><td>Two fragments of closed twining, lime bast, s2Z/z, 1.3mm/1.8mm, 2mm between warps, 4 weft/cm.</td></tr>
<tr><td>ARBO-009
(Leuzinger 2002:134; 94.01.5029.1 /
5031.1)</td><td>Two fragments of plain weave, linen, z2S/z2S, 0.7/0.7mm, count 10/12 per cm.</td></tr>
<tr><td>ARBO-010
(Leuzinger 2002:133; 95.01.8152.1</td><td>Lime bast twining, 11x4cm, z/s2Z, 8/3mm, warps 2mm apart.</td></tr>
<tr><td colspan="2">(BESN-) Lagozza di Besnate, Varese,Italy
Archive: Civiche Raccilte Archeologiche Numsimatiche di Milano (Collezione P.Castelfranco)
Site: Waterlogged settlement, possibly a lake dwelling, ceramics, lithics, flint flakes, polished stone. Recent Neolithi, Lagozza Culture.
Cloth: Only one textile fragment from the 19th century excavations.
Other: Disc-shaped spindle whorls and kidney-shaped loom weights.
Ref: Bazzanella et al. 2003:183-185</td></tr>
<tr><td>BESN-001
(Bazzanella, Mayr, Moser, & Rast-Eicher 2003:184; A 0.9.9623)</td><td>Fragment of twining, 8.4x4.6cm, plant fibres, probably tree bast with isolated wool fibres,2Z/2-ply, direction not identified, thread diameter 1.2-1.7 for both.</td></tr>
<tr><td colspan="2">(BUDD-) via T. Buddio, Alba, Piemonte, Italy
Archive: Museo Civico Alba
Site: Inhumation burial, low-walled sandstone tomb, male 25-30 years, dagger and coiled wire finger ring.
Cloth: Remains of animal skin in contact with copper dagger.
Ref: On display in Alba Museum</td></tr>
<tr><td>BUDD-001</td><td>Remains of animal skin in contact with copper dagger, interpreted as a dagger sheath.</td></tr>
<tr><td colspan="2">(CAST-) Castione Marchesi, Fidenza, Parma, Italy
Archive: Museo Nazionale di Parma
Site: Nineteenth century excavation, deep stratigraphy with lake dwelling structure at base. Middle to Recent Bronze Age, relative date 1500-1200 BC.
Cloth: Cloth probably from middle Bronze Age level.
Other: Baskets, tool handles and a full disk wheel from same level.
Ref: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:199-200</td></tr>
</table>

CAST-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:200; 40767)	Plain weave wool cloth, 8x4cm, 2Z/2Z, diameter 1.3 both, thread count 8/6 per cm, mainly coarse black hair with little fine wool, like a muflone.
(CHAV-) Charavines, Isère, Lake Paladru, France *Site*: Settlement with two main occupation phases, from c.2670-2650 BC and c. 2631-2609 BC, possibly semi-permanent site, evidence of trade through Baltic amber, north Italian Green stone axes and Loire flint. *Cloth*: Cord for wooden structures, basketry, threads of all dimensions to sew and for cloth, nets, loop and twist knotless netting, two plain weaves with predominant warps one plain weave with pile which was probably introduced during weaving to create a design. *Other*: Pebble loom weights, wooden combs, spindle whorls of clay and stone, wooden spindle shaft. *Ref*: Bocquet 2003, Desrosiers 1989, Cardon 1998, Bocquet & Berretrot 1989	
CHAV-001 (Rast 1995:150, Desrosiers 1989:129)	Tree bast woven textile, plain weave.
(CHRI-) Christian Tuschwerk Gallery, Hallstatt salt mines, Upper Austria, Austria Archive: Vienna Naturhistorisches Museum *Site:* Galleries of a salt mine. Salt preservation. Christian Tuschwerk gallery (CHRI) 1310-930 cal. BC (2 sigma), Urnfield culture *Cloth:* Animal skins, wool and linen, skin hat, carry sacks, straps, hand leathers, wool and linen plain weave and twill textiles. *Other*: Animal skin strips used to sew wooden artefacts. *Ref*: Barth 1992, Barth & Neubauer 1991, Barth & Lobisser 2002, Barth 1982, Barth 1994, Grömer 2005, Grabner et al. 2006, Ryder 1993, Reschreiter 2005. Stadler 1999:79.	
CHRI-001 (Harris 2006:71; 93.811)	Composite sheet of fur, 78x17.2cm max, 1.2mm thick, four dark brown fur pieces sewn together with 1mm thread, with hem. Tree root pushed through rough hole.
CHRI-002 (Harris 2006:73,fig.4; 94.837)	Torn strap, 3.25mm thick, 2cm wide animal skin strap with 2.6cm slit at one end, both ends torn.
CHRI-003 (Harris 2006:71; 92.029)	Fragment of fur with torn off seam, pierced hole and evidence of strain. 19.5x5cm, 2mm thick, red-brown short fur 4-8mm long.
CHRI-004 (Harris 2006:71; 91.974)	Fragment of a hand-leather, 10.8x45cm, 10-15mm thick, two pieces of fur sewn together with thong, fragment of a handleder, light yellow-brown fur.

CHRI-005 (Harris 2006:71; 90.946)	Animal skin hand-leather, 12x10cm, 1mm thick, roughly circular piece of fur with off-centre hole and strap cut from the same piece, yellow-brown fur.
CHRI-006 (Harris 2006:71; 92.031)	Irregular flat sheet of animal skin, 76.5x29cm, 1.25mm thick, many tears, and bristly fur, dark to light brown.
CHRI-007 (Harris 2006:71; 93.433)	Broken half bucket with joins and repairs using animal skins straps and dark brown fur patch. Straps from 1-4mm thick, 6-9mm wide.
CHRI-008, CHRI-009 (Harris 2006:71-72,fig.3; 94.895)	Pair of hand-leathers, 17.2x10cm, 3mm thick together, two circular pieces of fur, with fringed off-centre thumbhole and strap ties, yellow-brown fur.
CHRI-010 (Harris 2006:71; 93.498)	Hand-leather, 16.4x9.4mm, 3mm thick together, oval-shaped, two-layered hand-leather with off-centre thumb-hole and long straps, yellow-brown fur.
CHRI-011 (Harris 2006:71; 89.943)	Fur band, 14.7x2.9mm, 1.5 thick, with three holes 9-13mm diameter along one edge, other edge torn, yellow-brown fur.
CHRI-012 (93.810)	Large composite cloth of furry animal skins, 154.5x108cm max, with shaped central hump.
CHRI-013 (Grömer 2005:20-21,fig.4; 94.849)	Plain weave wool cloth edge reinforced with stitching, 11x9.5cm, simple yarn, both 1.5-2mm, count 5/5 per cm.
CHRI-14 (Grömer 2005:20-21,fig.4; 92.020)	Plain weave wool cloth with reps starting border, 16x7.7cm, simple yarn, both 1.5-2mm, count 5/5 per cm.
CHRI-015 (Grömer 2005:20-21,fig.4; 94.053)	Plain weave wool cloth, 12.5x9cm, edge (possible starting border) reinforced with stitching, simple yarn, both 1.5-2mm, count 5/5 per cm.
CHRI-016 (Grömer 2005:20-21,fig.4; 91.929)	Plain weave wool cloth, 11x6.8cm, reps starting border, simple yarn, both 1.5-2mm, count 5/5 per cm.
CHRI-017 (Grömer 2005:20-21,fig.4;94.113)	Plain weave wool cloth, 10x11.5cm, with reinforced edge, simple yarn, both 1.5-2mm, count 5/5 per cm.
CHRI-018 (Grömer 2005:20,fig.3)	Dyed, fine wool fabric, 7x4.1cm, twill with paired warp and weft, simple yarn, both 0.3mm, count 16-20 per cm, olive colour dye.

