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Renewal and Reinvention: the role of learning strategies in the Early to Late Middle Bronze Age of the Carpathian Basin

by

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Abstract

In this thesis a deep understanding of the principles of pottery manufacturing has been placed at the centre of the search for learning strategies in a prehistoric context. Learning strategies are argued to be culturally and socially specific. They, therefore, have an important role to play in understanding broader social mechanisms.

By developing a new methodology that encompasses a wide range of technological observations it has been possible to document technological signatures of production. Moreover, by combining this close observation of technological signatures of production with an equally profound understanding of the nature of the skill acquisition it has proven possible to assess degrees of skill related to specific vessel groups. Skill starts with the way in which discursive knowledge is turned into procedural knowledge through the repetitive enactment of a skill. This in turn leads to repeated processes of production and specific classes of pots that share the same socially constituted technological signatures.

Arising from this approach it has been possible to explore the very different roles that individual vessel groups play in articulating social dynamics. Moreover, it has been possible to identify the possibility of two arenas of skill, a formal and less formal one, each related to particular institutionalised practices. A formal skill arena is argued to be linked to a highly prescribed learning strategy that safeguards the continuity of elite and specialist pottery vessels. This is turns protects the articulation of rank through the visual display of an elite category of material culture. Meanwhile, an informal arena of skill is argued to be linked to the expression of kinship relations. In this informal arena of skill a less structured regime results in a limited opportunity to gain the incremental acquisition of procedural knowledge. This results in a static and, therefore, lower investment of skill in this learning arena.

The ability to suggest two arenas of skill is an advance on previous understandings of potting practices within this cultural milieu which have tended to focus on tracking material change through time in order to determine chronologies and typologies. This thesis offers an insight into the complex and overlapping nature of institutionalised practices related to learning strategies and, it is argued, therefore to broader social mechanisms in the Early to Late Middle Bronze Age in the Carpathian Basin.

Contents

Chapter 3 Learning Strategies, Skill and Society

Chapter 4 The Methodology: Rationale and Execution

Chapter 5 Data Results

Chapter 7 Conclusion and Contributions

Appendices

List of Figures

Chapter 6

List of Tables

List of Illustrations

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This work could not have been completed without the encouragement, support and guidance that I have received from my supervisor, Dr, Joanna Sofaer, and my advisor, Dr. David Williams. I should like to thank them both warmly for their commitment to this project.

I extend grateful thanks to Dr Ildikó Poroszlai and Dr Magdolna Vicze for their enthusiasm for this project and the generous access I was given to the study material. I would also like to thank Dr Magdolna Vicze for her generosity in making available her own PhD research. I hope that I have done some justice for her desire to see Dunaújváros-Duna-dűlő as the subject of further investigation. I must also warmly thank the director and staff of the Dunaújváros museum who made me so very welcome and helped me in every possible way.

A project such as this has profound consequences for those close to you. My family have supported me in a quest that started as a modest dream to gain an undergraduate degree but somehow just continued and continued to be finally realised with this PhD thesis. Their unfailing belief in me through both the struggles and successes has meant the world to me. Also, friendships have played their part and to all those friends that stayed with me on this (sometimes strange) journey, I can't thank you enough. But most particularly I must thank Tim Barthorpe and Jenny Barthorpe who give new meaning to the saying 'a friend in need is a friend in deed'; thank you.

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My final acknowledgement is rather strangely to my past. Before embarking on this academic career I was a professional studio potter. I should like to remember here the person who taught me to pot, Malcolm Pepper. Malcolm's enthusiasm and dedication to his craft gave me a deep love of potting a profound respect for skill. I am grateful that I have been able to carry these things forward into a new area of my life and that I have ended my studies with an even greater regard for potters and pottery.

This work is dedicated to my wonderful daughter Katy, her lovely James, and Ollie the wonder dog — who nearly made it to the end, and of course Roscoe.

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Chapter One

Introduction: Research Question and Thesis Outline

"You are interested in pottery; do you know what this means? Do you know that to have the whole world's pottery to look at is like having the whole world's food to eat? Can you digest it? Can you find a way of judging what is a good pot, whether it is made in twelfth-century China, Persia, or Greece, in Europe or by American Indians? How can you come to say with conviction to other people and (to yourself), 'That is a good pot'? Are you prepared for that? It means a whole life's work and it means that you must care about it tremendously".

Bernard Leach 1976: 15

1.1 Introduction

In this chapter the research question, aims and study material are introduced. Following this an outline is given as to the way in which this thesis is organised (Figure 1.1) and a brief resume is offered for each chapter.

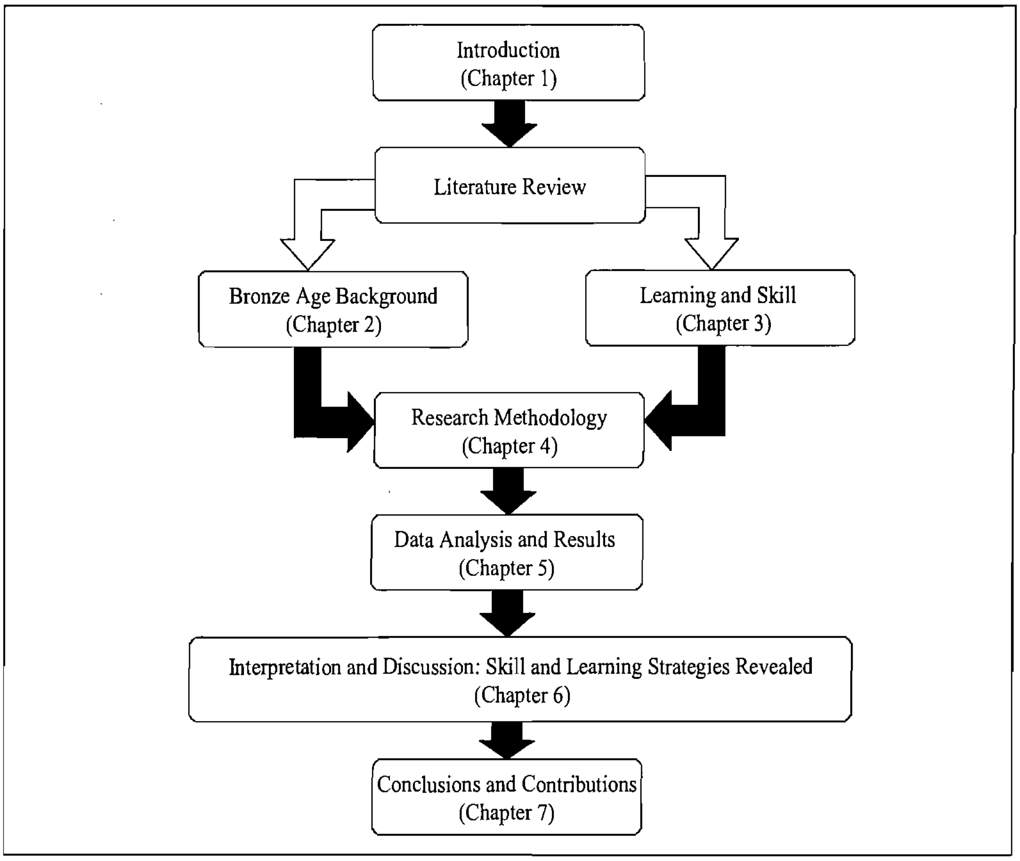


Figure 1.1 Flow chart introducing thesis layout

1.2 Research Question, Aims, and Study Material

1.2.1 Research question and aims

It is argued that all societies have specific ways of passing on knowledge that result in culturally and socially constituted learning strategies. Learning strategies facilitate the acquisition of skill which sits at the heart of all technology and the reproduction of material culture, through which cultural and social expression is mediated (Sofaer & Sørensen 2006). It is only by the passing on of knowledge, through learning strategies, from one generation to the next that essential practical skills are maintained. Ethnographic studies have shown that how people learn to produce and reproduce technologies directly links to the choice to renew or reinvent, resulting in continuity or change. Institutionalised learning strategies are argued to promote continuity by preventing innovation and encouraging specialisation. Conversely, liberal learning strategies are seen as an encouragement to change and to challenge social norms. Despite their acknowledged importance, learning strategies have rarely been investigated in a prehistoric context.

This research aims to address this situation by combining a theoretical understanding of learning and skill with a methodological framework that offers a profound understanding of pottery as a socially situated technology. By doing this it is intended that an exploration of the role of learning strategies as culturally and socially constituted strategies in the Early to Late Middle Bronze Age in the Carpathian Basin can be made. Given that learning strategies are culturally and socially constituted, they provide a point of reference from which to address broader social questions. This research will offer a new perspective on the social dynamics of this period and address questions of continuity and change.

The Bronze Age of Central Europe is a dynamic period characterised by moves toward multiple technologies and specialisation within a stratified society. Specialisation implies institutionalisation within society and the likelihood of continuity in terms of manufacturing principles. During such periods of continuity it is suggested that highly institutionalised learning practices will demand that learners work within structured regimes mastering prescribed skills in incremental stages. Despite a general feeling of continuity within Bronze Age of the Carpathian Basin there are also distinct episodes of change as cross cutting cultural groups, or ideas, ebb and flow between territories creating new negotiations of social dynamics. Such periods of change, when institutionalised practices are in flux, may well be marked by evidence of learners working in a less structured way.

1.2.2 Research material

Pottery technology is the medium through which this investigation will be carried out. Pottery shares characteristics with other technologies, for example, the skilled manipulation of raw materials, while its dependence on pyrotechnic skill links it to metalworking. In this way it acts as a metaphor for other technologies. Pottery is, however, a plastic additive medium where manufacturing processes leave visible and permanent technological traces. With a profound understanding of pottery technology it becomes possible to record these traces. Because of this it is possible to observe both repeated competence and repeated error in characteristics that should be constant to particular vessel types. Observation of both technical competence and error will allow the observation of patterns of continuity and variability of skill, and therefore also of learning, within each assemblage studied.

The Bronze Age tell sites of Százhalombatta (Poroszlai 1989–1995) and Dunaújváros-Kosziderpadlás (Mozsolics 1952) and the contemporary cemetery assemblage of Dunaújváros-Duna-dűlő, recently studied by Vicze (2001), offer the provision of three extremely large, well-preserved and catalogued assemblages from the central Danube region of the Carpathian Basin. These assemblages will provide the primary case studies for this research. Together these sites represent two complex communities spanning the Early Bronze Age through to the Late Middle Bronze Age, and encompass a period of time when both continuity and change are known to be present and thus where variations in learning strategies may be seen to occur.

In terms of the Hungarian Bronze Age chronology these sites offer a starting point at the Szigetszentmiklós phase of the Nagyrév, continuing through the Vatya period and ending with the Koszider period. This covers a time frame from approximately 2500BC to 1450BC and represents a continuous period of social activity over a period of *c.* 950 years. The considerable time scale offered by these three sites greatly facilitates the process of observing learning strategies and of assessing any variations in the way in which learning appears to be conducted both at times of stability, and as these communities witness transformation and adopt new ideas about technology.

All of the pottery assemblages offer the opportunity to examine whole pots, partial pots and large featured sherds. As previously stated the range of pots within these assemblages offers the opportunity to analyse a broad range of vessel types. The importance of this diversity to this study is discussed within the methodology. The size of these assemblages demand a sampling strategy to be implemented, this issue is also addressed within the methodology.

Insights into pottery manufacturing technology processes for the pottery implicated in this research will be a further outcome of this project. A deep understanding of these processes is used to underpin the methodology. This material has not been investigated in this way before.

1.3 Chapter 2: Research Context: The Early to Late Middle Bronze Age of the Carpathian Basin

In order to situate this study within its particular geographic and temporal framework a review is made of the nature of Early to Late Middle Bronze Age societies in the region of the Carpathian Basin. It should be noted that the available literature for this study is predominately influenced by a culture-historic perspective. Hungarian archaeology has traditionally been dominated by the desire to understand the chronology and territory of the complex array of contemporary regional groupings that emerge toward the end of the Early Bronze Age and continue to the Late Middle Bronze Age. The constant flux of cultural groups has been 'mapped' through the use of material culture to gain an understanding of both the geographic and temporal span of each group. To this end a great deal of work has been done on creating typologies to underpin chronological sequences.

This approach is well known for its tendency to focus on ideas of migration, diffusion and cultural identity without addressing the underlying social dynamics of these cultural groupings. However, the close observation of changing pottery forms, both through time and between numerous cultural groups, by archaeologists such as Bóna (1958, 1960, 1963, 1975) and Mozsolics (1942, 1957) allows today's more socially oriented questions to be asked. Without an understanding of the movement of changing pottery styles across regions and the development of pottery styles within a single cultural milieu the vast and complex ceramic assemblages of the tell settlements would be impenetrable to the social agenda of present day archaeology.

Despite the culture historic nature of the literature it serves not only to clarify the complicated regional groupings and their movements through both time and space but also to draw out themes within Bronze Age society that are important to this research. As stated in the introduction the Bronze Age in this region is seen as a dynamic period characterised by the adoption of new ideas and technologies. The constant flux of cultural groups' aids the spread of ideas and it is typical to find 'exotic' goods in the form of pottery and metal work imported from neighbouring regions. There is also competition for resources and both the Danube and the Tisza play significant roles in the development of trade and communication (Kristiansen 2000b).

The success of firstly the Nagyrév, the first major Early Bronze Age tell building culture (Poroszlai 2003: 143), and then the Vatya in this region is undoubtedly linked to access to important metal resources. Through time there emerges a whole chain of fortified tell settlements in this region that are closely linked with the expression, and defence, of the specific cultural ideas of the Vatya (Poroszlai 2000a). By the end phase of the Vatya, the Koszider phase, specialisation and institutionalised practices are clearly evident and are closely linked with power relations. Despite the apparently dynamic nature of society there are also periods of stability and continuity. The temporal longevity of these tell settlements offer a time span that allows the observation of periods of development, continuity and change as cultural groups converge on new territories; settle into an understood way of life but eventually witness disruption yet again at a later date.

The tell settlements and, in some cases, their accompanying cemeteries offer large, complex and well preserved assemblages of pottery. These assemblages encompass a diverse range of vessel types that represent the different social arenas of daily life and different degrees of technological complexity. This provides the opportunity to observe the varied deployment of skill related to each vessel type and trace how learning strategies are affected as different social circumstances come into play. The diversity of the assemblages also offers the opportunity to assess any correlation between complex and simple pots and the deployment of skill.

1.4 Chapter 3: Learning strategies, skill and society

The central theme of this research is to identify learning strategies and reach an understanding of how they are positioned within social and cultural dynamics. To this end a number of literature reviews have been carried out in order to appraise contributions already made to this area of research. These are followed by discussions about how it is possible to reach an understanding of learning strategies that facilitates the possibility of addressing broader social questions.

The first issue to be addressed is that of previous work carried out that has impacted on archaeological understandings of learning strategies. These cover three main topics that are seen to have made contributions to ideas about how technical knowledge is passed from generation to generation, and the socially embedded nature of pottery production. The topics reviewed are: modes of production and the dichotomy between household and specialist production, the contribution and some of the limitations of chain opératoire, and the essential role of ethnographic studies in facilitating the broadest possible interpretation of data but, again, attention is drawn to some of the limitations of this perspective.

Following this review is a discussion about the fundamental nature of skill and learning. This discussion aims to make a necessary separation of these two concepts and to place skill clearly in the realm of the outcome of learning strategies. To this end discussion surrounding the precise nature of knowledge as both discursive and non-discursive is made. This creates the platform to understand the biological nature of non-discursive, or procedural, knowledge. Having reached the conclusion that procedural knowledge is fundamental to the passing on of skill it is necessary to place this in its appropriate social framework. This entails creating a clear understanding that procedural knowledge is enacted, or performed, within specific culturally and socially defined ideas of what is an appropriate way to carry out the specific actions required to complete a skill based task. This is argued to result in repeated practices that are deeply engrained and hard for a practitioner to alter. This phenomenon gives rise to specific vessel forms and specific sequences of production that, because of the particular physical characteristics of pottery result in permanent and recognisable technological signatures of production.

In drawing this chapter to a close it is necessary to review the social nature of pottery production, learning strategies and ensuing skill within the framework of institutionalised practices. Again, a review is offered as to how institutionalised practices have been understood and used within archaeological discourse. The discussion surrounding this is followed by an appraisal of how institutionalised practices are situated within this research and the fundamental role they play in allowing learning strategies to be revealed in an archaeological context.

In conclusion to this chapter all of the preceding discussions are drawn together to offer a final appraisal of how learning strategies can be traced in the archaeological record and the fundamental role they play in maintaining and negotiating cultural and social dynamics.

1.5 Chapter 4: Methodology

In order to create the required methodology a review was made of ceramic literature, ethnographic literature and archaeological perspectives that place pottery production within the social sphere. The results of these reviews are not addressed individually but are used throughout the chapter to inform the principles underlying each part of the methodology. In regard to the use of both ethnography and ceramic literature there are certain caveats. It is important to stress that many of these accounts stem from a particular westernised view of ceramic production. As such, ideas surrounding specifically understood 'correct or incorrect' ways to proceed do not necessarily have a direct relationship to today's traditional societies or past societies. An example of this would be Fournier's (1973: 51) description and illustration of coiling which bears little relationship to any ethnographic account. Their contribution is seen as valuable, however, in terms of the general insight into the skilled management of the many tasks involved in working with clay, which despite its enormous versatility requires a certain fundamental understanding and the skilful execution of certain basic techniques. In respect of this it is essential to draw attention to a core element of this approach which is that not only are potters variously skilled different vessel types have a *range* of technological complexity.

The methodological rationale is informed through the theoretical discussions surrounding the cultural and social nature of learning strategies and skill. It also rests on a number of key principles involved in potter manufacturing processes. The first of these surrounds the plastic additive nature of clay combined with the end process of firing. These two elements, in combination, mean that every technical action undertaken in the production of a pot is 'fossilised' at the time of firing. These actions are permanent and visible and are described within this research as the 'technological signatures' of production. The second principle builds on technological signatures of production by addressing the fact that certain tasks have to be undertaken, or may be chosen to be undertaken in quite specific orders resulting in constitutive processes of production. The methodology also rests on the principle that it is not in the best interests of potters (or communities) to produce pots that are technologically inadequate (Barley 1994; Longacre *et al* 2000). The third principle rests on discussions previously made within chapter 3. In order to meet a socially condoned outcome production methods and sequences are necessarily linked to repeated practise. This means that various classes of pots may be expected to have certain repeated technological signatures.