(DELL-) Delley-Portalban II , Canton of Fribourg, Switzerland *Site*: Village site, five occupation phases, Auvernier-Cordé (Corded Ware) dendro date 2787-2462 BC, Horgen culture dendro date 3272 - 3985 BC. *Cloth*: Textile mainly from Auvernier-Cordé with a single plain weave textile from the Horgen culture layer. *Ref*: Médard 2000	
DELL-001 (Médard 2000: 3, 246; 557 [1978: 351])	Plain weave, lime bast, 4x2cm, thread diameter 0.7/1mm, thread count, 3.5/8 per cm, Horgen culture.
DELL-002 (Médard 2000: 3, 246; 558 [1977: 5394])	Spool of thread on spindle, z-spun, thread diameter 0.4mm.
DELL-003 (Médard 2000: 3, 246; 560 [1977: 5395])	Spool of thread, 6.4x3.8cm.
DELL-004 (Médard 2000: 3, 246; 559 [1973: 999])	Fragment of twined cloth slant stitch Z, 15x7.8cm, tree bast, s-spun, starting border.
DELL-005 (Médard 2000:67, 251, fig.564)	Ball of thread, grass fibres, s2Z, found out of context, thread diameter 0.8mm.
(EGOL-) Egolzwil 3, Wauwilermoos, Switzerland *Site*: Multiple sequence settlement site with house structures and hearths, radiocarbon dates Egolzwil 3: 4000-3820 cal. BC. Egolzwil culture. *Cloth*: Bag and other cloth finds. *Ref*: Wyss 1990, Wyss 1976.	
EGOL-001 (Wyss 1990: 131)	Twined, pear shaped bag, top of bag missing, contains 30 stone beads, a number of shells and flint flakes.
(FELD-) Feldmeilen-Vorderfeld, Meilen, Canton of Zurich, Switzerland *Archive*: National Museum Switzerland *Site*: Waterlogged, multiple layered site, Pfyn and Horgen cultures, Horgen dendro dates, 3239 - 3023 BC. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:220-222, Winiger 1981, Ruoff 1981.	

FELD-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:222; SLM 79113	Knotless netting, 17x12cm, tree bast, 2Z, thread diameter 2mm, Horgen culture.
FELD-002 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:221; SLM 79574)	Knotted netting, 26x20cm, tree bast, 2Z, thread diameter 2.5mm, tree bast retted and combed, Horgen culture.
FELD-003 (Winiger 1981:189, Taf.75)	Knotted net, 33x26cm, plant fibre, meshes 4cm, Horgen culture.
FELD-004 (Winiger 1981:160, 188, Taf.60-2,Abb.41)	Close weft twining in a roll, 27cm long, rope at one end, possibly part of fishing equipment.
FELD-005 (Winiger 1981:63, Taf.14-4)	Open twining with fine threads, 14x8.5cm, Pfyn culture.
FELD-006 (Winiger 1981:63, Taf. 14-2)	Dense open twining with thick threads, 25x17cm, Pfyn Culture. Thick threads close together, contrast with open twining of FELD-005
FELD-007 (Winiger 1981:162, Taf. 61-2)	Roll of plain weave, 15.2cm wide, length unknown, Horgen Culture.
FELD-008 (Ruoff 1981:261, fig. 16)	Net with fine threads.
FELD-009 (Winiger 1981:166,170, Taf. 67-3)	Open twining of fine threads with bast frame, 20x22.4cm including frame, possibly a sieve.
FELD-010 (Winiger 1981:206, Abb. 42)	Circular basket with central hole, Horgen Culture.
FELD-011 (Ruoff 1981:264, fig. 20)	Plain weave bast strips, 18x16cm, un-spun bast strips, thread diameter 1-2cm both, interpreted as matting, Horgen Culture.
FELD-012 (Winiger 1981:190-191,taf.76.3)	Knotless netting with two twists in each loop, 37x28cm, one edge appears drawn together, possibly a bag, Horgen Culture.

(FIMO-) Fimon-Molino Casarotto, Vicenza, Italy *Site*: Neolithic settlement in the Val Padana, waterlogged site, Square Mouthed Pottery culture (SMP), radiocarbon dates 4571- 4350 cal. BC. (2 sigma). *Cloth:* Impression of a binding strip on the resin of an arrow head, two impression of cloth on pots. *Other:* Use-wear on stone tools shows skin working. *Ref:* Bagolini et al. 1973, Skeates 1994 (dates).	
FIMO-001 (Bagolini, Barfield, & Broglio 1973: 201, fig. 31)	Impression of a binding strip on the resin of an arrow with a leaf-shaped arrow head.
FIMO-002 (Bagolini, Barfield, & Broglio 1973: 186, fig. 21)	SMP pot with impression of twined cloth on the base, open twining (?).
FIMO-003 (Bagolini, Barfield, & Broglio 1973: 186, fig. 21)	SMP pot with impression of cloth on the base.
(GRIC-) US Navy Support Site, Gricignano d'Aversa, Caserta, Campania, Italy *Archive*: Museo Nazionale Preistorico Ethnografico "L.Pigorini" *Site*: Copper Age to Early Bronze Age village and cemetery covered with volcanic ash, Laterza period. *Cloth*: Mineral preserved textile on an axe. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:210	
GRIC-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:210-211)	Plain weave, hemp, 2S/2S, thread diameter 0.2-0.45/0.2-0.25.
(GRUN-) Grünerwerk Gallery, Hallstatt salt mines, Upper Austria, Austria Archive: Vienna Naturhistorisches Museum *Site:* Galleries of a salt mine. Salt preservation. Grünerwerk 1650-900 cal. BC (2-sigma), middle bronze Age / Urnfield. *Cloth:* Animal skins, wool and linen, skin hat, carry sacks, straps, hand leathers, wool and linen plain weave and twill textiles. *Other*: Animal skin strips used to sew wooden artefacts. *Ref*: Barth 1992, Barth & Neubauer 1991, Barth & Lobisser 2002, Barth 1982, Barth 1994, Grabner, Reschreiter, Barth, Klein, Geihofer, & Wimmer 2006, Grömer 2005, Hundt 1960, Ryder 1993, Reschreiter 2005	

GRUN-001 (Hundt 1960:129-130, Taf.15; cloth number 26)	2/2 twill cloth, linen or hemp, 16x8.5cm, both z-spun, thread diameter 0.6-0.8/0.5-1mm, 6 warps/cm, 12 wefts/cm, stitching on the back of cloth.
GRUN-002 (Barth 1992:124-5, number.5 86.599)	Carry sack of cow-skin and wood, 78cm high, top opening 22x36cm, sewn with animal strips with wooden supports.
GRUN-003 (Barth 1992:124, number 4 86.567)	Carry sack of cow-skin and wood, 78cm high, top opening 20x37cm, sewn with animal strips with wooden supports, beige-brown.
GRUN-004 (Barth & Lobisser 2002:15)	Cone-shaped fur hat with tassel, animal skin, fur facing inwards, seams connect triangular-shaped panels.
GRUN-005 (Hundt 1960;129-130, Taf.12; cloth number 22)	Light natural yellow colour, plain weave wool cloth with turned and sewn upper edge, 16x14cm, both s-spun, no selvedges, thread diameter 1.4/3-4mm, thread count 8x1.5 / cm. Turned edge with seam, side edge with stitches, sewing thread mixed with dark hairs.
GRUN-006 (Hundt 1960;129-130, Taf.16; cloth number 23)	Fragment of plain weave woollen cloth with unattached rips border, 11x5cm. Main cloth both s-spun, thread diameter 0.6-2mm, thread count both 6 per cm, natural colour with bristly hair, damaged remains of a seam. Rips border 0.5x7cm, both s-spun, thread diameter 0.4/0.4-0.5mm, thread count 24/7double wefts per cm, white wool.
GRUN-007 (Hundt 1960:126-150,Taf.14.1; cloth number 24)	Light yellow wool cloth in plain weave, 9x6cm, s/z, thread diameter both 1-1.6mm, thread count both 6 per cm, seam on upper edge with natural colour wool with dark hair and another 3cm below o pure white s-spun wool.
GRUN-008 (Hundt 1960:126-150, Taf.16.1; cloth number 25)	Plain weave cloth in natural light yellow, 21x8cm, no selvedges, s/z, thread diameter 1.2-1.5/1-1.5mm, thread count 6 per cm.
GRUN-009 (Hundt 1960:126-150, Taf.14.2, cloth number 27)	2/2 twill in hemp or flax, 8x5cm, both z-spun, thread diameter 0.8-1/1.2mm, thread count 9/6-7 per cm, natural colour, cloth 1.4-2mm thick.
GRUN-010 (Hundt 1960:126-150, Taf.16.2; cloth number 28)	Fulled plain weave woollen cloth, 26x7cm no selvedges, z/s, thread diameter 1.5-1.6/1.2-1.4mm, thread count 4 per cm, one edge over sewn with slanting stitches, sewing thread z-spun, 2.5mm diameter.

(HAUT-) Hauterive Champréveyres, Lake of Neuchâtel, Switzerland *Site*: Final Bronze Age village with two occupation phases: first phase 1050-1040 BC and second phase 990-960 BC: dates from piles range 1050 -860 BC *Cloth*: Rare wool thread. *Other*: Willow-bast cords, a wool thread inside a bead and ring-shaped "ropes" twisted from wood or fibres from clematis, white pine, yew and hazelnut. *Ref*: Reinhard & Pillonel 1989, Rast-Eicher & Reinhard 1998:285.	
HAUT-001 (Reinhard & Pillonel 1989:285, Rast-Eicher & Reinhard 1998:285)	Sheep's wool thread inside a tubular bead, 2S, thread diameter 0.7-1mm.
HAUT-002 (Reinhard & Pillonel 1989:145-147; HR2212)	Three strand plaited cord, willow bast strips, un-spun, plait diameter 9.4mm.
HAUT-003 (Reinhard & Pillonel, 1989: 145-147; HR2208)	Simple cord, willow bast, s-spun, thread diameter 5-5.5mm.
HAUT-004 (Reinhard & Pillonel 1989:147; HR2201 & HR2307)	Two pieces of 2-ply cord, willow bast, s2Z, diameter 3-4mm, simple threads 1.8-2mm.
HAUT-005 (Reinhard & Pillonel 1989:147; HR2204 & HR2220)	Two pieces of 3-ply cord, willow bast, diameter 8-10mm, simple threads 3.5 -5.2mm.
(HORN-) Hornstaad Hörnle IA, Lake Constance, Germany *Archive*: Constance National Archaeology Museum, Hemmenhofen, Kreis Konstanz *Site*: Lake dwelling settlement site, waterlogged preservation, textiles mainly from late Neolithic levels, dendro date c.3900 BC. *Cloth*: Tree bast and flax fibre cloth, plain weave, twining, thread, cord, sieves, small drawstring bag, twined pile hats, nets. *Other*: Flax processing debris. *Ref*: Körber-Grohne 1987, Körber-Grohne & Feldtkeller 1998, Schlichtherle 1990.	
HORN-001 (Feldtkeller 2004:59)	Conical hat bast, twining with pile.

HORN-002 (Feldtkeller & Kȍrber-Grȍhne 1998:171, Taf.3c,5e, cat.21; Ho 86 Q 41/45-4)	Fragment of linen net, Pfahlbauknoten with alternating rows of knots, 17x21cm, s2Z, mesh size 1cm, thread diameter 0.9 - 1.2 mm.
HORN-003 (Schlichtherle 1990:196, Taf.46, cat.1135-1137; HO869)	Long strips of un-processed tree bast strips, length 28cm. From AH-3
HORN-004 (Schlichtherle 1990:196, Taf.46, cat.1140)	Uncharred bast strips 2-3mm wide ad 2-7.5cm long. From AH1-3.
HORN-005 (Schlichtherle 1990:194, Taf.51,cat.1076; HO71/42)	Plaits from simple twisted bast threads.
HORN-006 (Feldtkeller & Kȍrber-Grȍhne 1998: 177, Taf.14&15, cat.71; Ho 87q85/39-21)	Large sheet of open twining with thread sewn onto the surface, 35x51cm, lime bast, distance between rows 2-3cm,passive threads un-spun, active elements s2Z thread diameter 4mm, sewn on thread 2-ply thread diameter 3.5-4.5mm
HORN-007 (Feldtkeller & Kȍrber-Grȍhne 1998:171, 133, Taf. 2f, cat. 24; Ho 87Q 45/40-55	Several fragments of linen net with Pfahlbauknoten, possibly all from the same net, associated with a short tree bast thread 6x4.5cm, net thread s2Z, thread diameter 1.3-2.0mm, mesh width 2.5-3.5cm, short strip of tree bast simple, loose z-twist.
HORN-008 (Feldtkeller & Kȍrber-Grȍhne 1998:172, Taf. 2,g. 5,f.Cat. 26; Ho 80 Q 46 / 45-28-4	Fragment of linen net with Pfahlbauknoten, 5x8.5cm, s2Z, thread diameter 2.0 - 2.7 mm tightly spun, mesh width 2.5-3cm.
HORN-009 (Feldtkeller & Kȍrber-Grȍhne 1998:171, Taf. 2h, Cat.17; Ho 87Q 43 / 40-48	Fragment of linen net with Pfahlbauknoten rows worked in the same direction, s2Z thread diameter 0.8 - 1.0 mm, mesh width 2-7mm.

HORN-010 (Körber-Grohne & Feldtkeller 1998: 171,Taf.3b, cat.16; Ho 87Q 43 / 40-48)	Two fragments of net with Pfahlbauknoten, rows worked in the same direction, largest piece 6x6cm, Some of the fibres remain un-separated, others are only partially separated, showing that the hackling was only partial. S2Z, thread diameter 0.8 - 0.9 mm, mesh width 3 - 8 mm.
HORN-011 (Feldtkeller & Körber-Gröhne 1998:171, Taf.3a, cat.23; Ho 87Q 48/43-11	Several fragments of linen net with Pfahlbauknoten including one complete mesh, possibly all from the same net, largest pieces 6.4x2.6cm, s2Z , tightly spun, thread diameter 1.3-2.0mm, mesh width 1.5-2.5cm, short strip of tree bast simple, loose z-twist.
HORN-012 (Feldtkeller & Körber-Gröhne 1998:171, Taf.4a, cat.19; Ho 80 Q 43 / 45-24-2)	Linen net with Pfahlbauknoten, rows worked in the same direction, 12-18cm, s2Z, thread diameter 0.8-1.3mm, mesh width 3-8mm.
HORN-013 (Feldtkeller & Körber-Gröhne 1998:170, Taf.4.c, cat.10; Ho 87Q26/61-0-2)	Fragment of fine-thread linen net with fisherman's knots 9x14, z2S thread diameter 0.4 - 0.5 mm, mesh width 4cm.
HORN-014 (Feldtkeller & Körber-Gröhne 1998:170, Taf.4b& 5.bc cat.9; Ho 80 Q 26 / 61-20-2)	Bundle of fine linen net with tree bast starter edge, bundle measures 5x12cm, s2Z (net) thread diameter 0.2-0.3m, z2S (starter cord) thread diameter 2.5-3mm, mesh width 2-3cm.
HORN-015 (Schlichtherle 1990:194,Taf.51, cat.1077; Ho 71/42)	Twining with plaited passive elements. Plaits from simple twist threads from 4.5-7mm in diameter, twined with s-twist thread, thread diameter 1.5-1.8mm, leaving spaces of 2cm between twining. Total of 12 plaits for 11cm.
HORN-016 (Schlichtherle 1990:195,Taf.48,cat.1107;Ho1875)	Sieve type object with a combination of coiled basketry forming an oval-circular frame and twined centre, mesh width 1,5-2mm.
HORN-017 (Feldtkeller & Körber-Gröhne 1998:171, Taf.6a, cat. 14; Ho 86 Q 34 / 51 – 6)	Fragment of wide-mesh linen net with fishing net knots and tree bast edge cord, threads preserved up to 13cm, s2Z (net) thread diameter 1.8-1.9mm, three simple threads twisted together with diameter of 3.5 - 4.0 mm, mesh width 6.5cm.