Such signatures are already well understood and widely used within the field of ceramic archaeology (Rye 1981; Rice 1987; Gibson & Woods 1997). The research methodology presented here builds on, and extends that understanding by establishing the normal technological practise involved in the production of any particular class of pottery and by looking at technological signatures across a range of production variables for any particular vessel type. Once a normal technological pattern is established as a baseline for any class of pottery consistency and variability can be observed. By observing patterns of consistency and variability within the range of pot types available both within each individual assemblage, between assemblages and through time it becomes possible to observe the deployment of skill, and therefore learning strategies.

Following the discussion of these underlying principles is an explanation of the principles underpinning data collection and analysis. A detailed account as to the skill involved for each technological signature (technological variable) and the potential likelihood for error is then given. This is further underpinned through reference to verbal descriptions and photographic evidence presented within Appendix 2.

1.6 Chapter 5: Data Results

In this chapter analysis of the data is presented. An overview is given as to the numbers and types of vessel groups analysed. The precise range of technological variables analysed is listed. The nature of analysis used is briefly outlined. Following this the data results are displayed using text accompanied by appropriate tables and charts. The first section of analysis concentrates on the percentage frequencies and significant differences observed between all three assemblages for each technological variable. A summary is offered at the end of this section. The next section of analysis again reveals the percentage frequencies and significant differences observed, but in the case, for each technological variable between vessel groups within each assemblage. Again a summary is available at the end of the section.

Following from these analyses the fabric series is introduced along with analysis of 'textural types' of fabrics. This section offers an initial characterisation and labelling of fabric types. The aim of the fabric series is to observe relationships between particular fabrics, fabric groups or textural types both within and between assemblages. Percentage frequencies are used to show the different use of individual fabrics and fabric groups in relation to certain vessel groups within each assemblage. Percentage frequencies and significant differences are observed to show the relationships of textural types to each vessel group both within and between sites.

The final element of analysis deals with the possibility of skill variability related to change and continuity over the time span studied. This analysis takes a different form to preceding analysis and is based on a point scoring system that is explained at the beginning of the section.

1.7 Chapter 6: Interpretation and Discussion: Skill and Learning Strategies Revealed

Interpretation of the data is offered in relation to the social dynamics of the Early to Late Bronze Age (chapter 2) and the theoretical and social concerns laid out in chapter 3. Each vessel group is discussed in terms of variability of skill investment using close reference to the data previously presented in chapter 5. This is followed by a broader interpretation of the data in terms of social dynamics surrounding the individual vessel groups, and apparently very specific ideas about how to implement learning strategies in relation to each vessel group. Following this a broader discussion is offered as to the nature of learning strategies and the role they play in a complex social order. The possibility in skill fluctuations through time are then discussed and related to the possibility of a period of change during the Early to Late Middle Bronze Age which may be seen to have briefly affected learning outcomes.

1.8 Chapter 7: Conclusions and Contributions

The aim of this chapter is to offer an overview of the thesis as a whole. An evaluation is made as to how well the original aims of the thesis have been met and the contribution of the thesis to archaeological investigation of learning strategies. This is accompanied by a discussion of further applications for the theoretical perspective and methodology adopted.

Chapter Two

The Early to Late Middle Bronze Age of the Carpathian Basin and the sites used in this study

"There is little doubt that specialisation amongst craftspeople is a key element enabling the creation of exotic and high status material culture and that craftspeople may be seen as linked to people with power and status"

Ildikó Poroszlai (2002 unpublished manuscript)

2.1 Introduction

This chapter aims to situate this study within the social dynamics of the Carpathian Basin, and in particular within the region of the Central Danube and the Danube / Tisza interfluve during the Early Bronze Age through to the Late Middle Bronze Age. The nature of regional cultural groupings and society as it is understood from the perspective of archaeological literature is explored and related to the research question. Attention is particularly focused on the nature of the Nagyrév and Vatya groups, whose pottery provides the primary data for this research, and the primary study sites of Százhalombatta, Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás. The nature of the literature associated with this period and region is strongly characterised by a culture-historic approach and, therefore, the following discussion is by necessity also informed by this approach.

2.2 The Early to Late Middle Bronze Age in the Carpathian Basin: a general background

The Carpathian Basin is defined geographically as stretching from the Carpathian Mountains in the east to the foothills of the eastern extension of the Alps in the West. This area encompasses present day Hungary, parts of Romania, Croatia, Serbia and Slovakia. The area is transected by large rivers such as the Danube, Tisza and Sava and hemmed in by extensive mountain ranges (Coles & Harding 1979). The Danube is noted as representing the main north-south communication channel of the region. This combined with rich ore deposits in the Carpathians allowed communities in Hungary to develop rapidly from the earlier 2^{nd} millennium BC onwards (Kristiansen 2000a: 9) and to continue to develop north-south trade and communications across Europe throughout the 2^{nd} millennium BC (Kristiansen 2000b: 360). The strong clustering of Early and

Middle Bronze Age sites along both the central Danube and Tisza Rivers suggests how important these areas were (Figure 2.1). Meanwhile the broader Carpathian region is described by Kovacs (1977: 9) "as one of the gates of Europe". The fact that the landmass barely ever exceeds 200m above sea level and that much of it consists of rich "loess-derived black-earth or brown forest soils suitable for intensive agriculture" (Coles & Harding 1979: 68) further enhanced the possibility of settlement patterns that would facilitate the development of trade and specialisation.

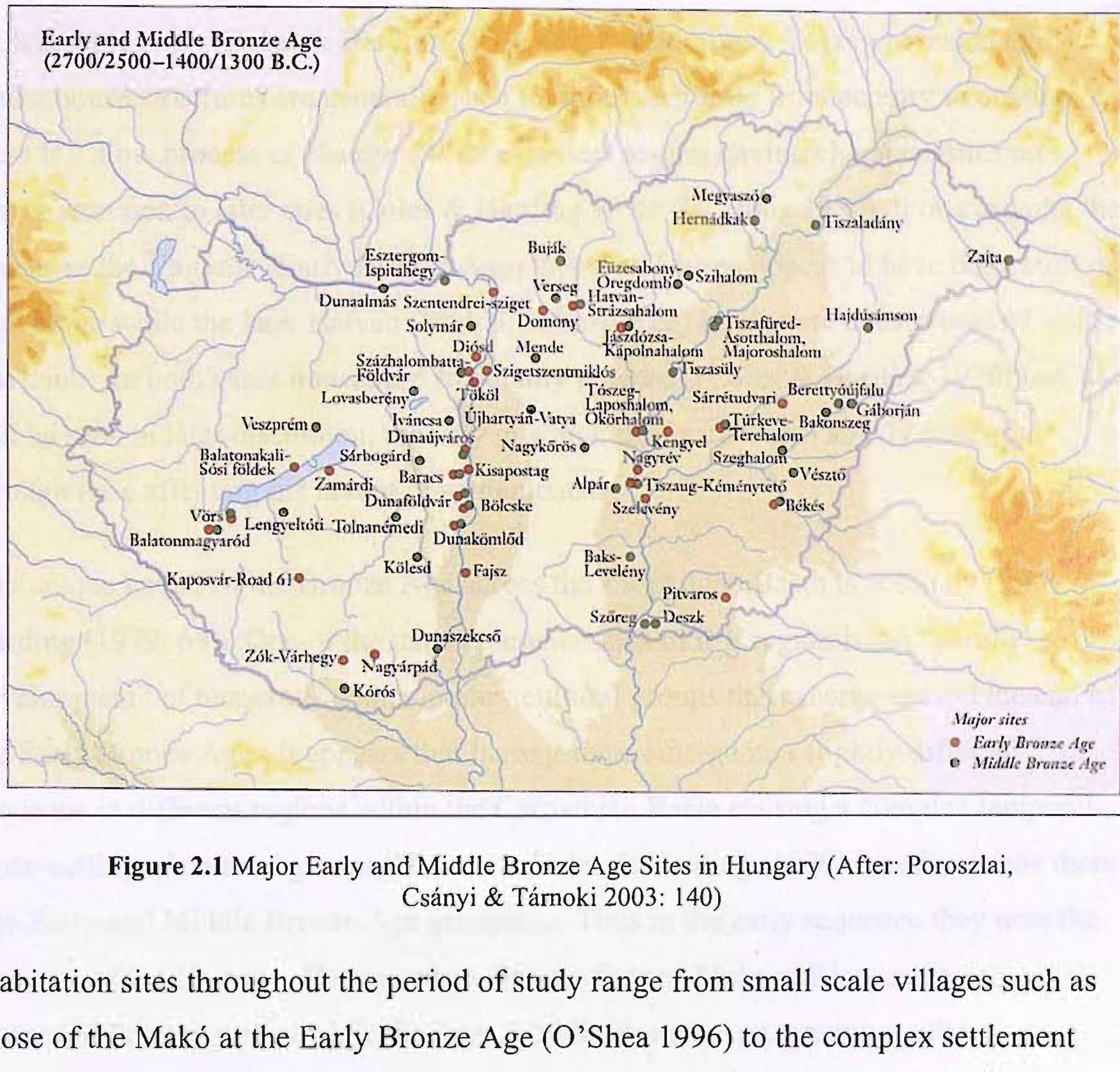


Figure 2.1 Major Early and Middle Bronze Age Sites in Hungary (After: Poroszlai, Csányi & Tárnoki 2003: 140)

Habitation sites throughout the period of study range from small scale villages such as those of the Makó at the Early Bronze Age (O'Shea 1996) to the complex settlement systems that emerged in the Carpathian region centred around fortified tell settlements. These fortified settlements began to emerge at the start of the Middle Bronze Age and Kristiansen (2000a: 9; 2000b: 370) argues that through time these fortified sites came to have "specialised functions in production and trade, ranging from the Black Sea to Slovakia". These settlements were linked to the emergence of elite groups engaged in long distant relationships, the increasing production of bronze, spreading technological innovations and new social institutions forming across Europe (Kristiansen 2000a;

Engedal 2002). Bona (1958) considered that such fortified tell settlements in Transdanubia formed a system of defence protecting the western fringes of the Vatya group. Poroszlai (2000a) certainly reiterates this idea in relation to Százhalombatta. Tell settlements are a key feature of the Bronze Age landscape and can be found in the Carpathian Basin from Mezőföld to Tiszántúl but do not extend north or west of this point (Horváth Jólan & Keszi 2004: 33). Where good excavation techniques have been engaged it is possible to identify "many building levels within a single period" and at sites such as Tószeg and Jászdóza it has been possible to reveal detailed plans of settlement layouts (Coles & Harding 1979: 68). Excavation at Tószeg revealed that whilst house structures are generally seen to differ very little from century to century there is a slow process of change with the earliest houses having characteristics no longer common in later ones (Coles & Harding 1979: 73; Bona 1980). For example, the houses in the Nagyrév (Early Bronze Age) layers at Tószeg appear to have been built of mud alone while the later Hatvan (Middle Bronze Age) houses are constructed of wattle and daub. In both cases houses are frequently renewed (Coles & Harding 1979) but, as will be seen in later discussion, the way in which this occurs also slowly changes through time affecting the layout of settlements.

The unique nature of the Bronze Age across the Carpathian Basin is noted by Coles & Harding (1979: 69). One of the main characteristics of this region is the "parallel development" of numerous contemporary cultural groups that emerge toward the end of the Early Bronze Age. It appears that these groups emerge in a slightly different sequence in different regions within the Carpathian Basin causing a complex temporal cross-cutting of cultural groups. However, Coles & Harding (1979) broadly divide them into Early and Middle Bronze Age groupings. Thus in the early sequence they note the presence of the Nagyrév, Hatvan, early Perium-Szöreg-Mokrin, Kisapostag and Encrusted Pottery groups while the later, Middle Bronze Age, groups are the Füzesabony and Vărşand east of the Danube, the Ottamány in the Rumanian foothills, the Vatya along the and to the west of the Danube, the Mad'arovce in south-west Slovakia and eastern Austria and finally the Vattina related groups (Coles & Harding 1979: 90). Despite the differences expressed within the material culture, used to define these many groups, Coles & Harding (1979) also argue for a noticeable degree of homogeneity.

Such homogeneity is reflected from the Early Bronze Age on with certain general characteristics being common to all groups. It is significant that all of these groups became settled and chose locations that encouraged a steady intensification of agriculture. This in turn encouraged an economic basis for the development of mining metal ores, engaging in metal production and trading over long distances (Kristiansen 2000a: 365). Metal working starts as a small-scale enterprise but is seen to reach "impressive proportions" by the Middle Bronze Age (Coles & Harding 1979: 102) with the Carpathian Basin, and Hungary in particular, becoming an area of excellence and productivity. This may be due to the proximity of metal ores in Transylvania and the ability of Hungarian smith's to obtain ore supplies to their east. The central location of Hungary also enabled access to extensive markets across the Carpathian Basin (Coles & Harding 1979: 93). Hungarian metalwork is known to have reached well beyond the Carpathian Basin and as far as Southern Scandinavia (Engedal 2002: 15).

With regard to both metalwork and pottery while distinct traits of design are notably characteristic for certain groups the basic repertoire of what was produced was broadly the same. Potters produced a range of small cups, jugs, bowls, urns and domestic pots while smith's produced axes, weapons, pins and jewellery. Both pots and metalwork are implicated in notions of an elite class emerging. Many of the various cultural groups produced pottery that is seen as linked to high status individuals (Poroszlai 2000a). Examples are: the finely burnished Rákospalota pottery produced in the later days of Vatya groups, and the ornate, and again highly burnished, pottery of the Ottamány decorated with complex spiral channelling and bosses (Coles & Harding 1979: 90). Meanwhile, the link between metalwork, rich graves (Vicze 2001) and weaponry associated with an elite class of warriors is well documented (Bogdanović 1998; Kristiansen 1998; 1999a, 2000b), as is the changing nature of what metalwork is produced at various phases of the Bronze Age. Kristiansen (1989: 23) notes, for example, the disappearance of bronze axes as prestige goods toward the end of the Early Bronze Age and the emergence of "...a variety of new personal prestige goods. For males they are linked to warfare and ritual and for females to personal ornaments".

Hoards are another distinctive characteristic of this period and have been discussed in great detail in all the Bronze Age literature. There are various views as to the purpose of hoards but in general they are again linked to ideas surrounding an emerging elite and the control of resources (Coles & Harding 1979; Harding 2000; Kristiansen 1999a, 2000b). Weapon hoards, in particular swords, are seen by Kristiansen (1999a) as linked to ideas of ritual after battle. Meanwhile, hoards are also implicated in the closing days of the Middle Bronze Age across the Carpathian Basin when many items such as jewellery, fineware pots, axes and other metalwork were deposited. The precise nature of hoards, that is the content of hoards, is seen to change through time offering some insight into changing technology and ideas of what was 'valuable' through time (Coles & Harding 1979).

2.3 Chronologies and Regional Groupings of the Carpathian Basin

The principle chronological schemes associated with this area are complex and often at slight variance with one another. Harding (2000: 12 &13), however, usefully outlines the key aspects of the schemes developed by both Reinecke and Montelius and shows how they correspond to the more commonly used scheme of Hänsel (Figures 2.2 & 2.3).

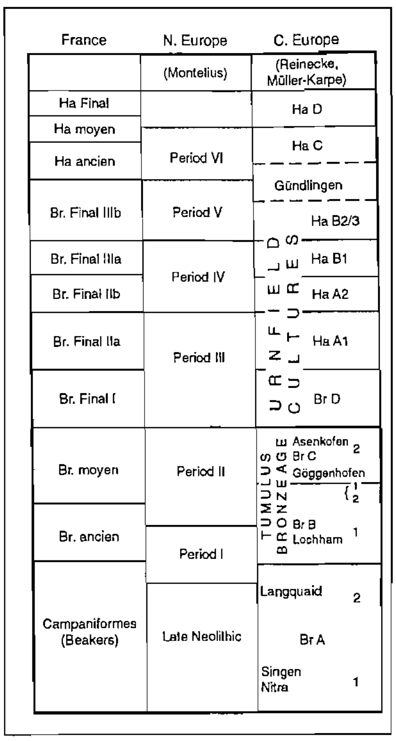


Figure 2.2 'Cultural sequence for east-central and eastern Europe' (Harding 2000:13)

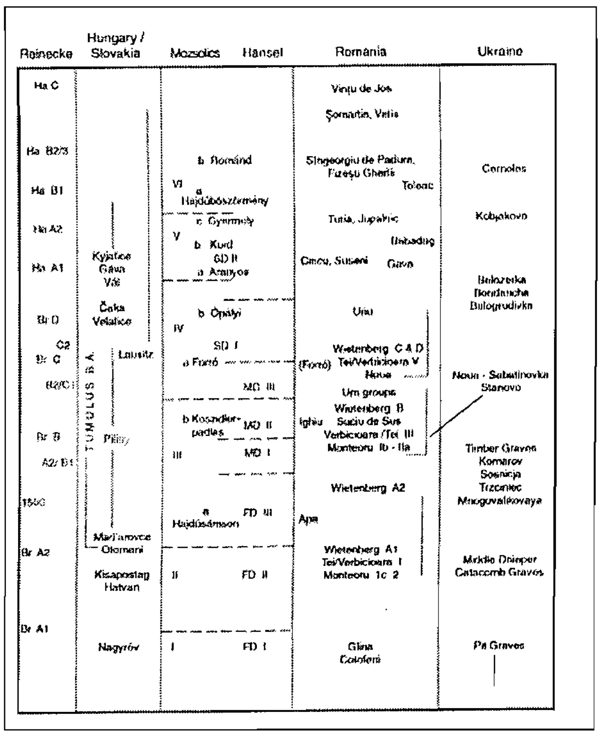


Figure 2.3 'Cultural sequence for east-central and eastern Europe' (Harding 2000:13)

These three schemes are all in regular use and are essential to an understanding of dating in the Carpathian Basin. Within this research use is made of Hänsel's scheme which rests on a wide range of sites and artefacts and an immense amount of work carried out in the Central Danube area. The scheme adopts the terms Early (Frühe), Middle (Mittlere) and Late (Späte) Danubian Bronze Age. These terms are abbreviated to FD I–III, MD 1–III and SD I–II. Particular use is also made of the chronology set out in Bona's 1992 edited volume which appears to closely follow Hänsel's scheme and which refers directly to the following outline of cultural groupings across this area.

At the very outset of the Early Bronze Age a large cultural group, known as the Makó, occupied almost all parts of the Carpathian Basin (Kulcsár 1998:31). Kulcsár suggests that recent C^{14} dates place this group as appearing at 2700/2500 BC and continuing to 1900/1880 BC cal. Dates given by Raczky *et al* (1992) are for just one site, Szeghalom-Környe, and start at 2566BC cal. and end at 2346BC cal. Both set of dates are used in the comparative table of dates below (Table 2.1) The Makó population was characterised by wide-spread small settlement groups which practised 'soil-changing' agriculture and stock farming. A reasonably transient existence was pursued with groups moving to new locations as and when soil conditions deteriorated. This transience extended to burial where it seems that small cremation cemeteries "did not serve as a steady recurring place" (Horváth Jólan & Keszi 2004: 32). The Makó enjoyed low population density and are generally seen as egalitarian in nature with sub-groups being seen more as social and family units rather than being of a political nature (Laszlo 2003; Horváth Jólan & Keszi 2004).

By Bóna's (1992b: 16) second phase of the Early Bronze Age, FD II, The Makó were replaced by a complex range of broadly contemporaneous regional groups which spread across this entire region. Such complexity of regional groupings has been described by Hawkes (1940: 287) as a desperately confusing patchwork of cultures which are often "not even geographically distinct, but interpenetrating one another in a fashion only in part to be explained by the physical geography of their environment". These groups may best be defined as having many similarities with regard to settlement structure, material culture and burial traditions; however, they are equally defined by distinct regional diversification and traditions. The boundaries of these many groups are characteristically hard to define and it may be surmised that a degree of flux existed between neighbours, such as that outlined between the Early Bronze Age Maros group and that of the neighbouring Nagyrév group, where Nagyrév pottery is characteristically found in Maros funerary samples as 'exotic' imports (O'Shea 1996: 356). These regional groups continue to characterise the region through the Early and Middle Bronze Age with different groups emerging and then disappearing as a constant flux of cultural activity.

As noted, the region previously occupied by the single Makó group becomes broken into several smaller territories with the Makó group having declined and shrunk towards the northern most boarders of its original distribution area (Bóna 1992b: 16). Sitting in the centre of the region in the Central Danube area is the Proto-Nagyrév group surrounded by Somogyvár to its west, the declining Makó group to the north and the Ada and Pitvaros groups to the east/south-east (Figure 2.4). To the south the Maros group is established and thrives alongside the Nagyrév community which despite being surrounded by other regional groups thrives. By Bóna's third Early Bronze Age phase, FD III, the Nagyrév group has extended its region to encompass a significant area of the Danube's loess plains and to extend eastward as far as and beyond the River Tisza (Figure 2.5). Of the Early Bronze Age groups the most important to this study is that of the Nagyrév complex. Raczky (*et al* 1992) give ^{C14} dates of 2578BC cal to 1928BC cal for the Nagyrév group (Table 2.1). At the end of the Early Bronze Age and at the start of the Middle Bronze Age, FD III–MD 1, the Nagyrév culture gravitates toward its eastern boundaries bowing to continued pressure from the Kisapostag culture who continue the eastward movement started in the second phase of the Early Bronze Age (Figure 2.6).

At the point where the Middle Bronze Age milieu is truly established, MD I, the Vatya culture is occupying the same region previously taken by the Nagyrév communities (Figure 2.7). C^{14} dates for Dunaújváros-Duna-dűlő, Dunaújváros-Kosziderpadlás and Százhalombatta suggest the Vatya group as emerging in this region at around 1900BC and continuing to 1500/1450BC (Raczky *et al* 1992). These dates include the final Koszider phase of the Vatya group (Table 2.1).

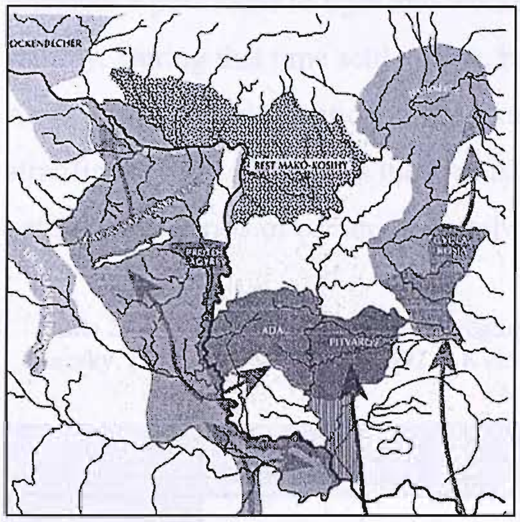


Figure 2.4 Distribution of the Proto Nagyrév group (After Bona 1992b:16)

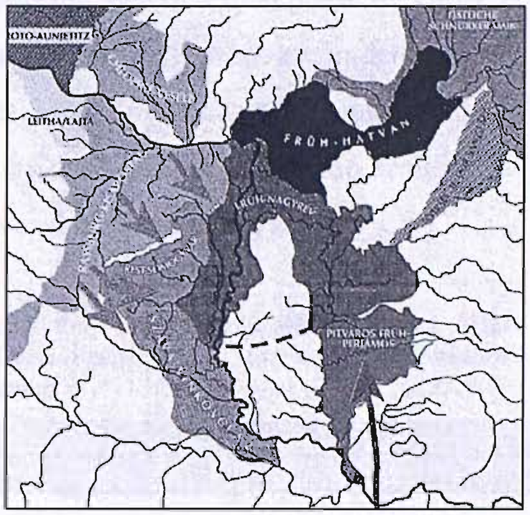


Figure 2.5 Distribution of the Nagyrév at the height of their cultural milieu (After Bona 1992b: 16)

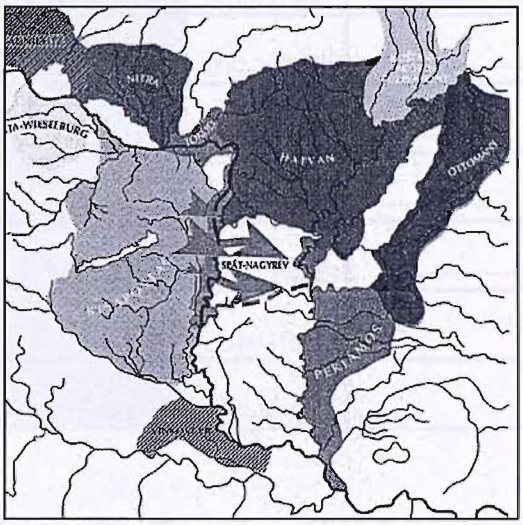


Figure 2.6 Distribution of the Kisapostag and Nagyrév groups as the Kisapostag move eastward into Nagyrév territory (After Bona 1992b: 16)

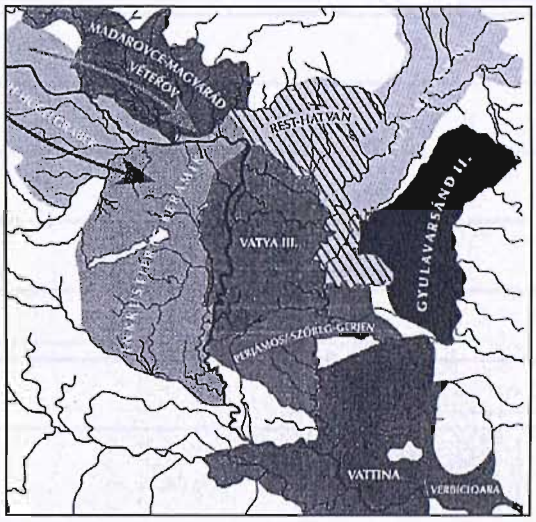


Figure 2.7 Distribution of the Vatya at its greatest extent and just preceding the final Koszider phase (After Bona 1992b:17)

In terms of Bóna's (1992b) chronology this means the Vatya emerge at the earliest Middle Bronze Age period (MD I) and continue to the end phase of the Middle Bronze Age (MD III). This group not only maintains its hold on the area but is recognised as having three distinct phases in its development, Vatya I, II and III, (Bóna 1975: 33; 1992b: 40) until it reaches an epoch known as the Koszider phase (Mozsolics 1957), which is seen to emerge at 1630/1620BC and to continue to the end of the Late Middle Bronze Age period at 1500/1450BC (Table 2.1). This phase has in part, been defined by the exceptionally refined and exaggerated pottery forms known as Rákospalota and named after the type site of Rákospalota (Schreiber 1967) where a small hoard of these distinctive pots came to light and worked to support the idea of a final phase of Vatya society. During this time settlements, burial, ceramics and metalwork are understood to reach a height of elaboration that is clearly suggestive of an increasingly complex and stratified society. After this the area is inhabited by the Tumulus group who bring entirely new forms of ceramics, metalwork and burial customs to the area.

Table 2.1 C^{14} dates and chronology of regional groupings in the Central Danube area. (C^{14} dates: After Raczky, Hertelendi & Horváth 1992 & Kulcsár 1998). The earliest and latest known dates are cited for each cultural group

		Early Bronze Age	Middle Bronze Age	Late Middle Bronze Age
Cultural group	C^{14} dates cal.	2800BC 1900BC	1700BC	1450BC
Makó	2566-1880BC	-------------------------		
Maros (Perjámos)	2870-1319BC	-------------------------	-------------------------	-------------------------
Somogyvár	2582-2310BC	----------------		
Ada	*not available	----------------		
Pitvaros	*not available	----------------		
Nagyrév	2578-1928BC	-------------------		
Vatya	1946-1630BC	--	-------------------------	-------------
Koszider	1650-1450BC			----------------------------

2.4 The Nagyrév and Vatya cultural groups

Both tell and single layer settlements are characteristic of Nagyrév and Vatya societies. Most tell settlements were originally inhabited by Nagyrév groups who settled on the subsoil of the sites, established dwellings and utilised the surrounding rich loess soils for increasingly intensive animal husbandry and farming that would provide the platform for the economic expansion and trade that would follow (Poroszlai 2000a: Kristiansen 2000b: 365). These sites are increasingly developed to become defended settlements with ditch and rampart systems and form the earthwork system of the Middle Bronze Age Vatya Culture which covers an oval distribution area along the Danube and the Danube-Tisza Interfluve and which dominate the region throughout the Middle Bronze Age period.

2.4.1 The Nagyrév

The Nagyrév culture emerges, at Bóna's (1992b) second phase of the Early Bronze Age. Earlier research favoured the original development of this cultural group along the Tisza (Bóna 1963; Csányi 1992) but more recently the Danube has been cited as a point of origin (Bóna 1992a; Szabó 1992 & 1994). At the height of its existence the Nagyrév population maintained a very large territory that spread from Lake Valence to the Körös River and from the Danube-bend as far as Baja (Horváth Jólan & Keszi 2004: 33). It has been argued by Bóna (1992a) and Szabó (1994) that the Nagyrév complex is a descendent of the Somogyvár cultural group. Their argument rests on similarities of early Nagyrév pottery forms and pottery decoration to those of the Somogyvár, however, research has also shown that Nagyrév communities chose to occupy previously unused sites (Bóna 1991: 78).

The Nagyrév people favoured the rich loess soils of the Danube plateau and the Danube / Tisza interfluve where they cleared and ploughed land for mixed agriculture and stock raising (Horváth Jólan & Keszi 2004: 34). As previously stated, in many instances, for example as at Százhalombatta, they settled on the original ground surface, the subsoil, of tells that would only become fully developed in later Bronze Age, Vatya, phases. Equally, they established significant tell settlements in their own right, for example, the large tell settlements of along the River Tisza, such as Tószeg and Nagyrév. These sites, in particular, were in a position to participate in long distance trade networks, influence the flow of goods to and from the north and possibly 'intercept the flow of finished metal goods out of the northern Carpathian workshops or act as middlemen in the southerly trade of these goods' (O'Shea 1996: 357). These locations, along with the tell sites associated with the eastern Maros River, such Perjámos and Pécska, would also facilitate access, through trade, to easterly sources of copper such as those to be found in Romania.

Although, in many respects the general characteristics of the Nagyrév culture are similar throughout its history three different phases are seen to denote developments of this regional group and are represented by variations in pottery forms, settlement characteristics and changes in burial customs throughout time. These three phases are known as Ökörhalom, Szigetszentmiklós (otherwise described as the classical phase of the Nagyrév) and Kulcs respectively (Bóna 1960; 1963). It should be noted that these groups appear to have a degree of flux across the distribution area of the Nagyrév and may be seen to overlap and develop at slightly different times in certain places (Horváth Jólan & Keszi 2004:34).

Looking at burial custom it is seen that through time a slow but steady change occurs. Burial rites go from being flexible and diverse at the beginning of the Nagyrév complex to being rigidly uniform in nature by the end (Vicze 2001: 53). Early on bodies are either inhumed with the body placed in a contracted position in a rectangular grave or cremated ashes are spread into the bottom of a grave pit. In other cases ashes are placed in a funeral urn (Vicze 2001: 53). Meanwhile, during the Szigetszentmiklós (classical) Nagyrév phase scattered ash burials appear to increase while other burial forms decrease. By the last, Kulcs, phase of the Nagyrév burial universally takes the form of cremation with ashes deposited in a funeral urn which is then, most usually, placed in a small round pit unlike the rectangular grave pit common to the earlier, Szigetszentmiklós, phase. The urn, always the largest vessel of the grave group, is without fail covered by a bowl and a small cup, and / or a small bowl is placed inside the urn above the ashes. Not only does the treatment of the body change but the quantity and positioning of grave goods changes in such a way as to reflect this increased uniformity. Less grave goods accompany Kulcs burials and their positioning becomes highly structured (Vicze 2001: 53). Bóna (1963: 19) also draws attention to this altered practice and places the change from crouched inhumation to cremation at the Szigetszentmiklós phase and notes considerable uniformity by the Kulcs phase.

With regard to settlement while the general locale remains the same the inner structure is seen to follow a similar pattern of fluctuation and change, albeit a little earlier. Vicze (2001: 54) notes that in the early phases at Dunáujváros-Kosziderpadlás the inner structure of the settlement constantly changes with small clusters of houses being rebuilt in new locations so that space has an irregular dimension to it through time and the inner settlement pattern is in a constant state of flux being transformed as re-building occurs. By the final, Kulcs, phase of the Nagyrév the site the overall settlement becomes fixed and static as houses are rebuilt on top of existing ones and physically oriented to either cardinal points or to face toward the loess plateau (Vicze 2001: 55).

This is also the time when elaborately whitewashed houses appear at Dunáujváros-Kosziderpadlás and the elaborate and exceptionally well constructed house uncovered at

Tizaug-Kéménytető is suggested by Csányi (2003: 144) as being most likely linked with "one of the outstanding, high status members of the community, whose status is also reflected in the outward appearance of his [sic] house". This house was placed in a central clearing where the exceptional construction and the ornamentation of the external walls with complex geometric motifs would be clearly visible to other members of the community. A similar settlement pattern is observed elsewhere; for example the classical Nagyrév settlement of Baracs-Földvár (Bóna 1992b), and at some of the Nagyrév cultures eastern and southern settlements such as Igar, Lovasberény and Gerjen (Bóna 1992b). The same pattern is also observed by Poroszlai (2000a) at Százhalombatta-Földvár. Houses are generally rectangular, possibly round-cornered and are constructed from either mud alone or wattle and daub. They are suggested to have one, two or even three distinct rooms. They are generally seen to have a short life-span of perhaps two or possibly three generations thus accounting for the need of continual renewal (Harding 2000; Poroszlai 1996 & 2000a; Horváth Jólan & Keszi 2004: 33).

The early phase of the pottery assemblage, that is the Ökörhalom period, is characterised by forms that are considered by Bóna (1963: 20) to relate to the antecedent Somogyvár group. These vessels are suggested by Bóna to have an extensive distribution that covers the entire area of Nagyrév expansion. In particular, he draws attention to 'the bi-conical angular jug or pot' as having a Somogyvár antecedent. However, at this time new 'baggy' shaped jars also emerge (Bóna 1992b). By the classical, Szigetszentmiklós, phase Bóna (1992a) suggests regional forms emerging which develop into a strongly recognisable cultural assemblage through this classical phase and continue into the Kulcs phase. In particular the well documented classic Nagyrév form of a one-handled, slightly squashed, rounded / ovoid bellied jug (or cup) with a long arching neck and a flaring rim but with a comparatively small rim diameter and a handle that springs initially from the neck rather than the lip but later from the rim (Figure 2.13 & 2.15) is seen as an essential element of all Nagyrév assemblages. Bóna (1963: 19) noting, that "at places where these are not found then Nagyrév culture is out of the question". Also of note is the classic Nagyrév bowl form described by Poroszlai (2000a: 24) as having a truncated-cone shaped bottom half, an arched shoulder and a flaring rim either without handles or with three small handles (Figure 2.14). These, and other forms, are part of highly prescribed ceramic repertoire that comes to characterise the Nagyrév group at the epoch of their occupation of the region and which later influence the ceramic repertoire of the Vatya cultural milieu at the beginning of the Middle Bronze Age.

With regard to this thesis an important aspect of the ceramic assemblage of the Nagyrév group is highlighted succinctly by Bóna (1963) who states that

> "In other words, Nagyrév man [sic] buried with its dead vessels manufactured especially for the graves, very often different from those for everyday use or festive occasions; or to put it inversely, the carefully wrought vessels of good material, to found in the settlements, were not placed in the graves".
>
> Bona 1963: 19

This observation between settlement and cemetery assemblages is born out by the primary data collected for this research and is a significant factor in establishing social ideas relating to the deployment of skill.