HORN-018 (Feldtkeller & Körber-Gröhne 1998:171, Taf.5a, cat.12, Ho 87Q 42 / 40-20)	Fragment of fine, wide-mesh net with fishing net knots, associated with a pieces of tree bast edge – thread, 7x13cm, s2Z (net) thread diameter 0.5 - 0.6 mm, loosely spun, starting cord simple twist (tree bast) thread diameter 3mm, mesh width: over 30 mm, although not really measurable.
HORN-019 (Feldtkeller & Körber-Gröhne 1998:171, Taf.8c.d, cat.11;Ho 73 881)	Fragment of fine, wide-mesh linen net with fishing net knots and tree bast edge cord, Zply, spin direction unidentified (net) thread diameter 0.4-0.6mm, 2S (net edge) thread diameter 1.4 - 1.5 mm, mesh width 3.9-4.2cm.
HORN-020 (Feldtkeller & Körber-Gröhne 1998:171,cat.13; Ho 87 Q 42/39-37)	Fragment of fine, net with fishing net knots, s2Z, thread diameter 0.5 - 0.7 mm, loosely spun. Individual threads 0.3 - 0.4 mm, mesh width 2-4cm.
HORN-021 (Feldtkeller & Körber-Gröhne 1998:171, cat.15; Ho 87 Q 43/40-48)	Fragment of close-mesh linen net in Pfahlbauknoten, rows worked in the same direction, 9x9cm, fibres only partially separated through hackling, thread diameter 0.7 - 1.0 mm tightly spun, mesh width: 3 - 7 mm.
HORN-022 (Feldtkeller & Körber-Gröhne 1998:171, cat.18; Ho 87 Q 43/39-47).	Fragment of close-mesh net, Pfahlbauknoten, rows worked in the same direction, 3x5cm, s2Z, thread diameter 0.8-1mm, mesh width 3-5mm.
HORN-023 (Feldtkeller & Körber-Gröhne 1998:171, cat.20; Ho 87 Q 44/40-46)	Fragmentsof linen net with Pfahlbauknoten and combination of same-direction and alternating mesh rows, all fragments together 11x15cm, s2Z tightly spun, thread diameter 0.9-1.2mm, rows worked in alternating direction: mesh width: 7 - 17 mm, rows worked in same direction: mesh width : 2-7mm.
HORN-024 (Feldtkeller & Körber-Gröhne 1998:171, cat..22, Ho 87 Q 45/41-8)	Fragment of linen net with Pfahlbauknoten, some rows worked in the same direction, 6x9.5cm, fibre bundles only partially separated, s2Z tightly spun, thread diameter 0.9-1.3mm, mesh width 2-7mm.
HORN-025 (Feldtkeller & Körber-Gröhne 1998:172, cat.25; Ho 87 Q 46/46-25-5	Net with Pfahlbauknoten, rows worked in the same direction, 10x18cm, s2Z tightly spun, thread diameter 1.8-2.2mm, mesh width: 15 - 25 mm, fibres hardly separated, which means they were barely hackled.
HORN-026 (Feldtkeller & Körber-Gröhne 1998:172, cat.27; Ho 87 Q 46/44-27 – 4)	Net with Pfhalbauknoten, linen net with tree bast cord, 2Z (net) thread diameter 2.7 - 2.8 mm, tree bast simple twist (but possibly part of a two ply that has unravelled), thread diameter 2.7 - 2.8 mm, mesh width: 40 mm.

HORN-027 (Feldtkeller & Körber-Gröhne 1998:178, Taf.21,cat.88;Ho85Q55/49-15)	Close twining in fine oak or lime bast threads, no gaps between the twining construction, 14x27cm, thread diameter 0.8-1.1mm.
HORN-028 (Feldtkeller & Körber-Gröhne 1998:169, Taf.1c, cat.3; Ho 84Q36 /29-62)	Plain weave linen textile, two fragments, loose weave, 1.5x2.5cm and 1x2cm, z2S, 6-7 threads per cm, fibres are well hackled.
HORN-029 (Feldtkeller & Körber-Gröhne 1998:169,Taf.1a, cat.1; Ho 87Q44/40-46)	Plain weave linen textile fragments, 1x1cm to 4x4cm, dense weave, 6 threads per cm, z2S thread diameter 0.6-0.9mm, flax fibres are well separated by hackling.
HORN-030 (Feldtkeller & Körber-Gröhne 1998:169,Taf.1b, cat.2; Ho87Q42/39-28)	Plain weave linen textile, dense weave, 9-10 threads per cm, flax fibres are well separated by hackling.
HORN-031 (Feldtkeller & Körber-Gröhne 1998:170,taf.1d, cat.4; Ho 84Q36/29-59)	Plain weave linen textile, loose weave, 2x2cm, z2S thread diameter 0.8-1mm loosely spun, 7-8 threads per cm.
HORN-032 (Feldtkeller & Körber-Gröhne 1998:178,cat.89; Ho87Q40/38-12)	Thick twining. 1.5x3.5cm.
HORN-033 (Feldtkeller & Körber-Gröhne 1998:175,Taf.12.c.d, cat.64;Ho 87 Q39/41-1)	Plain weave lightly (or un-spun?) bast strips, possibly lime bast. 2x3cm, thread diameter 0.8-2.0 mm, light z-twist, loose weave.
HORN-034 (Schlichtherle 1990:194,Taf.49-51, cat.1082-1100)	Twining fragments found together and possibly belonging to the same piece, tree bast, distance between rows 2-3cm, passive elements simple thread, thread diameter 2-3mm.

HORN-035 (Körber-Grohne & Feldtkeller 1998:176, Taf.18 d.e, cat.79; Ho84Q 44/29-29)	Open twining with pile, elm bast, 2.5x3cm.
HORN-036 (Schlichtherle 1990: 194,Taf.52,cat.1071; Ho881)	Net fragment with fine threads and thick cord edge, part of net 32x85cm, net thread diameter 0.4-0.6mm, 2Z, mesh width 3.9-4.2cm. Cord edge 2S with two knots.
HORN-037 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:278, Körber-Grohne & Feldtkeller 1998:170,cat.5;Ho Q48/49c-28-1)	Draw string bag in plain weave linen cloth, 9.5x17cm, draw string also of plain weave cloth.
(ICEM-) Iceman, Hauslabjoch / Similaun, Tyrolean Alps, Italy *Archive*: Bolzano Museum, Alto Adige / Sud Tyrol *Site*: Mummified and frozen body, clothing and equipment of a man who died at high altitude, radiocarbon dating c. 3300 cal. BC. *Cloth*: Clothing and equipment of animal skins, netting and twined tree bast. *Other*: Two birch-bark containers, wooden artefacts. *Ref*: Pfeifer & Oeggl 2000, Egg 1993, Groenman-van Waateringe 1993, Groenman-van Waateringe & Goedecker-Ciolek 1992, Goedecker-Ciolek 1993.	
ICEM-001 (Pfeifer & Oeggl 2000: 70-76, tab.1)	Sample of 295 bast threads / cords from the Iceman and his equipment including from the grass cloak, strings, sewing thread for tunic and birch-bark container. All identified as lime bast, either in strips or processed fibres.
ICEM-002 (Pfeifer & Oeggl 2000: 70-76, tab.1)	Thread used for sewing, microscopic analysis shows the fibres were well separated and must have been processed by retting.
ICEM-003 (Goedecker-Ciolek 1993:112)	Fragment of wide-mesh net, grass and bast fibres, thread diameter 2-4mm, plied, variety of knot-types.
ICEM-004 (Goedecker-Ciolek 1993:109)	Bear skin conical cap with chin strap, c.25cm high, shaped pieces sewn together with overstitch, chin straps attached either side, worn fur inside.
ICEM-005 (Egg 1993:72-73)	Upper garment in alternating dark and light fur stripes, probably goat skin, closed at the front, no evidence of sleeves, probably knee length.