All of these changes may be seen to reflect a change in social order of the Nagyrév from a family based, egalitarian society echoing its antecedent Makó roots toward the beginnings of a more structured society that would continue into the Vatya period to eventually become highly stratified in nature.

2.4.2 The Vatya

Evidence from both Dunaújváros-Duna-dűlő and Százhalombatta suggests that the emergence of the Vatya group was very possibly a peaceful merging of the Nagyrév and Kisapostag groups (Poroszlai 1996: 8, 2000a: 25; Vicze 2001). If this explanation holds true the area of the Central Danube and the Danube / Tisza interfluve may be seen to have a continuously evolving social and cultural group that maintains use of this region for a period of approximately 500 years as the Vatya culture develops throughout the Middle Bronze Age.

The identification of the Vatya phenomenon as a separate cultural group has a complex history within Hungarian archaeology. At the time of its emergence several changes are occurring across this region as various cultural groups enter a period of flux; some groups disappear or are forced into smaller territories whilst others emerge and thrive (Bóna 1992b) (Figures 2.6 & 2.7). One of the main arguments for the emergence of

Vatya society has been that just such a regional group, the Kisapostag, expanded their territory eastwards into Nagyrév territory at the Kulcs phase of the Nagyrév lifespan and that the influence of these two groups co-existing in the same territory led to a fusion and intermingling of ideas resulting in a peaceful emergence of a single new society known as the Vatya (Patay 1938; Bóna 1975 & 1992b; Vicze 2001). It is interesting to note that the central distribution area of the emerging Vatya group was initially focused on territory along the Danube that might be considered as a "boarder" between these two groups (Bóna 1992b: 16-17). The notion that these two groups intermingled is highlighted in the mortuary arena where graves of both groups are found contemporaneously in the same cemeteries and where grave goods, namely pottery, is seen to be influenced by both groups (Vicze 2001: 39; Horváth Jólan & Keszi 2004: 37).

Whatever the roots of the emerging Vatya complex there is no evidence to suggest any kind of major hiatus at Vatya I, the opening phase of this cultural group. It seems most likely that some sort of peaceful transition took place and that life continued on many sites in an uninterrupted manner (Bona 1992c; Poroszlai 2000a; Poroszlai 2000b; Horváth Jólan & Keszi 2004). Certainly, excavations at Százhalombatta show an unbroken continuity between the Nagyrév and Vatya settlement layers. House 3 at Százhalombatta particularly confirms that houses continued to be built in the same way, in the same style and with the same orientation. Meanwhile, the pottery record from level 4, the earliest Vatya layer, suggests a strong continuation and influence of form from the antecedent Nagyrév population (Poroszlai 2000a: 18–22).

At Dunaújváros-Duna-dűlő Vicze (2001: 37) argues for the same continuation of form and decoration in the ceramic record but also suggests a degree of innovation as being present with what she describes as transitional shapes occurring and diverse styles of decoration coming into being. Also at Dunaújváros-Duna-dűlő Vicze (2001) notes that the burial custom continues without hiatus; grave groups apparently started in the Nagyrév period continue in use and follow the pre-determined small oval or boat-shaped clusters representative of small, family burials. Vicze (2001) sees this as the continuation of tradition by the first generation of the new cultural milieu.

Despite the apparently peaceful transition it is evident that through time the Vatya culture developed new ideas about how to live and this is clearly demonstrable through changes to material culture (in particular the pottery assemblages), burial, the nature of settlements and ideas relating to agriculture. The now well documented "classical Vatya earthworks", a complex of multi-layered, defended hilltop tells that extends along the Transdanubian side of the Danube and eastwards to the Tisza region begins to emerge and continues to develop throughout the Vatya time-span (Kovacs 1977; Poroszlai 1988). Poroszlai (personal communication and unpublished manuscript) notes this earthwork system as having thirty fortified tell-settlements that can be divided into two groups. Twenty-two are situated in a semi-circular position on the western and eastern border of the Vatya's territory and another eight are situated along the Transdanubian (right bank) of the Danube, of these Százhalombatta is the most northerly. These eight settlements are seen by Poroszlai to represent the "defence-line" of an agrarian society wanting to protect its economic and tribal territory on the one hand and control its most important trade routes and crossing places on the other. Thus tells, certainly in this region, are seen to represent an extremely well organised, and increasingly secure but stratified society and become central to the economic and social framework of Vatya society (Laszlo 2003: 10). As Poroszlai notes (2000b: 136) "A long existence on the same sight without major disruption requires a stable arrangement for economic and social development". These fortified tell settlements are also accompanied by extremely large and prominent urn cemeteries (Bóna 1992b) indicating continued use over hundreds of years (Vicze 2001).

An important factor underpinning such organisation is the increased need and ability to "produce a significant surplus" (Laszlo 2003: 53) so that those engaged in the manufacture of metalwork (and pottery?) were free to pursue these tasks. Such surplus would allow for trade and enable the purchase of raw materials for smith's to pursue the metalworking that is evident at many settlements (Horváth Jólan & Keszi 2004; Laszlo 2003; Poroszlai 2000a). Poroszlai (2002 unpublished manuscript) points out "craftsmen and merchants are now important and influential members of the society". Provision of surplus is linked to improved agricultural practices that allow the population to remain static, unlike the preceding Makó population. By Vatya II, and continuing into Vatya III, agriculture becomes more focused on intensive arable farming and crop-rotation is introduced (Poroszlai 1988: 30). At this time at Bölcske-Vörösgyűrű, for example, an increased repertoire of cereals comes into being and millet appears for the first time. These are used alongside leguminous plants and winter grain weeds indicating the implementation of autumn sowings (Poroszlai 2000b). A similar intensification of cereal production also occurs at Százhalombatta (Sumegi & Bodor 2000: 87) and here burnt cereal grains are found in association with a 'female' Rákospalota urn suggesting a link between gender (or fertility) and grain (Poroszlai 2000a) and, given the understanding of Rákospalota as high status pottery, with rank as well.

This is not the only site where such finds occur. Another outstanding anthropomorphic vessel (urn) was found at Mende-Leányvár (Poroszlai 2000a: 22), again in a pit with burnt grain. Poroszlai suggests that to this agrarian society grain is of the utmost importance and valuable and that this practice may be part of a custom designed to protect cereal in some way by placing grain with 'fertility gods and goddesses'. Alongside the intensification of agriculture there is intensification in animal husbandry and an increased use of animals, including horses. The many, sometimes elaborately, decorated bone cheek pieces found in the Carpathian basin suggest that the presence of the horse was a social as well as a practical phenomenon and that horses may be linked with the notion of ranked individuals (Champion *et al* 1984: 207). Warmer and wetter weather lends itself to all these processes and this combined with securing a sound economic community, allowing for settled dwelling, is seen to have led to an inevitable concurrent population expansion which in turn worked to create an increasingly complex social hierarchy (Laszlo 2003: 56).

This expansion in population is demonstrated by the increase in both the size and numbers of tells (Vicze 2001; Laszlo 2003). At Százhalombatta (Poroszlai 1996) estimates that 50–70 houses may have been present indicating a population of 400–500 people. Population expansion, in an area such as a tell which is bounded by distinct physical boundaries, means that through time the nature of the settlement, and the physical use of space, must change with the population having to adapt to new conditions (Horváth, Jólan & Keszi 2004: 39). This physical change to space is witnessed by the houses on tells becoming closer to one another through time (Bóna 1992a). Perhaps the pressure on space offers some explanation for the particular phenomenon of the numerous pits that are often found located within Vatya households (Poroszlai 1988: 33, 2000b) and which cause so much disruption to the excavation process.

It is important to stress that fortified tell settlements are to be seen as at the 'top' of the Vatya settlement system (Horváth Jólan & Keszi 2004: 39) and that many single layer settlements are also evident (Kovacs 1977); although few have been excavated or published. These may bear a particular relationship in the Vatya III period to population expansion and many such settlements, such as Koszider-asztal at Dunapantele, appear to be related to larger fortified settlements. At Nágyköros Földvár, Poroszlai's excavations of 1984 and 1985, revealed what she describes as a village, or large rural settlement, rather than a typical fortified settlement (Poroszlai 1988: 34; 1992b: 158). This settlement is apparently only established at the outset of Vatya III, is defended with a bank and ditch toward the end of the Vatya III period and is then, apparently peacefully, abandoned by the final Vatya – Koszider period. The faunal assemblage of goat, pig, dog, sheep and cattle suggests that the population were engaged in farming and animal husbandry in a way that would appear typical for this period. Meanwhile, there is no sign of any bronze industry linked with the site. This site suggests that not all later Vatya life was played out on the fortified tell settlements and that there was some diversity in settlement patterns. This is not to say that single layered sites such as Nágyköros Földvár, or smaller, settlements were not intimately linked with the dynamics of the tell culture.

From Vatya II onwards there is a discernable development in the ceramic repertoire. The enigmatic diversity that Vicze (2001) notes at the transition from Nagyrév to Vatya I is replaced by a greater consistency of forms that are defined by a new degree of simplicity with regard to both form and decoration. Decoration is not common to the repertoire but where it does occur it most often takes the form of simple incised geometric motifs. This simplicity of the ceramic repertoire is also noted by Bóna (1992b) although he seems to place it as a slightly earlier phenomenon of the Vatya development. By Vatya II Vicze suggests that "a consensus has been reached on the basic proportions, shapes and decoration" by Vatya communities (Vicze 2001: 152). This "bedding down" of a new and distinctive ceramic assemblage is seen by Vicze (2001: 152) to represent the overall consolidation of Vatya society after the earlier phases of integration. At this time there is also a notable increase in the amount of pottery being produced which is most certainly linked to the aforementioned population expansion; interestingly this coincides with a general perception that "better quality" pottery is now being produced (Bóna 1992 c: 150).

The forms that begin to emerge at the Vatya II phase continue in use through to Vatya III and the development of certain elements within a classic Vatya assemblage can be clearly traced. For example, the development and use of the anza lunata handle (Figures 2.8 & 2.9) which becomes a key component of some of the highly exaggerated Rákospalota Koszider forms towards the closing phase of the Vatya group. By Vatya III the previous period of simplification and consolidation begins to open out and new forms and decoration are introduced and supplement, but do not change the essential characteristics of the pre-existing repertoire of the Vatya II period (Vicze 2001: 173).

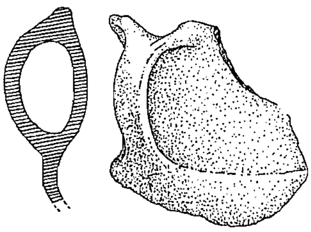


Figure 2. 8
An early example of an anza lunata handle

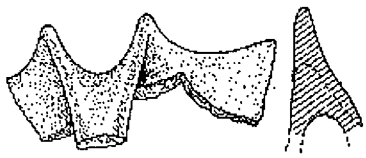


Figure 2. 9
A later form of an anza lunata handle

At this time decoration on vessels increases concurrently with the almost total disappearance of bronze grave inclusions and Vicze (2001: 174) sees this as a transferral of ideological or personal expression form one arena to another. By the Vatya III / Koszider period ideas surrounding decoration are also seen to be influenced by external contacts, for example the garland decoration found usually on Szőreg/Gerjen pots appears in the Vatya repertoire as do the humps and plastic scribed motifs of the Szeremle culture suggesting links to the south-west of the Vatya region. This exchange of decorative styles is argued to suggest a strong degree of contact, perhaps through increasing trade and movement of goods, with other societies (Bona 1992b; 1992c; Poroszlai 2000b; Vicze 2001; Horváth Jólan & Keszi 2004). This increased contact is further revealed by the numbers of 'exotic' goods, found at Vatya settlements and in grave assemblages.

It seems that throughout the Vatya period the changes that can be observed in burial customs relate mostly to the grave accompaniments and the urns used than to the nature of cemetery layout or the basic rite of cremation. Bóna (1992b), like Vicze, notes the varying use of grave goods. He observes that in the earlier Vatya phases large numbers of bronze objects are placed with the dead prior to cremation and then appear in urns and that furthermore the fairly even spread of these items suggests a society that was still reasonably un-stratified even if becoming more standardised. By Vatya II there is an observable decrease in the number of traditional bronzes placed in grave assemblages (Vicze 2001). Meanwhile, by Vatya III, at the same time that traditional Vatya sheet ornaments (bronzes) almost totally disappear from grave assemblages. Bóna (1992b) notes a shift away from this more egalitarian burial tradition and the inclusion in certain graves of bronze weapons and decorated bronze and gold items, suggesting a greater degree of stratification or differences between people and groups within Vatya society. The deposition of high ranking items is a well documented feature of the later Middle Bronze Age in the Carpathian region and its occurrence is seen as linked to a stratified society with clear leadership and ranked individuals (Shennan 1993; Laszlo 2003: 55-56). This reflects a degree of change in society from the opening phase of the Vatya culture.

By the final, Koszider, phase of the Vatya culture this stratification of society is undeniable (Shennan 1993; Poroszlai 2000a; Vicze 2001; Laszlo 2003). Vicze (2001: 210) draws attention to the quality of the remaining elaborately decorated bronze items being deposited, along with other high status objects, at Dunaújváros-Duna-dűlő. She argues that while differentiation and rank may have been previously present in Vatya society this is the point at which it is being visibly and 'bluntly' articulated. This articulation of rank is also visibly demonstrated through the production and distribution within the Vatya territory of the highly elaborate and exaggerated Rákospalota pottery (Figures 2.13, 2.15 & 2,16). This pottery requires a high investment of technological expertise to produce (Budden 2002: 67-68) and its striking visual characteristics may have worked as a recursive medium to reinforce or protect specific understanding of life patterns and divisions within Vatya society at a time of imminent change (*ibid.*). The Koszider period is certainly seen to be characterised by "fundamental changes in the whole Carpathian basin" (Vicze 1992: 95) and a sense of 'agitation' indicated by both larger and smaller communities beginning to move between traditionally held territories (Horváth Jólan & Keszi 2004: 42). Thus at the time that mutual influences from neighbouring groups are seen in the pottery repertoire and change is occurring on all fronts it may also become important to "transmit collective message"' (c.f. Sterner 1989: 458) about what constitutes an understanding of Vatya society and for powerful elites to exhibit control and strength. Despite the apparent uncertainty surrounding Vatya society this is a period when metalwork is at a production peak in terms of both quantity and quality. The distinctive nature of Koszider, Late Middle Bronze Age, metalwork (Figures 2.10 & 2.11) makes it easily traceable and highlights continuing trade across and beyond the Carpathian basin as does the inclusion of amber pearls in many Koszider treasure hoards (Laszlo 2003: 57).

Figure 2.10. Late Middle Bronze Age Bronze hoard from Százhalombatta (After Kemenczei 2003: 167)

Figure 2.11 Late Middle Bronze Age hoard from Dunaújváros-Kosziderpadlás (After Poroszlai 2003: 155)

There are two fundamental arguments for the decline of the Vatya culture. The first and most commonly accepted is the culture historic view of the emergence of the Tumulus culture extending into Vatya territory and forcing the abandonment of many sites (Vicze 1992 & 2001; Poroszlai 1996). Laszlo (2003: 57-59), however, draws attention to the stresses placed on an ever increasing population facing decreasing agricultural resources as land becomes exhausted at a time of downturn in climate. Either scenario, or a combination of both, is likely to cause social tension and increase the likelihood of overt and strong leadership from the elite. This becomes evident in the increasingly fortified settlements, the overt use of material items to differentiate groups within society and the production of highly skilled, high status objects. Coles & Harding (1979: 102) also draw attention to possible economic and demographic causes and note that not all tells are deserted at the end of the Vatya horizon.

2.5 The Early to Late Middle Bronze Age at Százhalombatta, Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő

Both the settlement sites Százhalombatta and Dunaújváros-Kosziderpadlás were initially inhabited by Nagyrév populations and then developed to form part of the Vatya earthwork system of the Middle Bronze Age Vatya Culture which covers an oval distribution area along the Danube and the Danube-Tisza Interfluve (see Figure 2.5). Meanwhile, Dunaújváros-Duna-dűlő is the cemetery of the Dunaújváros-Kosziderpadlás community.

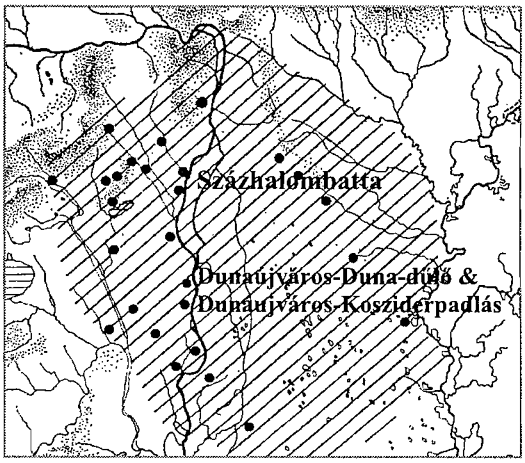


Figure 2.12 Location of Százhalombatta, Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás in the region of the Central Danube region of Hungary

2.5.1 Százhalombatta

The Százhalombatta tell settlement site is situated in the central part of the Carpathian Basin and lies on a high bluff on the right bank, or Transdanubian side, of the Danube 30 km south of Budapest (Poroszlai 2000a: 13; Sumegi & Bodor 2000: 83). It has well preserved occupation layers, 3–5 metres thick, representing roughly 500 years of occupation from ca. 2000–1500/1400 BC (Kristiansen 2000: 9). The earliest layers of occupation at Százhalombatta show that the site was first settled by peoples of the classical Nagyrév at the transitional stage of classical Nagyrév to Late Nagyrév society (Poroszlai 2000a: 24) toward the end of the first phase of the Early Bronze Age (Bóna, I 1992b). This is demonstrated through the material record with an absence of any Ökörhalom style of ceramic but both Szigetszentmiklós and Kulcs assemblages represented in the earliest level, level VI, of the site and the presence of a particularly 'beautiful' and well preserved, round-cornered Nagyrév house which had burnt down (Poroszlai 1996; 2000a).

This house was oriented northwest to southeast and, typical to the period, was built with thin wattle and daub mud-walls supported from the outside and had a beaten earth floor. There were two distinct rooms divided by a deep step and a light internal wall indicated by small post-holes. One room is seen as a 'kitchen' area which revealed a working pit and a shelf possibly used for the storage of pottery vessels used in daily life and the other a 'living' area with a clean and well plastered floor. Between the two rooms at the step area a substantial post hole suggests that this was where the main supporting post for a gabled roof had stood. Burnt remains from the roof further support this theory. In level V-Vb bowls with a truncated-cone shaped lower part and arched shoulder and 'Kulcs' style jugs, both typically characteristic of the culture and found across the whole Nagyrév distribution area represent the late (end) phase of the Nagyrév culture at Százhalombatta (Poroszlai 1996 & 2000a). At this level more houses were found immediately above the previous one from level VI. They were of a similar style and construction as before, being round-cornered and following the same orientation, but seemingly of less elaborate design. The houses all followed the same pattern of wattle and daub walls of an average thickness of 10–15cms and well preserved beaten clay floors and houses were continually rebuilt in the same location. During the Nagyrév phase of occupation the site was more sparsely populated than in later phases and this is demonstrated by the far smaller ceramic assemblage of mainly domestic pottery for this period (Poroszlai 2000a: 24).

As with the general account for this period and region it seems that a peaceful transition took place at Százhalombatta at the end of the Early Bronze Age from which the Vatya culture emerged. This is clear both from the excavated settlement layers, at level V, which are no deeper between the various Nagyrév phases than during the Nagyrév / Vatya transition and from a continuation of both building techniques and a continuation of pottery styles (Poroszlai 2000a:20). The development of the settlement at Százhalombatta unfolds in a manner to be expected of the Vatya group. All four phases from Vatya I through to the final Vatya / Koszider phase can be broadly identified. From Vatya Period I through to Vatya Period III earthworks were erected and Százhalombatta became a fortified semi-urban settlement typical of the Vatya culture. The internal structure of the settlement is noted by Poroszlai (1996: 8) to have been carefully planned with houses built on the highest and most prominent part of the plateau while animals and cereal cultivation were kept on the sloping flanks. Like most fortified Vatya settlements a rampart and ditch, observed in the north-eastern part of the earthwork, was established during the Vatya occupation of the site and an internal division also existed (Poroszlai 1996: 5; Varga 2000:76). This internal division may represent a division between a supposed acropolis and the village (Kristiansen 2000: 9; Poroszlai 2000a: 13). This is seen to suggest either the presence of a hierarchy existing within the site occupying a privileged position within the internal fortifications or that one area represents the dwelling part of the community while the other is allocated to economic activities and workshops (Poroszlai 2000a: 13). Unfortunately the disturbed layers, caused by the usual presence of Vatya pits, make it hard to identify the precise nature of this division (Varga 2000: 76).

As well as a change to the settlement layout the nature of the ceramic assemblage also changes through time with a slow but steady elaboration of the original pottery repertoire until the 'fineware' element of the assemblage reaches an epoch of elaboration in the form of high quality Koszider (Rákospalota) pottery. A cache of this fine-ware secreted in Pit 2 just prior to abandonment of the site (Poroszlai 2000a) lends credence to the argument for a degree of social stratification existing at Százhalombatta. It is in this pit that burnt cereal grains are found inside the finely made anthropomorphic Rákospalota jar representing a woman wearing bracelets. This is suggested by (Poroszlai 2000a) to imply a possible link between gender, fertility, grain and, given the understanding of Rákospalota as high status pottery, rank as well. The excavation of a pottery-workshop, 11 ovens (kilns) associated with discarded pottery slag (wasters) of the Vatya-Koszider period is evidence that production of high status Rákospalota ware certainly took place at Százhalombatta (Poroszlai 1996: 10, 1992a: 153-155). The placing of such pottery in caches, such as pit 2, at the end of the sites history further suggests a certain value attached to these items.

An oven for bronze-casting, casting dross and clay bellows found in the earliest, Nagyrév, layers suggest that metalwork was produced at Százhalombatta from the earliest days of its occupation (Poroszlai 1996: 7). The production of metalworking, as with pottery, appears to have increased throughout the Vatya phases and Poroszlai (1998: 9) notes the presence of two bronze hoards deposited at the end of the Koszider horizon. The first hoard consisted of "two bronze shaft-hole axes, pins, bracelets, spectacle-spiral pendants, buttons with two holes, panpipe-shaped plaques of bronze sheet, and plaques of bronze sheet with twisted terminals" (Poroszlai 2000a: 15). The second larger hoard was hidden in a two-handled decorated pot and was characterised by Koszider metallurgy. It included 3 armlets, 4 chisels, 3 daggers, 4 bracelets, 4 pendants and 3 golden rings. Both hoards suggest considerable wealth and again indicate the presence of ranked, or wealthy, individuals at Százhalombatta at the closing phase of its occupation (Poroszlai 2000a: 15). The high quality pottery and metalwork produced at Százhalombatta also indicate that specialisation was in place here as at other Vatya sites and that skilled craftspeople were part of the fabric of Vatya society.

The end of the Vatya occupation of Százhalombatta may have been caused by the same reasons as those for the rest of the Vatya group; the emergence of the Tumulus culture extending into Vatya territory (Vicze 1992 & 2001; Poroszlai 1996), the stresses placed on an ever increasing population facing decreasing agricultural resources as land becomes exhausted, and a downturn in climate (Laszlo 2003: 57-59). There is certainly evidence to suggest that "large clearance and human disturbance" (Sumegi & Bodor 2000: 87) occurred from the Middle Bronze Age onward at Százhalombatta at the same time the population on the tell increased (Poroszlai 2000a). Environmental pressure and population pressure cannot be ruled out as contributory factors for the decline of the Koszider epoch. There also seems, however, to be some hint that people left in a hurry. Poroszlai (1996: 10) notes that pottery depots were not placed in pits, and hoarded, but left lying on the surface of the pottery area or gathered up close to hearths and that some limited occupation of the site occurred by the incoming Tumulus culture (1992a: 153).

2.5.2 Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás

Dunaújváros-Duna-dűlő is the largest known Middle Bronze Age cemetery within the region of the Carpathian- Basin (Vicze 2001: 22) and is the burial ground of the community that inhabited fortified settlement of Dunaújváros-Kosziderpadlás for several hundred years from the Early Bronze Age to the beginning of the Late Bronze Age. Kosziderpadlás is one of the many island-like loess plateaus on the right bank of the Danube and is noted by Bona (1992c: 149) as being one of the most significant Nagyrév-Vatya-Vatya/Koszider settlements. It lies only several hundred meters to the east of the cemetery in an easily defendable position (Vicze 2001: 11). Both sites are approximately 30 km south of Százhalombatta.

The pottery recovered suggests that Dunaújváros-Koszíderpadlás was initially settled towards the end of the first Nagyrév phase, the Ökörhalom, phase. There is no independent layer of Kisapostag material culture at Dunaújváros-Kosziderpadlás but the presence of Kisapostag items in the same levels as the Nagyrév (Kulcs) phase suggests a peaceful co-existence and transition into the Vatya culture. As at Százhalombatta there is no significant change to the building technology or sizes of houses. Meanwhile, the four house levels of the Nagyrév culture form a 120cm-thick layer and are similar to those found at Baracs-Földvár. The houses were roughly 4 metres wide by 5 meters long. Excavation of the Nagyrév pits revealed a significant number of 'beautiful jars' (Bona 1992c:151) that were associated with burnt grain. The ceramic assemblage of the late Vatya phase of the site is "dominated by excellent quality and elegance" (Bóna 1992c: 151) and in the Koszider period there are finely made Rákospalota jugs with anza-lunata handles and bowls with typically exaggerated forms. A 'male' version of the anthropomorphic vessel found at Százhalombatta is also thought to have been made at the settlement and then to have been used as an urn in the cemetery (Bona 1992c: 152). Meanwhile, urns, bowls and jars are present within the assemblage that belong to the Szeremle culture indicating strong external contacts with this group in the sites later history. Bóna (1992c: 150) notes a particular increase in the quantity of pottery during the Vatya III and Vatya / Koszider phase and suggests that this is linked with population expansion.

Signs of population growth are also suggested by the rebuilding of the rampart at Koszider-Padlás at the end of the Vatya 1 phase to facilitate expansion of the site. The original rampart appears to have been a significant structure with posts several metres high placed approximately a metre apart and in-filled with stomped loam. In later phases the rampart is cross cut with a series of pits and buildings suggesting that population pressure caused a need to remove this substantial construction in order to facilitate expansion of the site (Bóna 1992c: 151). The further use of Koszider-asztal, a triangular hill lying 110 meters to the north of the site, as an outpost or refugium in the late Vatya III (Bóna 1992c: 152) phase may indicate yet further expansion of the population and a repeated need for more domestic space. Bona (*ibid.*) and Horváth Jólan & Keszi (2004: 37) observe that this kind of expansion is usual at other fortified Vatya settlements.

As at Százhalombatta there is evidence at Dunaújváros-Kosziderpadlás to support the probability that high quality metalwork was being produced on the site. Stone moulds which were used to produce cut-work and cross-rippled trinkets suggests that jewellery was produced on the site and the presence of a stone mould of a barrel tube axe suggests that these too were produced at the settlement (Bóna 1992c: 152). Bóna suggests the further likelihood that some of the items found in hoards deposited at the end of the Vatya / Koszider occupation were also made on the site. In spite of the occurrence of hoarding associated with the closing phase of the settlement there appears to be no reason to suspect a major hiatus and Horváth Jólan & Keszi (2004: 38) suggest a "peaceful appearance of the Tumulus culture". They also suggest that while the ramparts at Dunaújváros-Kosziderpadlás are clearly developed and strengthened in later Vatya phases there is no evidence of them having ever been defended, "the devastation layers suggesting grand sieges are also missing" (Horváth Jólan & Keszi 2004: 38). With regard to the purpose of the rampart they prefer the explanation of an internal social development linked to a growing population resulting in an emerging "aristocratic" class who were capable of organising public projects that would work to define their status and provide a defence of high ranking homesteads but not necessarily against an external enemy (Horváth Jólan & Keszi 2004: 39).

The contemporaneity of the settlement and cemetery were established through a series of excavations that clearly confirmed the first use of the Dunaújváros-Duna-dűlő cemetery as coinciding with the initial settlement of Dunaújváros-Kosziderpadlás (Vicze 2001: 21). The cemetery is oriented NW-SE and seems to follow the natural direction of the valley separating the cemetery from the settlement. Vicze (2001: 23) notes the steep sided nature of the valley and draws attention to its visual accessibility by members of the community that it served. There are eleven major grave groups within the cemetery each of which has a slightly different orientation seemingly adjusting to the changes in direction of the valley to create a 'circling' of the settlement from the west. Vicze (2001) sees this as a conscious decision "to follow and emphasise the characteristics of the landscape itself" (*ibid.* 24) and by so doing to deliberately order there visual environment. The eleven grave clusters are arranged in oval or 'boat shaped' groups with each cluster containing 100–200 burials. In other Vatya cemeteries, such as Kulcs, Dömsöd and Lovasberény, these have been argued as being related to extended family or clan groups (Vicze 2001 *citing* Bóna 1975:37). The situation at

Dunaújváros-Duna-dűlő is noted by Vicze to be possibly more complex with smaller concentrations of burials of perhaps 10–20 graves, also arranged in half-circles, being present within the larger clusters.

In the opening phase of the cemeteries use Vicze (2001: 25) notes the presence of both Nagyrév and Kisapostag graves in fairly even numbers occupying the same area of the cemetery. This appears to support the notion of dual occupancy of the settlement by both cultural groups from the outset. The Nagyrév burials appear to be characterised by a distinguishable group-system representing family burials within larger kinship groups. There are also groups that are clearly situated independently from one another which Vicze (2001: 32) suggests may indicate either lineage based or socially based differentiation. The numbers of burials increase significantly by the late Kulcs phase and burial customs have changed from diverse with a mixed use of cremation with scattered ashes, cremation with ashes placed in an urn and contracted inhumation to highly uniform with ashes now always being put into an urn. This was covered with a bowl and a small cup, and possibly a bowl as well, were placed in the urn above the ashes (Vicze 2001: 55). Kisapostag burials appear to follow a similar pattern to the Nagyrév one but there are no scattered ash burials and Vicze notes that the frequency of bronzes within urns may suggest an expression of wealth or rank.

The uniformity of burial started in the last (Kulcs) phase of the Nagyrév communities use of the cemetery is noted by Vicze (2001: 52) to continue into the Vatya period which she describes as being “the most straightforward” phase. The burial rite is cremation and ashes were always placed in urns. A bowl was placed base down into the mouth of the urn to ‘seal’ it then a larger bowl was inverted over this. Cups were either placed inside the urn above the ashes or outside next to the urn. Vicze (2001) draws attention to the fluctuation of bronzes included in Vatya burials and suggests that the higher percentage presence of these in the Vatya I and II phases may be a continuation of Kisapostag tradition. The decline of this practice at the Vatya III period is argued by Vicze (2001:210) to be unlikely, given all the other evidence surrounding Vatya society, to represent any impoverishment of the settlement but more likely represents the previously noted consolidation and simplification of Vatya custom. As previously noted, by the Koszider phase the quality of the elaborately decorated bronze items being deposited, along with other high status objects at Dunaújváros-Duna-dűlő suggests that while differentiation and rank may have been previously present in Vatya society this is the point at which "indicators of high status and rank" were overtly displayed (Vicze 2001: 210).

2.6 Conclusion: main themes for this research

This review of the Early and Middle Bronze Age of the Carpathian Basin area raises a number of themes of particular interest to this research. There are issues linked to the social construction of society, access to resources, and the link between material culture, status and ideas of social storage. There are also considerations regarding the two contrasting social contexts – the settlement and the cemetery.

It is seen that the nature of society appears to move from being of a broadly egalitarian nature at the outset of the Nagyrév cultural milieu to increasingly structured and stratified through time. It would, however, be mistaken to suggest that this change proceeds in a simple linear manner from Early Bronze Age to Late Middle Bronze Age. The first hints of increasing stratification, and even rank, are noted at the final (Kulcs) phase of the Nagyrév period. The elaborate and exceptionally well constructed house uncovered at Tiszaug-Kéménytető (Csányi 2003: 144) and the elaborately whitewashed houses at Dunaújváros-Kosziderpadlás are seen to suggest links to individuals of high status. Meanwhile, Vicze (2001: 53) notes the increase in control structure of settlement which she describes as becoming increasingly "fixed and static", and at this time burial rites become rigidly uniform in nature (Bona 1963: 19; Vicze 2001: 53). Similar patterns are noted elsewhere (Bóna 1992b; Poroszlai 2000a). This structuring of society also appears to be repeated within the ceramic assemblage, which by the Kulcs phase of the Nagyrév has distinct characteristics and core items that are highly distinctive in character.

Interestingly the characteristics that may be seen as linked with a fairly rigid structuring of society and possibly with a degree of stratification are far less evident at the outset of the Vatya period. If, as has been suggested, the merging of Kisapostag and Nagyrév traditions led to the emergence of the Vatya (Patay 1938; Bóna 1975 & 1992b; Vicze 2001) their combined traditions appear to have resulted in some dilution of earlier distinctive traits. Vicze (2001) argues that the pottery produced at the opening of the Vatya period is characterised by an enigmatic diversity representing a melting pot of ideas and experimentation. By Vatya II this diversity is replaced by a consistency and simplicity (Vicze 2001; Bóna 1992b) that is seen to represent an emerging period of stability as ideas surrounding understandings of a 'Vatya identity' become consolidated. It is only as the Vatya culture develops through time and approaches the final Koszider phase of its life-span that clear evidence of social stratification, status, rank again emerge and are articulated through the elaborate material culture of the Koszider period.

The implications for this research are that the temporal span of the study is characterised by two distinct periods where the social order appears to be highly prescribed with well defined practices surrounding material culture repertoires. This occurs, firstly, during the closing (Kulcs) phase of the Nagyrév and secondly, and at a more exaggerated level, during the closing (Koszider) phase of the Vatya group. Both periods are marked by an apparent degree of stratification in society that appears as a distinct social factor. Following an apparently peaceful transition the Nagyrév community slowly develops a new persona and re-emerges as the Vatya group. A degree of stability emerges at Vatya II and III and by the close of the Vatya, at the Koszider phase there is a very strong indication of a highly stratified community. This provides a potential opportunity to compare and contrast the impact of these differing social dynamics on the pottery assemblages and to trace any changes that they may bring to bear on the deployment of skill and repeatability, and thus indicate learning strategies and outcomes. This task is greatly aided by the clear changes in vessel morphology through time (Figures 2.13, 2.14, 2.15 & 2.16). The attention that has been paid to these by Hungarian archaeologists allows vessel form types to underpin dating in cases where site levels, stratigraphy, have been disturbed by the ubiquitous presence of pits (Varga 2000: 76). The difficulty that does arise is the disparity in vessel numbers available. As noted by both Bona (1992c) and Vicze (2001) the increase in pottery production during the Vatya period appears to be significant. This means a far greater number of vessels are available for examination from the Vatya phases. The relevance of this for this research is discussed within the methodology, chapter 4).

As well as the temporal and social dimensions the choice of study sites allows the possibility to explore the production of pottery to be used in two contrasting social arenas: settlement and cemetery. It has been noted that Bóna (1963) observed a difference between pottery 'buried with the dead' and that found on the settlement at the

Nagyrév period. The primary data for this research will demonstrate that this phenomenon continues through to the Vatya period. The nature of these differences implies the possibility that social ideas relating to the production of pottery and the deployment of skill are articulated differently in these two contrasting social contexts.

Differing social dynamics and differing social arenas are instrumental in the emergence of a range of pottery items that are, in turn, integral to the way in which communities of people create and re-create these social arenas. The result is a broad spectrum of pottery, as distinctive vessel groups, throughout the temporal span of this study (Figures 2.13, 2.14, 2.15, 2.16). Within this there is an array of domestic items, funeral urns, ubiquitous small cups, and very elaborate jugs and bowls that are linked with rank. This range of wares offers the opportunity to explore the possibility that different 'vessel groups' are treated differently, existing with differing meaning within different social arenas, and emerge from different arenas of learning. For example, the highly elaborate Rákospalota pottery of the Koszider period may be seen as intimately linked with hoarding, power relations and ideas of articulating status in the day to day arena of the living, while urns are obviously intimately linked with the dead — another highly charged but very different social arena. Meanwhile the domestic pots and cups may be implicated in different social ideas that are not necessarily less important but carry a different range of expectations.