ICEM-006 (Goedecker-Ciolek 1993:106)	Pair of leggings, sewn to create conical shape, 65/67cm long, 49/46cm upper edge, 26cm lower edge, probably goat skin, patched ad repaired, red deer skin tongues to fit into shoes, suspenders used to hand leggings from belt.
ICEM-007 (Egg 1993:39)	Animal sinew used to sew skins, such as loincloth.
ICEM-008 (Goedecker-Ciolek 1993:108)	Goatskin loincloth, several long strips sewn together with sinew (ICEM-007) 50cm long, 23-33cm wide tapering in centre although back half missing, would have been held up by a belt.
ICEM-009 (Goedecker-Ciolek 1993:101)	Pair of shoes with cord netting, thread diameter 2-6mm, red-deer uppers and bear skin sole, stuffed with grass when worn, right shoe found attached to foot.
ICEM-010 (Egg 1993:80)	Three pieces of twined outer cape, at least 90cm long, grass warp with bast cord weft, open twining, front cord fastening.
ICEM-011 (Egg 1993:49)	Quiver, sew tapered shape with wooden support, possibly chamois, ibex or roe deer skin, containing arrows, two sinews, a tree-bast cord, bundle of bone points and curved antler point.
ICEM-012 (Goedecker-Ciolek 1993:112)	Oval, tubular birch-bark container with holes for seam, base 15x18cm, 20cm high.
ICEM-013 (Goedecker-Ciolek 1993:112)	Birch-bark container with zigzag side seam of lime bast thread, base 15x10cm, 20cm high.
ICEM-014 (Pfeifer & Oeggl 2000: 70, tab.1)	Lime bast thread used to sew birch-bark container.
ICEM-015 (Egg 1993:58)	Knife sheath, 12cm long, lime bast, open twining, stitched up one side to create pointed sheath, probably attached to belt with skin strip.
ICEM-016 (Egg 1993:50)	Calf-skin belt-pouch, pouch 20cm long, belt fragments 182.5cm long, stitched and repaired, contains flint scraper, flake, flint drill, bone awl, tinder.
ICEM-017 (Spindler 1995:92-94)	Cords and cord impressions associated with u-shaped hazel rod, lime bast, thread diameter 6-8mm, 2S.
ICEM-018 (Egg 1993:50)	Straps: mushroom strap possibly goatskin, straps around the axe head too worn to identify.

(IRGE-) Irgenhausen, Pfäffikon, Zürich Canton, Switzerland *Archive*: Museum für Völkskunde, Basel, Schwab Museum, Biel *Site*: Multiple period waterlogged lake dwelling, Neolithic to final Bronze Age, mainly Pfyn culture. *Cloth*: Cloth fragments from Neolithic (mainly Pfyn culture), early and final Bronze Age. Six brocaded fragments of cloth have no equivalents, however previously misquoted as Neolithic. Radiocarbon dates to 1600-1400 cal.BC). *Ref*: Vogt 1937, Bazzanella, Mayr, Moser, & Rast-Eicher 2003:226-227, Brunello 1973	
IRGE-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:228-227, Vogt 1937:76-90)	Woven textile with decoration in supplementary wefts, 22x16cm, linen, plain weave with supplementary weft, 2S/2S, thread diameter 0.5/0.5mm, thread count 11/11 per cm, dye analysis blue, red, purple, yellow, thread for brocade 2S with thread diameter 1mm, pattern analysis Vogt 37:76-90.
(KANA-) Zürich-Kanalisation Seefeld, Zürich Canton, Switzerland *Archive*: Swiss National Museum Zurich *Site*: Waterlogged settlement site, with stratigraphic sequence, dendro. dates: Pfyn Culture c.3816-3441 BC, Horgen culture c.3239 - 2882 BC Corded ware c.2718-2675 BC. *Other*: Coded Ware deer horn buttons. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:212-214, Rast-Eicher 1997.	
KANA-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:213; FK 6828, no SLM-Inv)	Ball of thread, 5.5x4cm, linen, z-spun, thread diameter 0.5mm, single thread wound in ball ready to be plied with a second thread, Horgen culture.
KANA-002 ((Bazzanella, Mayr, Moser, & Rast-Eicher 2003:214; FK 6828, no SLMInv)	Twelve fragments of plain weave linen textile, simple selvedge, one piece with sewn on reps strip and possible buttonhole, max 15x16cm, 2S/2S, thread diameter both 0.3mm, thread count 12/35 per cm, Corded Ware.
(LAND-) Landsteinerkehr, Hallstatt salt mines, Upper Austria, Austria Archive: Vienna Naturhistorisches Museum *Site:* Galleries of a salt mine. Salt preservation. Landsteinerkehr, North Group, radiocarbon dates of North Group: 1390-1040 BC 1-sigma interval cal. *Ref*: Grömer 2005, Barth 1992.	

LAND-001 (Barth 1992:123, number 3; 86.567)	Carry sack of cow-skin and wood, 81cm high, top opening 25x40cm, sewn with animal strips with wooden supports, beige-brown.
(LATT-) Lattrigen Hauptstation-aussen, Sutz-Lattrigen, Canton Berna, Switzerland *Archive*: Servizio Archeologico del Cantone di Berna *Site*: Waterlogged settlement site on lake Biel, Final Neolithic, dendro date 3203 - 3137 BC. *Cloth*: Lime bast twining and basketry, linen plain weaves with selvedge. *Ref*: Winiger 1995, fig.31&34, Bazzanella, Mayr, Moser, & Rast-Eicher 2003:238-240.	
LATT-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:240; 64276)	Plain weave basket, 17.5x22cm, lime bast strips, un-spun, strip width both 6-10mm, simple edge, bunched strip and plait form handle.
LATT-002 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:239; 63910)	Four pieces of twining with un-spun warp and plied weft, max 17x6.5cm, tree bast, un-spun/2S, thread diameter 6/3mm, plaited starting cord.
(LUCO-) Lucone di Polpenazze, Polpenazze del Garda, Brescia, Italy *Archive*: Musei Civico Archeologico della valle Sabbia, Gavardo. *Site*: Multiple stratigraphy settlement site, dated from early to middle Bronze Age. *Cloth*: All cloth fragments from same place, strato III, zone A, probably from same piece. *Other*: Loom weights and bone spatual associated with weaving from same level as cloth. *Ref*: Bazzanella & Mayr 1999	
LUCO-001 (Bazzanella & Mayr 1999: scheda 1; ST 14321/1_	Fragment of textile with fringe, 7.4x5.6cm, plain weave, linen, 2S/2S, thread diameter 0.4-05/0.6, thread count 18/16, selvedge on one edge, knotted fringe 4cm long.
LUCO-002 (Bazzanella & Mayr 1999: scheda 1)	Fragment of textile, 11.1x11.3cm, plain weave, linen, 2S/2S, thread diameter0.32/0.64mm, thread count 18/12-13 per cm, selvedge on one edge.
LUCO-003 (Bazzanella & Mayr 1999: scheda 2)	Fragment of textile, 2.9x6.6cm, plain weave, linen, 2S/2S, thread diameter 0.4x0.4mm, thread count 12/16 per cm, knotted fringe with four warp thread per knot.
LUCO-004 (Bazzanella & Mayr 1999: scheda 3)	Fragment of textile with fringe, 4.3x7.5cm, plain weave, linen, 2S/2S, thread diameter 0.42x0.48 mm, thread count 12/16/cm, knotted fringe with four warps per knot.