This range of vessel types also means that there is a range of technological complexity present which provides a valuable tool to explore the nature of skill investment and thus learning strategies and outcomes. This is discussed in detail within the methodology (Chapter 4).

Finally, if potters are aiming to produce pots with repeated characteristics, discussed in depth in chapter 3, a question of access to resources is raised. In order to consistently reproduce an item certain resources must also be consistently available (Budden 2002). Who has access to these resources and are they deployed evenly across the range of pots manufactured?

Page 41 absent

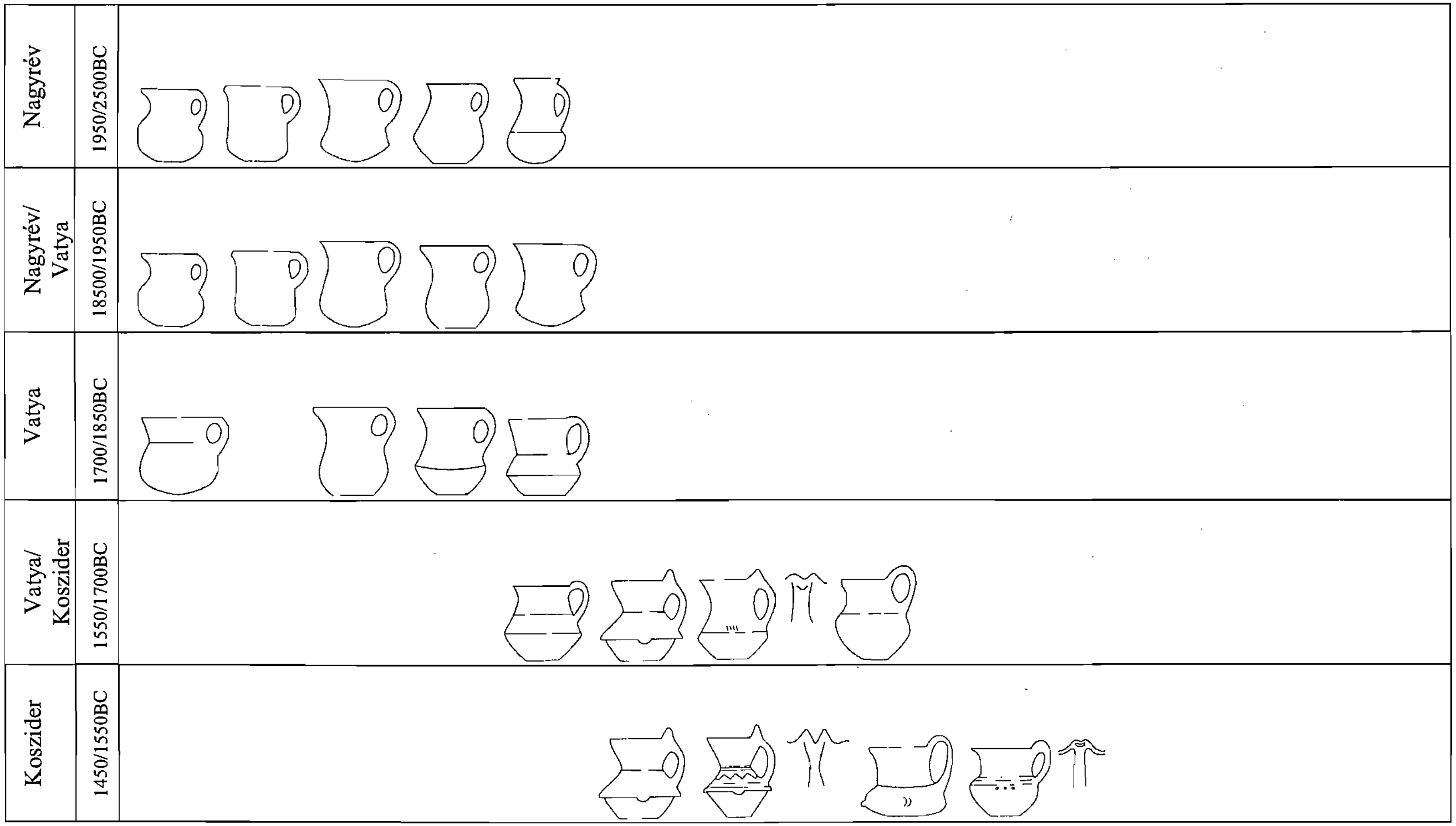


Figure 2.13 Cup form types over the temporal span of Early to Late Middle Bronze Age at Százhalombatta, Dunaújváros-Duna-dűlő and Dunáujváros Kosziderpadlás (Forms after Bona 1975; Poroszlai 2000; Viczse 2001. Drawings by Ms B. McNee and the author.)

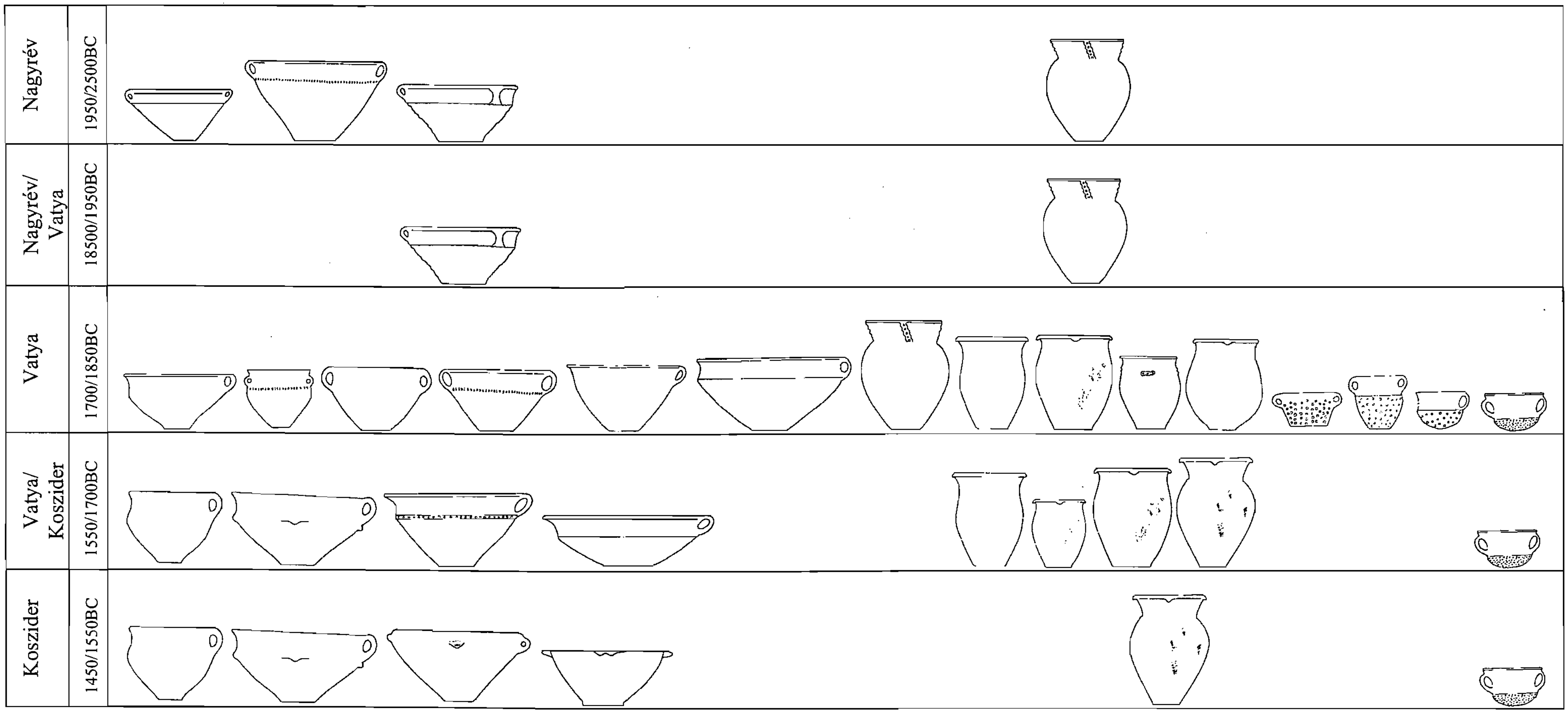


Figure 2.14 Domestic vessel form types over the temporal span of Early to Late Middle Bronze Age at Százhalombatta, Dunaújváros-Duna-dűlő and Dunáujváros Kosziderpadlás (Forms after Bona 1975; Poroszlai 2000; Viczse 2001. Drawings by Ms B. McNee and the author). From left to right, storage/cooking bowls, storage/cooking jars, strainers

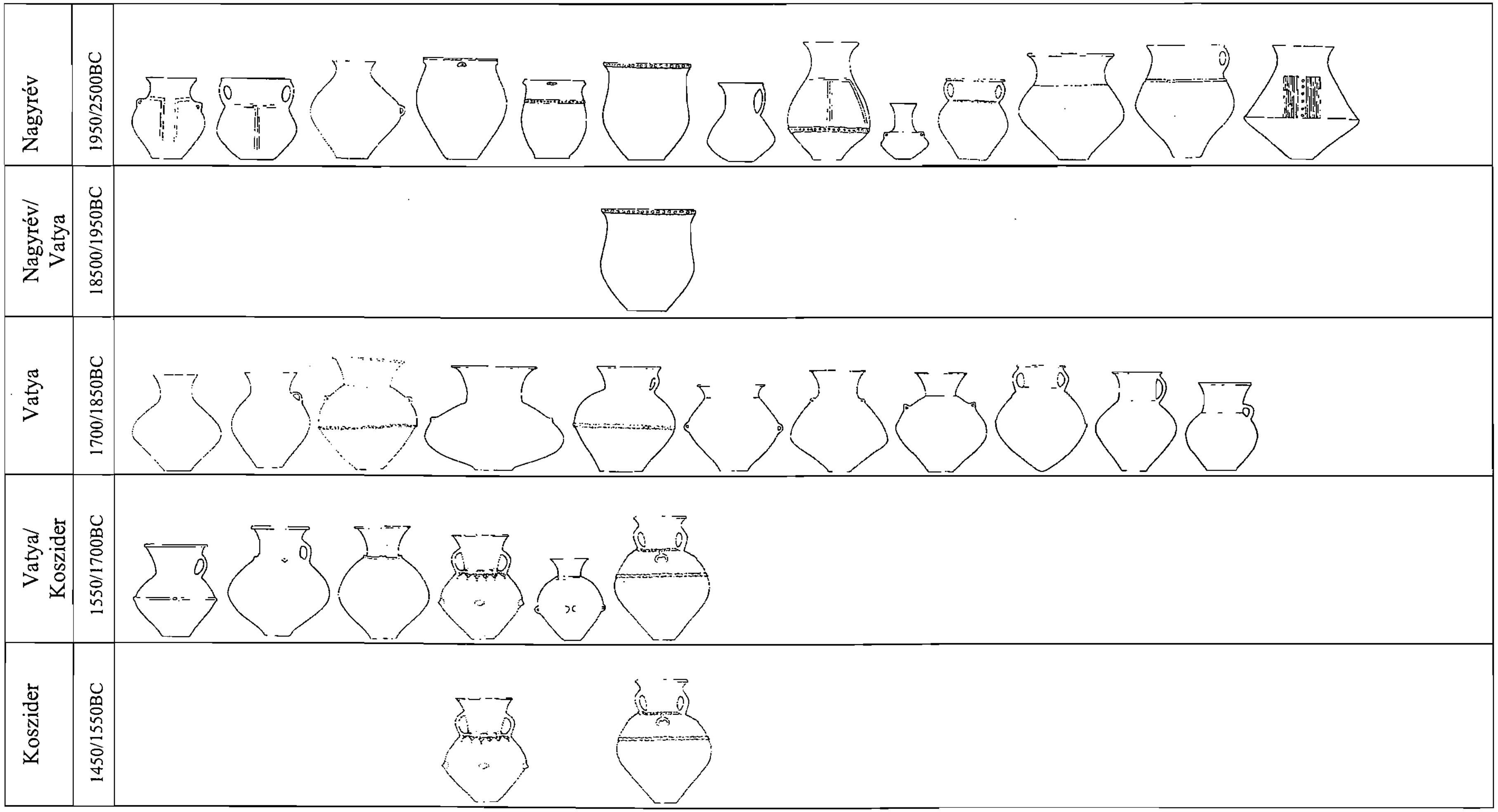


Figure 2.15 Urn form types over the temporal span of Early to Late Middle Bronze Age at Százhalombatta, Dunaújváros-Duna-dűlő and Dunáujváros Kosziderpadlás (Forms after Bona 1975; Poroszlai 2000; Viczse 2001. Drawings by Ms. B. McNee and the author)

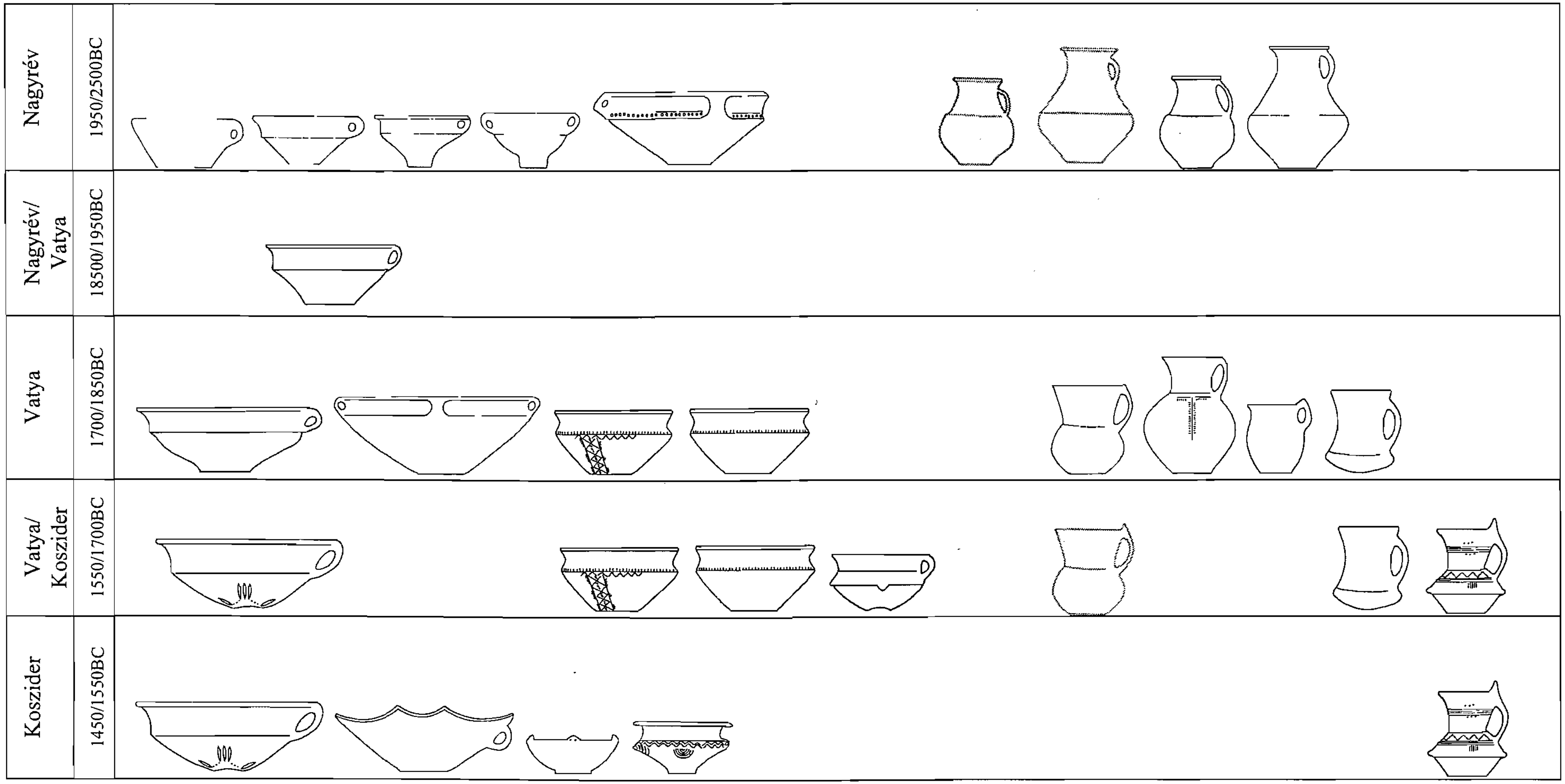


Figure 2.16 'Fineware' bowl and jug form types over the temporal span of Early to Late Middle Bronze Age at Százhalombatta, Dunaújváros-Duna-dűlő and Dunáujváros Kosziderpadlás (Forms after Bona 1975; Poroszlai 2000; Viczse 2001. Drawings by Ms. B. McNee and the author)

Chapter Three

Learning Strategies, Skill and Society

"Clay is alive, they told me; it is sensitive, delicate and gets upset easily; it responds to the mood of the potter. Clay knows when the potter is ill or inexperienced, and becomes impossible to work. Clay changes state, formed and shaped by the potter's idea, but sometimes, they told me, clay has its own idea"

Dorothy Hosler 1996: 83

3.1 Introduction

According to (Hosler 1996: 83) it may be argued that making a pot or working with clay cannot be assumed to be an easy matter. As in the manufacture of all items of material culture skill is required. But where does such skill emerge from?