LUCO-005 (Bazzanella & Mayr 1999: scheda 4)	Fragment of textile with fringe, 6.5x4.1mm, plain weave, linen, 2S/2S, thread diameter 0.35x0.41 mm, thread count 16-17/12cm, knotted fringe with four warps per knot.
LUCO-006 (Bazzanella & Mayr 1999: scheda 5)	Fragment of textile, 4.2x7.4cm, plain weave, linen, 2S/2S, thread diameter0.5/0.4-0.5, thread count both 12-13 per cm, stitching with 2S thread over cloth surface to reinforce or mend.
LUCO-007 (Bazzanella & Mayr 1999: scheda c)	Fragment of twining, 5.8x3.4, twining slant stitch Z, un-spun/s-spun, thread diameter 4.5/6mm.
(LUSH-) Lüscherz XVI Dorf on Lake Biel, Berna Canton, Switzerland *Archive*: Berna Museum *Site*: Lake dwelling site, *Cloth*: Spindles of thread, plain weave cloth with fringe *Other*: Bundles of ribs used for heckling *Ref*: Vogt 1937	
LUSH-001 (Vogt 1937:63-66, Abb.102-4, Gewebe 9; BHM 3631)	Textile with reps border and fringe, 13.4x7cm, linen, 2S/2S, thread diameter both 0.5mm, thread count plain weave 10/10 per cm, thread count reps 6/26 per cm, fringe of three braided wefts with knot Cortaillod Culture.
LUSH-002 (Vogt 1937:48, Abb.73)	Spindle wound with simple thread, 11x4.8cm.
(MOLI-) Molina di Ledro, Trentino, Italy *Archive*: Museo Tridentino di Scienze Naturali, Trento & Castello del Buonconsiglio, Trento *Site*: Waterlogged lake dwelling, radiocarbon dates 2329-1110 cal.BC, early to middle Bronze Age, Polada culture. *Cloth*: Plain weave linen cloth, netting, balls of plied thread, sewn on beads and embroidery, cloth from early levels of excavation. *Other*: Spindle whorls, loom weights, weaving knives, dress pins, dye plants. *Ref*: Battaglia 1943, Perini 1970, Bazzanella, Mayr, Moser, & Rast-Eicher 2003:148-174, Bazzanella & Mayr 1995, Skeates 1994:216	
MOLI-001 (Bazzanella & Mayr 1995:114-116)	Narrow strip of woven textile with lozenge decoration, 6.8x209cm, 2S/2S, thread diameter 0.5-0.6x0.5-0.7mm, thread count 16/12 per cm, simple selvedges, lozenge pattern in twill, resinous substance over pattern area.
MOLI-002 (Bazzanella & Mayr 1995:117-118)	Narrow strip of plain textile with fringe at one end and loop at the other, 2.2-3x204cm, linen, 2S/2S, thread diameter 0.4-0.5/0.4-0.6mm, thread count 18/12 per cm, simple selvedges, ends covered with sewn cloth, braided fringe.

MOLI-003 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:164-165; 8937 Vetro. 6, n. 2)	Fragment of plain weave textile with selvedge, 21.3x14.2cm, linen, 2S/2S, thread diameter 0.4-0.5/0.3-0.4, thread count 12/10-14 per cm, one simple selvedge, loosely woven.
MOLI-004 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:: 166; 8937/A736vetro/ 6, Vetro.3)	Fragment of plain weave textile, 11.6x6.3cm, linen, 2S/2S, thread count 0.4-0.5mm, thread count 16/18 per cm, densely woven.
MOLI-005 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:167; 159 Vetro.2)	Ten fragments of plain weave, possibly the same piece, max 5.9x1.9cm, linen, 2S/2S, thread diameter 0.6-07/0.6mm, thread count 14-16/10 per cm,
MOLI-006 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:168)	Fragment of plain weave with seeds sewn onto surface, 4x4.5cm, linen, 2S/2S, thread diameter 0.4/0.6mm, thread count 14-16/12 per cm, 21 seeds 2.5-3.5 in diameter of *Lithospermum offcinale* or *Lithospermum purpureo-caeruleum* sewn on with linen thread.
MOLI-007 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:169; 8934 Vetro. 6, n. 1)	Four fragments of plain weave, max 12.1x7.9cm, linen, 2S/2S, thread diameter 0.6x0.5mm, thread count 14/16 per cm.
MOLI-008 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:170-171)	Plain weave with embroidery, 9.5x9.6cm, linen, 2S/2S, thread diameter *0.3-0.4/0.4-0.5mm, thread* count 13-18/12-14 per cm, selvedge on one edge, embroidery in linen thread 0.6mm diameter in a 2cm strip.
MOLI-009 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:172; 8735/A73 Vetro.6)	Fragment of knotless netting, 12.8x16cm, linen, 2S, thread diameter 0.6mm, mesh spaces 3x1.5mm, fine mesh interpreted as hairnet or bag.
MOLI-010 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:173; 8933/A732 Vetro 6, n.5)	Ball of thread, 6x5.5cm, linen, 2S, thread diameter 0.4mm.
MOLI-011 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:174, left)	Un-spun thread in a ring-shaped bundle, 11.4mm, tree bast possibly lime, un-spun, thread diameter less than 1mm.

MOLI-012 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:174 right)	Un-spun thread in a ring-shaped bundle, 10.7mm, tree bast possibly lime, un-spun, thread diameter less than 1mm.
MOLI-013 (n.4,scheda Mayr. n. 10)	Dense plain weave textile in two pieces.
MOLI-014 (MTSN Ledro NP 154)	Multiple fragments of two-plied thread, 2S, thread diameter less than 1mm.
MOLI-015 (MTSN Ledro IP 152)	Multiple fine spun threads, thread diameter 0.5-0.75mm.
MOLI-016 (MTSN Ledro 18-155)	Multiple fragmentary fibres, un-spun, thread diameter 1-2mm.
MOLI-017 (Resti. n. Inv. 149/0004 9719)	Mass of broken un-spun fibres, un-spun, thread diameter c.1mm.
MOLI-018 (MTSN Ledro IP 150)	Four small fragments of plain weave cloth, spun thread, thread diameter 1-1.2mm, less than 10 threads per cm.
(MOZA-) Zürich Mozartstrasse, Zürich Canton, Switzerland *Archive*: Swiss National Museum *Site*: lake dwelling Neolithic to Final Bronze Age, dendro dates: Cortaillod culture 3908-3834 BC, Pfyn culture 3668-3538 BC, Horgen 3126-2882 BC, Corded Ware culture 2705 - 2498 BC, early Bonze Age 1647-1502 BC, Bronze Age 1057-953 BC. *Cloth*: Twined cloth and multiple cloth finds. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:215-217, Rast-Eicher 1997.	
MOZA-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:216; 5400 SLM inv. 79515)	Eight fragments of twining, max 27x17cm, lime bast, both un-spun, thread diameter 4-6/3-5mm, weft realised in 2/2 twill, with possible zig-zag pattern, Corded Ware.
MOZA-002 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:217; FK 7691 SLM inv. 79487)	Fifteen fragments of twined textile, 10x11cm, oak bast, close twining, 2S/2S, thread diameter 2.5x1.5 cm, upper boarder turned and sewn, buttonhole on edge, interpreted as bag, Corded Ware.