In this chapter it will be argued that all societies have culturally specific ways of passing on knowledge that result in socially constituted learning strategies. Learning strategies sit at the very heart of all technology and, therefore, at the heart of the essential production and reproduction of material culture. It is increasingly understood within archaeological studies that material culture is the medium through which cultural and social expression is mediated (Dobres 2000; Sofaer & Sørensen 2006). Only by the passing on of technological knowledge, through learning strategies, from one generation to the next can vitally important culturally constituted skills be maintained (Wallaert Pêtre 1998; Crown 2001; Sassaman & Rudolphi 2001). Additionally, technology is now convincingly argued to be both culturally and socially constituted (c.f. Miller 1985; Shanks & Tilley 1987; Barley 1994, 1997; Barrett 1989; Roux 1990; Dobres 1994, 2000; Sillar & Tite 2000; Chapman 2000; Schlanger 2006). This situation means that a relationship must exist between technology as technical systems and technology as social systems. Roux (2003: 142) argues that it through understanding the relationship between these two interrelated phenomena that material culture can be interpreted in terms of social organisation. In this research it is argued that in order for this to become possible – in terms of learning strategies – it is necessary to place an additional emphasis on an explicit understanding of the physical characteristics of technological processes, in this instance pottery technology. By combining an understanding of culturally and socially constituted action with an understanding of technological process it is possible to trace manufacturing actions left permanently embedded in an article (pots) during its production. This allows the observation and assessment of technological skill investment and deployment. Given that social dynamics and technology are interrelated the nature of skill investment and deployment will give rise to an understanding of the nature of learning strategies (Minar & Crown 2001: 369) which in turn allows broader understandings of social dynamics in play at the time of production.

In this chapter a review and critique is offered as to how archaeologists have dealt with topics that relate to learning. In order to clarify the nature of preceding work a number of topics are covered. The socially situated nature of technology is implicit to all of these discussions. Following from this, the arguments presented aim to situate a new approach to understanding learning mechanisms which rests on a profound understanding of potting principles and an understanding of the precise nature of skill acquisition. This requires a discussion about the distinct difference between skill and learning. To this end learning strategies are argued to be separate to the actual cognitive and physical processes of skill acquisition. The cultural and social nature of this process is also discussed. By making this separation it becomes possible to understand the specific nature of skill acquisition and thus to disclose how it is possible to observe patterns of skill investment archaeologically.

It is only possible, however, to recognise these patterns by also incorporating into this research a newly formulated methodology that allows pottery to be placed as the central context of analysis (a full account of the methodology follows in chapter 4). In order to meet the goal of this thesis and link learning strategies and technology to socially situated processes, a necessary discussion follows regarding the notion of culturally constituted institutionalised practices and the bearing they have on social action; in particular learning strategies. In conclusion, it will be seen that by combining an understanding of institutionalised practices with the ability to read patterns of skill in ceramic assemblages it becomes possible to infer the nature of learning strategies and their relationship with broader social mechanisms in play at the time of production.

3.2 Learning strategies: previous research

Archaeological studies have suffered from a lack of research that deals explicitly with the issue of learning strategies in a prehistoric context. Three particular areas of research have, however, touched on notions of learning. These are studies dealing with modes of production and their relationship with specialisation and standardisation; chaîn opératoire, and the use archaeologists have made of ethnographic studies — both separately and in combination with modes of production and chaîn opératoire. Each of these areas is explored in turn.

3.2.1 Ethnoarchaeology and Modes of Production: the case of household production versus specialisation and standardisation

There has been a long history of archaeologists studying prehistoric pottery with the dichotomy of household versus specialised production lying at the back of their thinking. Two particular ethnoarchaeological studies, Van der Leeuw (1976, 1977) and Peacock (1981, 1982) are renowned for using the notion of 'modes of production' to look at the social organisation of pottery production as being related to domestic / household production, restricted domestic / household industry, individual workshop / individual industry, nucleated workshops, manufactory or village industry, or full factory. Although these two studies varied slightly they both shared a particular aim which was to highlight issues of potter participation in terms of gender, the economic relationship of pottery to potters, the investment of time and materials and the relationship of the mode of production to consumer. The value of the subsequent framework and perspective that these studies offered, which influenced numerous ethnoarchaeological studies (Costin 1991, 1995; Rice 1987, 1991), should not be underestimated; and may be considered as having offered an important counter balance to equally influential notions of both technological and environmental determinacy (Binford 1965; Arnold 1976, 1985; 1988; Rye 1976; Braun 1983; Rice 1987; Schiffer & Skibo 1987; Young & Stone 1990; Schiffer et al.1994). These studies offered enlightening information about the relationship between material science and techno-function of pottery vessels, however, they frequently, although not always (see Sillar & Tite 2000), failed to endorse the social nature of pottery production (Gosselain (1998).

Unfortunately, and certainly not intended, a bye-product of the 'modes of production' framework was to introduce a dichotomy between household and specialist production that became implicit to many discourses relating to prehistoric pottery. Household production, a task seen to be predominately carried out by women (contra this view see Barley 1994; Sillar 1997; David 1990), is considered as little more than another easily accomplished 'monotonous' daily task requiring so little concentration that constant interruptions are of no consequence (Arnold 1988: 101). Any notion of skill is belied by such descriptions and it is not surprising that household production became equated, in more general texts dealing with prehistory, with casual (for which we usually read poor) production (for example, Thomas 1991: 101). Meanwhile, the products of potter specialisation, and ensuing standardisation, encompass notions of skill, sophistication, permanence and a relationship with emerging social complexity (Rice 1981, 1991; Kramer 1985; Brumfiel & Earle 1987; Arnold 1988; Sinopoli 1988; Earle 2002) and 'elite /ceremonial / high value goods' (Rice 1991:257). The importance of such studies with regard to understanding certain aspects of social organisation is not denied here. However, this perspective has also created a tendency to assume that where profound skill exists in prehistoric pottery manufacture it is only in the context of large scale specialist production.

This is clearly a misnomer and evidence of skill variability is being increasingly noted within prehistoric assemblages, where there is no evidence of large scale specialisation (Gibson 2003 viii; Morris 2005; McNee 2006a, 2006b, 2007 and personal communication). Equally, it complicates the argument for the possibility of the deliberate social control of fabric technology, technique in producing vessel form, capacity and style within prehistoric pottery assemblages that is so often noted (Cleal 1995; Boast 1995; Woodward 1995; Barclay 2002; Morris 2002; Kreiter 2006; Sofaer 2006). McNee (2007) has noted, for example, not only careful selection of tempering materials in Bronze Age Kent but definite indications that temper was sieved to obtain a uniform size of temper grains. The main problem with this situation, and with particular regard to the research offered here, is that skill is seen to exist or not exist — there is no recourse to observing incremental degrees of skill and therefore no way of observing, or comparing, variability of skill investment; and no way of assessing how skill may emerge (from learning strategies) in any given context.

Learning networks, skill and apprenticeship have been an implicit part of many ethnoarchaeological studies that have concerned themselves with the cultural dimension of technical practice. However, explicit arguments, beyond who learns from whom (i.e. daughter from mother) are rare and the precise social mechanisms that would facilitate the transfer of 'know how' or skill acquisition are poorly represented (Rye& Evans 1976; Marshall, 1985; Miller 1985; Costin 1991; van der Leeuw 1993; Arnold 1994, 1999; Gosselain 1998; Longacre 1999). Two exceptions to this are studies by Costin (1995) and Roux (1990). Costin (1990) uses an analysis of skill in combination with an exploration of labour investment and forms of specialisation to assess the organisation of pottery production in Late Prehispanic Highland Peru. Unfortunately, only two criteria are measured, variability of wall thickness and firing cores, to assess potential differences in degrees of skill between Inka and Wanka wares. This somewhat denies the complex nature of the numerous specific tasks and production sequences (discussed further later in this chapter and in the methodology, chapter 4) required to successfully manufacture a pot and therefore seems unlikely to provide a very accurate notion of skill variability.

The approach taken by Roux (1990) to understanding specialisation stands alone in making an explicit attempt to draw out the role of apprenticeship and skill. Roux makes a very important link between the complexity of the technological task, the length of apprenticeship and degrees of technical competency used to determine the possibility of specialisation occurring. Importantly, Roux's study offers some idea as to the importance of recognising incrementally acquired degrees of skill (Roux 1990: 150) that would work to maintain the vitally, necessary continuity of production techniques noted as being critical by authors such as Wallaert Pêtre (1999).

3.2.2 The role of chaîn opératoire

The notion of chaîn opératoire was originally derived from the work of the French ethnologist and sociologist Marcel Mauss (1935, in Schlanger 2006, translated by Brewster 1973; 1947 in Schlanger 2006, translated by Lussier 1967). Mauss observed that repeated technical sequences and routine physical action played a central role to the way in which cultural traditions were given continuity (Lemonier 1993; Dobres 1999) and saw the "use of tools as the result of mindful movements" (Garcea 2005: 215). Most importantly Mauss' perspective drew attention to the sequential transformation of natural resources and the 'unfolding' of technical action (Schlanger 1990; Dobres 1999) as being indicative of technology as a deeply social phenomena (Edmonds 1990: 57; van der Leeuw 1991: 148). Not only were such technical transformations linked to social constructs they were deeply embedded within the social nature of *'habitus'*. "These 'habits' do not just vary with individuals and their imitations; they vary especially between societies, educations, properties and fashions, prestige" (Mauss 1935 *in* Schlanger 2006: 80). Mauss saw technology as dynamic and social to the core (Dobres 1999: 127).

Leroi-Gourhan, one of Mauss' students, building on but also refining Mauss' idea of *enchainement organic* (Schlanger 1990: 21) first introduced chaîn opératoire as an analytical technique for the purpose of archaeological enquiry (see Lemonnier 1992a). However, in the process of refining Mauss' ideas Leroi-Gourhan also narrowed the perspective and in so doing diluted, and indeed almost reversed, the original deeply socially nature of Mauss' work (Dobres 2000). Following from Leroi-Gourhan's refined perspective early use of chaîn opératoire was centred on explorations of lithic technology and was traditionally situated within a French tradition of Upper Palaeolithic research. This narrowed perspective was very effective in terms of "...*describing* the structure or logic of specific sequences of action" (Edmonds 1990: 57) thus aiding archaeologists to "demonstrate rather than assume, that technical sequences unfolded in particular ways" (Dobres & Hoffman 1994: 214). Unfortunately, it failed to provide a platform for greater understanding of the broader social conditions under which procedures were implemented, or how such knowledge was initiated, sustained or transformed (Edmonds 1990: 58). As Dobres (2000: 172) notes "...empirical descriptions of material *chaînes opératoires* do not automatically establish these social dynamics". In his own work at the Magdalenian late Upper Palaeolithic camp of Pincevent, near Paris, Leroi-Gourhan used the procedure of refitting, derived from his notion of chaîn opératoire. In doing so he was able to follow stages of the knapper's craft and establish movement and activity across the site through observation of the spatial distribution of blades and waste around the site. Thus, Leroi-Gourhan's perspective did provided valuable understanding for archaeologist as to sequences of action and movement.

Despite his belief that biology and technique were inseparable (Schlanger 1990: 19)

Leroi-Gourhan's focus of attention was with the evolutionary implications of tool use and in particular the notion of the *separation* of humans and their technology. He saw "the evolutionary shift from the use of the hand *as* a tool to the hand holding a tool" (Dobres 1999: 129 original italics) as representing a meaningful progression in human evolutionary development. This created a separation in direct opposition to Mauss' original concept of the *'homme total'* where man is himself a tool — a notion re-explored more recently by Ingold (1990, 1998; 1999, 2000). By adopting this evolutionary perspective there was an unfortunate return to concepts that lay at the heart of what may have been Mauss' original raison d'être for pursuing his total social phenomenon of technique; the nineteenth century concept of techniques as "both the instrument and the embodiment of the Age of Progress" (Schlanger 2006: 4). Mauss was critical of the relationship of this concept with that of "...the self-aggrandising faith of modern nations in their own race, their own language, and their own civilisation" (Schlanger 2006: 41) that underpinned post 1st World War nationalism,

> "Almost invariably, a nation has the illusion of being the first in the world. It teaches its literature as if none other existed, its science as if it alone collaborated in its elaboration, its techniques as if it has invented them, and its history and morals as if they were best and the most beautiful"
>
> (Mauss 1920/1953 extracts in Schlanger 2006: 42)

> "The conviction that what we call civilisation is a national product has entered people's minds to the extent that it has become a foundation for territorial claims"
>
> (Mauss 1920/1953 extracts in Schlanger 2006: 42)

Mauss sought to challenge this perspective by drawing attention to the historical reality of constant exchange and borrowings between societies and nations that may be seen as an endless cross-pollination of ideas and practice — including technique. This is a notion that may be perceived as particularly apt in the context of the regional groupings across the Carpathian Basin throughout the Bronze Age. Most critically, through embracing Leroi-Gourhan's stance, the deep understanding and conviction that Mauss held concerning the link between education and technique (Mauss 1935 and 1947 in Schlanger 2006) was also lost. To take just one example of Mauss treaties on this topic he stressed; "Hence there is a technique of diving and a *technique of education* in diving" … "And you can see that it really is a technical education and, as in every technique, there is an apprenticeship in swimming" (Mauss 1935 in Schlanger 2006: 79, italics added). Mauss argued that in all of the various uses (techniques) of the body the fact of education was dominant (Mauss 1935, 1947 in Schlanger 2006). Of particular significance to this thesis is that somewhere in the refinement, and subsequent adoption, of Leroi-Gourhan's' notion of chaîn opératoire is the loss of Mauss original perspective. This resulted in a general failure to see that what should sit beneath chaîn opératoire is a proper understanding of learning — as originally advocated by Mauss.

Fortunately, the concerns noted by authors such as Edmonds (1990) and Dobres (2000) reflect an important trend for the re-appraisal of the use of chaîn opératoire and a desire to reintroduce the principle of the *'homme total'* (Mauss 1935 in Schlanger 2006: 81). As well as more general discussions as to the value of a socially holistic approach to the use of chain opératoire (c.f. Edmonds 1990; Schlanger 1990; Pigeot 1991; van der Leeuw *et al* 1991; Lemonnier 1992b; Dobres & Hoffman 1994; Hoffman & Dobres 1999; Dobres 2000; Gosselain 2000) a number of key authors have extended the use of the chaîn opératoire methodology to explore a range of social and cognitive issues implicit to specific types of technological processes. These include: lithic production (Pigeot 1987, 1990; Pelegrin 1990), bone and antler production (Dobres 1996, 1999), stone bead production (Roux & Matarasso 1999), ironworking (Childs 1999) and pottery technology (Roux 1990, 2003; van der Leeuw *et al.* 1991, van der Leeuw 1999; Gosselain 1992, 1998, 1999, 2000; Gelbert 1999; Roux & Courty 2005; Bosquet *et al.* 2005); thus proving the versatility of the chaîn opératoire methodology. Unusually, Garcea (2005) has produced research comparing the chain opératoire of both pottery and lithics for the same cultural horizons. The contributions of all these authors highlight the importance for the use of chaîn opératoire to encompass broader research and analytical strategies that allow archaeologists "to explore the parallel between technologies as acts of material transformation and technologies as acts of social transformation" (Dobres 1999: 128).

Collectively, these studies cover an impressive range of social issues related to technological production. For example: understanding the importance of choices not made as well as those made by potters (van der Leeuw *et al* 1991), the mediation of social power and identity (Dobres 1996), the reappraisal of choice and constraints related to technical production (Gosselain 1998), the exercising of prohibitions and rituals associated with pottery production (Gosselain 1999), the salience and scale of particular behaviours and the relationship of these to technological style and aspects of social identity (Gosselain 2000), the relationship between different stages of chaîn opératoire and the ability or likelihood for technical practices to change (Gelbert 1999), stressing the importance of a holistic approach to pottery analysis (van der Leeuw 1999), observation of cultural, behavioural and chronological changes (Garcea 2005), and finally a micro-scale study of technical, techno-petrographic and morphological-stylistic characteristics in order to determine macro-regional differentiation of technical operations (Roux & Courty 2005).

It is rare, however, to find studies using the chaîn opératoire methodology that deal explicitly with the notion of learning mechanisms or skill as a central focus of concern. Exceptions are Karlin and Pigeot (1989), Olive and Pigeot (1992), and Pigeot (1987 and 1990) whose work revealed differentially shared knowledge and a system of tutelage that might be thought of as apprenticeship — or 'lithic education' in the Late Magdalenian Paris Basin. Within pottery studies Roux (1990, 2003), Gosselain (1992, 1998, 2000; 2001) and Gosselain & Livingstone (2005) also offer important exceptions to the paucity of studies dealing with learning strategies. These authors place a heavy emphasis on the use of ethnographic and experimental work to formulate there arguments.

In her psychological analysis of technical activities to further understandings of specialisation Roux (1990) demonstrates a linkage between the use of chaîn opératoire and an understanding of skill acquisition and duration of apprenticeship. An important aspect of Roux's paper is the emphasis placed on the different facets that allow skill to come into being. For example, she makes an important link between cognitive understanding, perceptual 'motor habit' patterns, technological complexity and degrees of technological know-how (Roux 1990: 148). Roux (1990, 2003) and Roux, Bril & Deitrich (1995) use two ethnographic case studies to form the basis for their arguments and then use the findings in later papers to enable discussions surrounding skill acquisition and technological production in two very different archaeological examples: Harappan carnelian bead production (Roux, Bril & Deitrich 1995) and an exploration of a dynamic systems framework to better understand the evolution of the potter's wheel in

southern Levant during the 4th millennium BC (Roux 2003).
The work of Gosselain (1992, 1998, 1999, 2000 and 2001; also see Gosselain & Livingstone 2005) is also fundamentally situated within ethnographic study. Gosselain places a particular focus on the socially and culturally situated nature of technological style. By technological style he means the style associated with the core manufacturing of a pot rather than the just the form or decoration of a pot. By building an understanding of social constraints and norms, rather than just the more usual technological or environmental constraints, placed on pottery production Gosselain draws attention to the way in which different parts of a production sequence may be conditioned through a relationship to various aspects of cultural and social behaviour, or social boundaries (Gosselain 1998). His research also encompasses investigations of knowledge acquisition and learning mechanisms. He has highlighted the impact of different learning environments and noted a tendency for what is usually termed 'informal learning' strategies, that is the passing on of knowledge from person to person through direct guidance as to the performance of each task. Importantly, he also draws attention to the notion of 'motor habit' patterns (Gosselain 1992, 1998). The importance of 'motor habit' as a causal factor in determining production is also emphasised by Minar (2001) in her study of cordage final twist direction. Motor habit patterns (a term originally coined within archaeology by Arnold 1988) is strongly linked to what Schlanger (1990) refers to as the second of three levels of operational behaviour as "*'chaines operatoires'* acquired by experience and education" (*ibid.* 21 original italics). These aspects of learning strategies are discussed further in section 3.3 of this chapter.