(MURT-) Murten, Fribourg Canton, Switzerland *Archive*: Swiss National Museum, Zürich *Site*: Lake dwelling settlement, late Neolithic(?) old excavation poorly dated. *Ref*: Schlichterle 1988, Vogt 1937:36-37, 75.	
MURT-001 (Vogt 1937:37)	Two piece of plain weave cloth joined with a section of knotted netting, 4.2x3.8cm, seed beads of *Lithospermum purpureo-coeruleum* sewn on in rows through two holes made in the seeds.
MURT-002 (Vogt 1937:75)	Plain weave with two horizontal stripes, 5x3.2cm, stripes in weave using supplementary wefts in twill, four rows of twill separated by eleven rows plain weave, possibility of coloured stripes.
(MYTH-) Zürich Mythenquai, Zürich Canton, Switzerland *Archive*: Swiss National Museum *Site*: Multi-period lake dwelling settlement Horgen and Corded Ware, dendro.dates Corded Ware 2680-2548 BC. *Cloth*: Multiple cloth finds. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:218-219. Rast-Eicher 1992	
MYTH-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:218-219; FK 1375 no SLM inv.)	Fifteen fragments of plain weave textile with pile, max 12x9.5cm, lime bast, 2S/2S, threada diameter 0.5/0,5mm, thread count 13/10 per cm, simple selvedge, starting border woven as strip and mounted on the loom, lime bast strip pile added with Turkish knots, Corded Ware
(NIED-) Niederwil-Egelsee, Gachnang, Thurgau Canton, Switzerland *Archive*: Archaeology Office of Frauenfeld *Site*: Waterlogged settlement, rows of densely packed buildings, up to fifteen rebuilding phases, dendro date 3660-3585 BC Pfyn culture. *Cloth*: Cord, thread, balls of thread, twining with pile, twining, basketry, nets. *Other*: Wooden artefacts including weaving sword. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:245-252, Hundt 1991	
NIED-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:247,Hundt 1991,251-272;797)	Compact knotted netting, 7x6.5mm, tree bast 2S, thread diameter 1.4mm.
NIED-002 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:248,Hundt 1991,251-272; 779a)	Six fragments of twining, 13x6cm, spaced weft twining, tree bast, 2S/2S, thread diameter 1.8-2.5/1.2-1.5mm, fringe along edge.

NIED-003 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:249,Hundt 1991,251-272; 799c)	Fragment of twining with pile, 6x5.5mm, warp tree bast possibly willow, weft linen, 2S/2S, thread diameter 2-2.5/1mm, starting border wraped around a cord and fixed with two rows of weft twining.
NIED-004 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:250,Hundt 1991,251-272; 779d)	Nine fragments of plain weave with selvedge, 7.5x2.8cm, linen, 2S/2S, thread diameter 0.3/0.3mm, thread count 24-30/16 per cm, simple selvedge.
NIED-005 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:251,Hundt 1991,251-272; 592)	Twelve fragments of closed-twining, 13x17.5mm, tree bast 2Z/2Z, thread diameter 2/1.5mm, shaped not sewn corner.
(PAIO-) Valle delle Paiole, Corte Franca, Brescia, Italy *Archive*: Soprintendenza archeologica della Lombardia *Site*: Lowland waterlogged site, possible lake dwelling. At least two phases of occupation, ceramics dated to Polada culture and early Bronze Age, middle Bronze Age c.1800-1500 BC. *Cloth*: Multiple layers of cloth found together, early to middle Bronze Age. *Other*: Spindle whorls and dress ornaments Polada culture, early Bronze Age. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:197-198	
PAIO-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:198)	23 fragments of woven textile found in a layered lump, max size 6x8cm, 1 of the fragments are very similar and probably belong to one piece: 2Z/2Z with weak Z twist, thread diameter both 0.5-1mm, thread count 7-10/5-7 per cm, simple selvedge on one piece. The other two fragments are denser and have thicker threads.
(PEST-) Pestenacker, Upper Bavaria, Germany *Site*: Waterlogged settlement site with house structures. Cloth artefacts from burnt layer inside a house, dendro. date 3491 BC. *Cloth*: Finds include twined hat, small fragments of textile, interwoven padding and thicker constructions interpreted as mats or carpets. *Ref*: Bartel 2004, Bartel & Schönfeld 2004	
PEST-001 (Bartel & Schönfeld 2004:124)	Cone-shaped twined hat with tassels and leather point.

(PETI-) Petit-Chasseur, Sion, Valais, Switzerland *Site*: Megalithic burial site with engraved statue stelae. Stele erected between 2700-2150 BC. *Cloth*: Fragments of burnt cloth in ditch dated c.2150 BC, early Bronze Age. *Other*: Representations of clothing on the statue stelae, stone spindle whorls deposited in final Neolithic / Bell Beaker period of site c. 2450 BC. *Ref*: Bocksberger 1976:86, planche 36, Gallay 1995:168-178, Rast 1995:150.	
PETI-001 (Bocksberger 1976: 27, 86, 129, pl. 39	4 Fragments of plain weave textile, probably linen, s/s, thread diameter 0.5-0.3mm both, thread count 12 per cm, both.
(REME-) Remedello Sotto, Brescia, Italy *Site*: Inhumation burial site, radiocarbon date 2800-2400 cal. BC. *Cloth*: Mineral replaced textile on a triangular dagger with rectangular base, from tomb 83, male grave. *Ref*: Biagi 1989, Acanfora 1956:355, De Marinis 1994	
REME-001 (Ornella Aconfora 1959: 355, fig. 9)	Plain weave (?), mineral replaced cloth on a dagger.
(ROBE-) Robenhausen / Wetzikon-Robenhausen Lake Pfäffikon, Zürich Canton, Switzerland *Archive*: Muséum Hist.Nat.Grenoble, Cambridge University Museum of Archaeology and Anthropology. Swiss National Museum, Zurich (SLM). *Site*: Multi-period lake dwelling site including Chassey, Cortaillod, Pfyn, Rössen, Michelsberg and Horgen, recent excavations include typological date c.3800-3400 BC, Pfyn culture. *Cloth*: Plain weave cloth, tree bast twining, balls of thread, spindles with thread, knotted nets, twining with pile, close twining, open twining various scales, reps ribbons. *Other*: Loom weights, weaving sword or bracking instrument, possible loom construction with weights for twining, flax seeds. *Ref*: Vogt 1937, Altorfer & Médard 2000, Bocquet 1970a:pl.84. Online museum catalogue at http://museum.archanth.cam.ac.uk/Collections	
ROBE-001 (Bocquet 1970a: 203, Bocquet 1970b: pl.84; Grenoble: Coll.M.D.D.68.7.987)	Fragment of twining.
ROBE-002 (Bocquet 1970a: 203, Bocquet 1970b: pl.84; Grenoble: Coll.M.D.D.68.7.986)	Fragment of plain weave textile.
ROBE-003 (Cambridge:1951.446A-E Dept.Arch,)	Five samples of "matted" and woven flax (possibly twined tree bast?).

ROBE-004 (Cambridge: Z39537 Dept. Arch.)	Flax seeds.
ROBE-005 (Cambridge: Z39541, Z2451, Dept. Arch.)	Fragment of rolled birch bark.
ROBE-006 (Cambridge: 2003.20 A-C, Dept. Arch.)	Three textile samples mounted for museum.
ROBE-007 (Cambridge: 2003.21 A-B, Dept. Arch.)	Two mounted samples: A of thread, presumed flax, and B "matted" flax.
ROBE-008 (Vogt 1937:52. A.bb. 84-85, Gewebe 3; SLM 554)	Plain weave with stripes worked in a type of twill, 16.5x8cm, 2S/2S, thread diameter 0.4/0.4mm, thread count 18/10 per cm, side border with reps two threads per row, stripes in weft created by rows of twill over 3 warp fibres, Pfyn Culture?
ROBE-009 (Vogt 1937:53-54,Abb. 87, Gewebe 4; SLM 559)	Plain weave textile, 12.5x7.5mm, linen, 2S/2S, thread diameter 0.3/0.3mm, thread count 12/18 per cm, side border with reps two thread per row, fringe made with groups of three weft, Pfyn Culture.
ROBE-010 (Vogt 1937:63-66,Abb. 100-101, Gewebe 8, SLM 79606, A563)	Plain weave textile with reps and decorative fringe, 8.4x7.5mm, linen, 2S/2S, thread diameter 0.7/0.7mm, thread count both 11 per cm, Closing boarder with reps and fringe finished with knots, Pfyn Culture.
ROBE-011 (Vogt 1937:52,Abb. 93-95, Gewebe 6,SLM 551)	Narrow band of reps woven textile, 6.5x2.5cm, linen, reps in the weft, 2Z/2Z, thread diameter 0.8/0.8, thread count 17/7 per cm, Pfyn Culture.
ROBE-012 (Vogt 1937:49-51,abb 80-82, Gewebe 1)	Multiple fragments of a single plain weave cloth with starting border and selvedge; weft of selvedge passes through shed twice, creating a ribbed effect. Selvedge does not coincide with shed of main cloth, so must have been controlled separately. When attached to the loom, the warp and weft of starting border become the weft and warp of main cloth.

(SEEK-) Seekirch-Achwiesen, Baden-Württemberg, Germany. *Site*: Lake dwelling settlement site with multiple layers. Textiles from the house area, radiocarbon dates 2860-2490 cal. BC, 1 sigma, Goldberg III-Gruppe. *Cloth*: twined tree bast, cord, un-spun bast strips, plain weave linen cloth. *Ref*: Feldtkeller 2004, Schlichtherle 2004.	
SEEK-001 (Feldtkeller 2004:65,Taf.5, Sa90Q98/149B-195)	Plain linen weave cloth with rips selvedge, 21.5x8cm, 2S, thread count 14x8-10 per cm, rips selvedge 19 threads per cm, over-sewn edge, weave slightly unbalanced with slight rips effect.
SEEK-002 (Feldtkeller 2004:65, Taf.4.13, Sa90 Q 96/149D-33)	Compact mass of twined tree bast, 7.5x18.5cm.
SEEK-003 (Feldtkeller 2004:65, Taf.4-12, Sa90Q98/149C-153)	Open twining, 7.5x5.5cm, z/2S, 10mm gaps between twining rows, Open twining with additional strips, like pile, added into the warp and included in the next twined row. Rows slant stitch S, followed by pair of Z and S slant-stitch rows.
SEEK-004 (Feldtkeller 2004:65, Taf.4-11, SA90Q98/149D-171)	Un-spun bast strip, 4.5cm.
SEEK-005 (Feldtkeller 2004:64, Taf.3-9, Sa90Q97/149D-96)	Tree bast strip, 10cm, lightly z-spun.
SEEK-006 (Feldtkeller 2004:68, Taf.3-8, Sa90Q96/149-83)	Two pieces of cord, 6 and 11cm long, s3Z, thread diameter 12mm.
SEEK-007 (Feldtkeller 2004:64, taf.3-7, Sa90Q97/149B-97)	Muddle of frayed bast strips, 5x6cm mass, light z-spun.
SEEK-008 (Feldtkeller 2004:64, Taf.3.6, Sa90Q97/149D-95)	Unstructured mass of tree bast strips, mass 8x9cm.

SEEK-009 (Feldtkeller 2004:64, taf.3-5, Sa90Q97/149C-137)	Knotted cord, 5x7.5cm, s2Z, thread diameter 10mm.
SEEK-010 (Feldtkeller 2004:64,Taf.3-4, Sa90Q97/149A-128)	Tree bast strips with simple knot, 2.5cm, un-spun.
SEEK-011 (Feldtkeller 2004:64, Taf.3-3 and 4-3, Sa90Q98/149C-181)	Twining with pile with starting loop (found with SEEK-012 and probably part of a larger cloth), 14-16cm, twining with pile, z-spun/z2S, thread count 2 per cm in warp and 2cm gaps between twining in weft. Starting row knotted through a loop. Unusual form of starting border formed with hanging pairs.
SEEK-012 (Feldtkeller 2004:64, taf.3-2 and 4-2, Sa90Q98/149C-175)	Twining with unusual starting border found with SEEK-011 and probably part of a larger cloth, 13.5x19cm, Twining with pile, slant stitch S, rows at intervals of 2.5, 1 and 1.5cm, z2S, border with starting cord z2S, 4mm diameter, warps bent double and laid over starting cord, and fastened with a row of twining. Another warp is added into the loop formed by the bent-double warp of the starting border and added into the next row of twining, pile hangs up to 10cm.
SEEK-013 (Feldtkeller 2004:63-4, taf.1 and 2, Sa90Q99/147D-144)	Cone shaped tree bast twining with pile, possibly part of a hat, 19x18.5cm when flat, from tip to lower edge 11.5cm, z2S, distance between rows 1.2cm, bast strips are barely twisted, added in at every half-twist of weft-twining.
SEEK-014 (Feldtkeller 2004:65, taf.3-10, Sa90Q98/149C-153)	Tree bast cords with knots, 5.5cm, s2Z, thread diameter 4mm.
SEEK-015 (Feldtkeller 2004:65, Sa90Q98/149C-88)	Remains of twining or bast waste in a compact mass, 8x5.5cm.
SEEK-016 (Feldtkeller 2004:65, Sa90Q99/148B-150)	Five fragments of tree bast strips, 2-3.5cm, light z-spun, slightly frayed.
(SIPP-) Sipplingen, Lake Constance district, Baden-Württemberg, Germany *Site*: Lake dwelling, early Horgen culture, dendro-date 3317-3306 BC. *Ref*: Schlichtherle & Wahlster 1986, Körber-Grohne & Feldtkeller 1998, Bazzanella, Mayr, Moser, & Rast-Eicher 2003:279-280	

SIPP-001 (Schlichtherle & Wahlster 1986: 70-74)	Flint knife with piece of textile stuck onto the handle with birch pitch.
SIPP-002 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:280)	Hat with pile, 14x19cm, s-countered twining with complex pile construction, inserts 7mm wide by 65mm long.
SIPP-003 (Korbe-Grohne & Feldtkeller 1998:179; Si 87 2180-2)	Sandal, 14.5x22.5cm, lime bast, parallel weaving to form sole shape from spun and un-spun bast strips.
(TWAN-) Twann, Berna Canton, Switzerland *Archive*: Canton of Berna Archaeological Service *Site*: Final Neolithic settlement multiple periods, cloth from Cortaillod culture layer dendro date 3563-3532 BC. *Cloth*: Multiple cloth finds. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:241-242	
TWAN-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:241; Twann Inv. 691/OS10)	Rolled and tied textile, 65x7.7cm, linen, plain weave, 2S/2S, thread diameter both 0.6-0.8, thread count both 6.5 per cm, reps selvedge, cloth rolled in a bundle tied with thread, selvedge visible on one side, Cortaillod culture.
(UTOQ-) Zürich Utoquai, Canton of Zürich, Switzerland *Archive*: Swiss National Museum *Site*: Lake dwelling site, multiple periods Horgen c.3200-2800 BC and Corded Ware c.2700, typologically dated. *Cloth*: Multiple cloth finds. *Ref*: Bazzanella, Mayr, Moser, & Rast-Eicher 2003:223, Ruoff 1981,fig.6.	
UTOQ-001 (Bazzanella, Mayr, Moser, & Rast-Eicher 2003:224; SLM 79716)	Roll of plain weave textile with fringe, 75x9cm, linen, 2S/2S, thread diameter 0.5/0.5, thread count both 12 per cm, one reps selvedge worked with 10 rows tow weft threads per row, fringe s-twist with small tassels, Horgen culture.
(WANG-) Wangen, Baden Württemberg Lake Constance, Germany *Site*: Lake dwelling settlement, Pfyn culture, dendro. date 3824-3586 BC. *Cloth*: Textile, twining and threads. *Other*: Flax scutching debris. *Ref*: Feldtkeller 2004, Körber-Grohne & Feldtkeller 1998, Körber-Grohne 1987	

WANG-001 (Feldtkeller & Schlichterle 1998:170, Taf.1f; Wa81 10b,W1-1-19)	Fragment of plain weave textile, 7x10cm, linen, two plied, thread diameter both 0.5-0.6mm, thread count both 4-5 per cm, Pfyn Culture.
WANG-002 (Feldtkeller 2004:59, Körber-Grohne & Feldtkeller 1998: 176, Taf.16, cat.75)	Pointed hat, twining with pile, Pfyn Culture.