3.2.3 The role of ethnography in understanding learning strategies

Moving beyond the discussion of chaîn opératoire the value of ethnographic research to the ongoing process of understanding the socially and culturally constituted nature of learning strategies cannot be underestimated. There have been a number of notable contributors whose work is well referenced within archaeological discussions of technological practise (c.f. Rye & Evans 1976; Miller 1985; Schiffer & Skibo 1987; Barley 1994, 1997; Sillar 1996, 1997). All of these studies have shown the explicit culturally oriented and social nature of technological choice and technological processes and the entirely social nature of knowledge transference. A range of other studies have particularly highlighted the issue of the socially constituted nature of permissions allowing access to knowledge and skill by learners. For example: Arnold (1994) and

Sassaman & Rudolphi (2001) have essentially focused on rules of residence and decent as a factor governing access to learning, Aronson (1998: 149) indicates that prohibitions ruling apprenticeship in both Akwete, Nigeria and the Ivory Coast are determined primarily through rules surrounding ethnicity and gender, Beuchler (1998: 31) finds the access and execution of learning ruled by a flexibility determined by economic causes. Maynard (2002) has paid particular attention to the role of children as teachers in learning strategies and makes the important observation that in the passing on of skills by siblings to siblings, "Children create culture at the same time as they acquire culture" (*ibid.* 979). Gosselain (1992, 1998) among other authors has highlighted the effect of the social context and nature of learning strategies in terms of outcomes that encourage innovation or conservatism (Childs & Greenfield 1980; Greenfield 1984, 2000; De Boer 1990; Gosselain 1998; Maynard, Greenfield & Childs 1999; Wallaert Pêtre 1999, 2001; Greenfield, Maynard & Childs 2000; Minar 2001).

The work of Greenfield, Lave, Maynard and Childs with the Zinacantec Maya community of Highland Chiapas, Mexico, provides a particularly good case study in evaluating the importance of the social context of learning on learning outcomes. This study was maintained over a 24 year period allowing for original results and hypothesis drawn from those results to be re-evaluated through repeating fieldwork with the next generation of Zinacantec weavers. Greenfield (2000), and Greenfield, Maynard & Childs (2000) revealed how historical change brought about a developmental change in the contexts of learning and thus in the outcomes of learning. In the original study from 1969 to 1970 traditional apprenticeship strategies were found to be rigid and rule bound, described by Greenfield as a highly scaffolded learning; a system that works by closing "the gap between task requirements and the skill level of the learner" (Greenfield 1984: 118). In this learning system, often described as 'informal learning' (for example, Gosselain 1998), each stage of learning is carefully prescribed and controlled — rather belying the term 'informal' which is simply a dichotomy set up within western education/psychology studies meaning not formal as in terms of western tautology (Seitz 2007). This scaffolding strategy served to maintain a system where power and authority lay principally with the older generation. This power was in turn generated by the dependency for land, also in control of the elder generation. Greenfield and Lave (1982) saw this as education and socialisation organised to promote the intergenerational replication of tradition (Greenfield 2000) 'in accord with the broader cultural goals of maintaining the *baz'i* or 'true' way of acting; the 'true' way being the Zinacantec way' (Vogt 1969 *cited in* Greenfield 2000: 73). By the second study in 1991 and 1993 the emergence of new markets and an entrepreneurial cash economy meant that significant changes had occurred to the traditional apprenticeship scheme. This change was also brought about by a new development in schooling with girls being encouraged to follow and make printed paper patterns. Originally intended for cross-stitch needlework within the space of a single generation girls appropriated this new 'tool' and also learnt to transfer it to the process of weaving. In this way they gained independence from the scaffolded learning system which was replaced with a much less controlled regime that allowed innovation in design. In turn the change in learning was mirrored by a change in social relationships and culturally negotiated positions within the social structure.

This one case study cannot be used to argue for a generalised relationship between social contexts of learning and the social outcomes of learning out-with the community studied. Even less so could one safely infer a direct parallel to past pre-literate societies. For particular problems with this approach it is worth turning to Hodder (1999: 46) and Wylie (1985: 105) who highlight the difficulties in the wholesale transfer of information from society to society. However, Hodder (1999: 46) also notes the value of analogy in broadening possibilities for understanding of the past. Meanwhile van der Leeuw (1999) argues for a truly holistic approach to pottery studies and stresses the need for the "critical analysis of many ethnographic case studies" (*ibid.* 117) in order to use such work to make generalised statements. This is similar to Lewis-Williams (1998) appeal to be wary of "simple, look-alike analogies" and to rather "seek analogies which have multiple correspondences" (*ibid.* 157–175). In the case of prehistoric research it seems that ethnoarchaeological and ethnographic work may be best used in the sense suggested by Hodder (1990) to broaden the horizons of the questions to ask and in the sense of van der Leeuw (1999) to form a broad platform of ethnographic case studies to inform on a precise understanding of the technological processes of pottery manufacturing as a social phenomena. In this way ethnographic studies can help to underpin new methodologies that will allow the *primary* interpretation of empirical data to come through direct reference to the technological characteristics of the material studied with cross cultural analogy playing a supportive rather than a primary role.

Within ceramic studies Minar (2001) offers an example highlighting an attempt to do just this. Minar (2001) uses an ethnographic study to aid interpretation of archaeological empirical data that showed differences in the final cordage twist direction of yarn, as reflected in impressed prehistoric pot sherds from a range of sites across the prehistoric American Southeast. She noted a distinct pattern relating to both temporal and geographic distinctions. As an outcome of her research Minar (2001) convincingly argues the possibility of a strong relationship between communities of practice, ensuing culturally or socially embedded 'motor habit' patterns, and the final cordage twist direction of yarn used to impress patterns onto pots. Importantly for this thesis she also notes "In particular, those attributes that are motor-skill dependent seem to be of particular use in recognizing long term cultural continuity in the presence of other more changeable factors" (Minar 2001: 397).

A somewhat different approach to the use of ethnography has been taken by Crown (1999, 2001). Although her study encompasses the broader issues of the social contexts of learning affecting outcome (Crown 2001: 465) she also particularly explores the role of children, as apprentices, through the production of decorated pottery in the prehistoric Greater American Southwest. Crown refers to psychology, education studies, ethnographic data, and cross cultural studies to determine a methodology that will allow an exploration of the potential ages at which children become integrated, as potters, into society. Crown makes two very important observations. First she is willing to note that a *range* of skill is present within prehistoric ceramic assemblages. Second she dismisses the notion of "village idiot ware" and the idea that unskilled pots are the products of potters who don't care, potters whose motor control and cognitive abilities are adversely affected by alcohol or drugs, potters who are senile, or potters who are using pottery as a form of 'silent' protest (Crown 1999: 30; Crown 2001: 452). All these arguments are easily used to sidestep the important issue of the culturally and socially appropriated role of skill and skill acquisition and are further addressed within the methodology, chapter 4. Such arguments also belie the strong case put forward by Longacre *et al.* (2000) strongly suggesting that potters work very hard to meet a successful intended outcome because it is clearly in their best interests to do so. Rather, Crown (1999) argues that people who do not wish to pot or cannot pot, do not pot. Hodder makes the same point in reference to the decoration of calabashes (Hodder 1991: 88). It seems a rather naïve view of traditional society, pre-industrial societies, or prehistoric societies to assume that people are somehow coerced into doing things that they clearly have no ability for.

Crown's methodology is very credible in terms of the range of technological attributes studied and in this sense offers the opportunity for a good assessment of skill investment. Unfortunately, her assessment of 'degrees of skill', used to gauge probable ages of child potters appears to be entirely determined through reference to cross-cultural psychology. The balance of interpretation also relies primarily on ethnographic and psychological cross-cultural analogy, not only to collect data or to give breadth to her interpretation, but also as a major source of evidence to uphold empirical data. For example, (Crown 1999) states "I *expect that* prehistoric Southwestern children learning pottery production had visual stimulus, encouragement, aspiration and parental expectation *equivalent to* cross-cultural situations where children exhibit maturity in artistic ability at a relatively early age" (*ibid.* 28 italics added). Such statements may be appropriate for anthropological and ethnographic studies that provide insights into a particular community. However, in the context of this thesis by the present author, it is seen as problematic to assume that Southwestern children of prehistoric cultures shared the same cultural, social, cognitive, physical and social arrangements as their later counterparts. Crown (1999: 25-26), herself, draws attention to the problems to be encountered in such a strategy. She notes, for example, that ability is also related to both the social and physical environment, ideas of socialisation such as gender permissions and taboos, access to visual stimuli, access to materials and the social status of art within society (Crown 1999: 26). These multiple influences make cross-cultural evaluations difficult (Crown 1999: 27). Rogoff (1984: 1–8) draws attention to the importance of recognising the influence of context on the true evaluation of skill parameters that further brings into question the use of cross-cultural analogy to form a primary basis for interpretations of empirical data. No interpretation can ever be entirely free of analogical inference or our 'pre-understandings' (Hodder 1999: 47).

All of the approaches discussed so far have gone some way toward understanding the social nature of pottery production and how skill is passed from one generation to another. What they have not been able to do is offer a finer grained insight into skill acquisition or how to go from an understanding of skill to an understanding of socially constituted learning strategies. While recognising the value of all previous approaches, which provide understandings of technical processes and breadth to final interpretations, this research adopts a different approach.

3.3 From learning to skill: observing patterns of skill deployment

The aim within this research is to gain a deeper and finer grained understanding of skill acquisition and learning strategies by exploring both the relationship between them and the fundamental difference between them. It is essential to see skill as the outcome of learning strategies. This separation is made by appealing to the repeated processes of technological action embedded within a pot, and pot groups. Archaeological, ethnographic, sociological, psychological and, in this instance, ceramic literature are used to form a methodology (chapter 4) that places an emphasis on a precise understanding of the nature of clay as a working medium, and the technological processes employed in the manufacture of a pot. Thus, instead of looking at who made pots and in what social context, here it is the degree of skill variability exhibited within pots and the ensuing pattern of skill deployment across culturally and temporally contemporaneous pottery assemblages that is used as the primary informing principle of interpretation. In order to understand the difference between learning and skill acquisition and meet the aim of gaining a finer grained understanding of skill and learning as culturally and socially situated phenomenon, and their role in society, it is necessary to explore the following issues: the nature of discursive and non-discursive (procedural) knowledge, procedural knowledge as a socially constituted performance, the resulting phenomenon of repeated practise, and finally how these elements become embedded within pottery as visible and permanent technological signatures of production.

3.3.1 Discursive and non-discursive knowledge

Discursive and non-discursive learning knowledge are recognised as having connected but purposefully different roles in the processes of acquiring and enacting skill (Anderson 1982, 1983, 1987; Dr Itiel Dror, personal communication). Discursive learning strategies are based on the transfer of verbal information that the recipient uses in a cognitive manner to establish the principle of *what* needs to be done. Meanwhile non-discursive knowledge is strongly aligned with transferring information into the practical action about *how* things should be done. Understanding the relationship between these symbiotic elements of learning mechanisms is essential to a framework for skill acquisition (Anderson 1982: 369). It is argued by Anderson (1982, 1983, and 1987) that the acquisition of skill knowledge, which is the knowledge that enables the performance of a skill based task, is accomplished through a very specific cognitive process. This process sees 'factual knowledge' about *what* to do to accomplish a skill transferred into 'procedural knowledge' of *how* to perform the skill based task. Factual knowledge is based on verbal communication and the kind of interaction generally described as 'informal learning'. This is what Rogoff (1990: 7) describes as "children as apprentices in thinking, active in their efforts to learn from observing and participating with peers and more skilled members of their society". Anderson (1982) refers to this as the 'declarative stage' where the facts of what needs to be done become known to the participant. It is only through the transformation of factual knowledge, delivered during the declarative stage, into performative, or procedural, knowledge that skill can be realised as action. The more frequently procedural knowledge is performed (repeated) the less need there is to refer back to factual knowledge. Eventually, it may be that the original transfer of factual knowledge is almost, or even entirely, forgotten. In some instances the transfer of knowledge may be such that the discursive 'factual' stage is never consciously articulated and procedural knowledge is performed by 'the actor' even though he or she is unable to formulate the processes performed discursively (Giddens 1979: 57).

The more often procedural knowledge is performed the greater the execution of skill both in terms of degree of invested skill and speed of execution. The nature of procedural knowledge is such that once fully acquired it is literally physically embodied within the performer of a given task through changes to their neurology, musculature or skeleton (Anderson 1982, 1983, 1987; Arnold 1988; Ingold 1993a). This is recognised within psychological and educational fields of research as kinaesthetic intelligence (Seitz 1989, 2007). This kind of intelligence is more than just habitual performance of procedural knowledge 'practices' but is seen as becoming integral to the physical and cognitive nature of the body (Hacking 2004: 299). Ingold (1993a: 470) also argues for this biological incorporation suggesting that the routine processes of enacting procedural knowledge literally alter the biology of the body, "English speakers *are* different from Japanese speakers, cello players *are* different from sitar players, lasso throwers *are* different from archers". This author's personal experience of being taught to throw a pot on the wheel may provide another example. Having been taught by a left handed potter, the process was to cup the clay in the left hand and apply pressure with the right hand while centring the clay. This is a complete reversal to the normal procedure for a right handed person, which the author is. Although in time the realisation dawned that the procedure was, so to speak, a reversal in the 'normal' use of the hands, and despite technical problems that this raised, it was never cognitively or physically possible to reverse the original learning process. Mauss (1935) notes a similar phenomenon with regard to swimming; "Moreover the habit of swallowing water and spitting it out again has gone. In my day swimmers thought of themselves as a kind of steamboat. It was stupid, but in fact I still do this: I cannot get rid of my technique" (Mauss in Schlanger 2006: 79).

3.3.2 Procedural knowledge as social performance

It will be argued later in this chapter that the physically and cognitively embedded nature of procedural knowledge results in very specific and repeated sequences of action which can be observed quite clearly within finished pots. This phenomenon is, therefore, fundamental to the observation of skill patterning. Before moving on to discuss this in greater detail another matter of equal importance has to be addressed. This is the fact that procedural knowledge, as the execution of both biologically and culturally determined bodily technique and technology is undeniably both culturally and socially constituted (Mauss 1935 & 1947 in Schlanger 2006; Ingold 1981, 1993a, 1993b; Rogoff 1990; Maynard, Greenfield & Childs 1999; Schlanger 2006). Ingold (1999: 8), describes skill as being "…at once a form of knowledge and a form of practice, or – if you will – it is both practical knowledge and knowledgeable practice". In this sense procedural knowledge is embedded within social performance which is argued to play a critical role in the production and reproduction of material culture which, as noted previously, is central to the mediation of cultural and social expression (Dobres 2000; Sofaer & Sørensen 2006).

It is worth returning to, and expanding on, the work of Mauss (1935 in Schlanger 2006: 81) to illustrate the importance of this point. Mauss not only notes the culturally and socially embedded nature of technique as action through, for example, the importation of American walking styles to France through film media but also as the performance of skill tasks. One example he draws on is that of the use of spades by troops during World

War 1. The English troops could not master the technique of using French spades so that each time a division was replaced the spades must be replaced as well. Mauss (1935 in Schlanger 2006: 79) notes 'This plainly shows that a manual knack can only be learnt slowly. Every technique properly so-called has its own form'.

Returning to archaeological discourse Dobres (1999) endorses Ingold (1993b) in arguing "that the display and manipulation of cultural metaphors or practical knowledge signified outwardly in the performance of particular gestural techniques are also powerful 'mechanisms' for negotiating social identity and status" (Dobres 1999: 135). The point here is that technique or the performance of procedural knowledge is understood to be executed in variously situated and socially articulated public domains. Being seen to enact procedural knowledge places the 'performer' within the complex web of social positions — it is the doing of the task that makes the person a potter, a smith or a warrior. As Goffman (1959: 81) argues; "A status, a position, a social place is not a material thing, to be possessed and then displayed; it is a pattern of appropriate conduct, coherent, embellished, and well articulated". To use a particularly well known example Goffman (1959: 80–81) famously cites Sartre's (1957) example of a waiter in a café. What makes the waiter a waiter is essentially his performance as a waiter and this performance must be appropriate to his audiences socially situated expectation of how a waiter should be. Goffman (1959: 26) defines a performance as "all the activity of a given participant on a given occasion which serves to influence in any way any of the other participants". The other participants may of course be mutually engaged in the activity or observers of the activity. In order, however, to have influence the appropriate socially recognised performance must be given, as in the example of the waiter. Also, it is worth remembering that all social actors may contribute to a multitude of performances (Goffman 1959; Wells 1970) but each one must have the authority of being socially recognisable in order to be actualised.

Recognising the social nature of technological choices (c.f. Mauss 1935 & 1947 in Schlanger 2006; Ingold 1981, 1993a, 1993b, 1999; Miller 1985; Barrett 1989; Rogoff 1990; Roux 1990; van der Leeuw 1993, 1999; Barley 1994, 1997; Dobres 1994; 2000; Gosselain 1998, 1999, 2000, 2001; Maynard, Greenfield & Childs 1999; Chapman 2000; Sillar & Tite 2000) is also an explicit endorsement of the social nature of *technological processes* through the socially constituted enactment of technique. As

Maynard, Greenfield and Childs (1999) note there appear to be culturally appropriated ways for people to use their bodies. This idea is possibly best expressed by Schlanger (1990) in his review of Mauss and Leroi-Gourhan:

> "The nature of techniques ties them firmly to social life, but this link still remains somewhat abstract and intangible. It is in conceiving of techniques as *actes efficacies* that their social concreteness and relevance is emphatically demonstrated by Mauss. The technical object – as it exists, as it signifies, as it is 'given, received and returned' – is a *total fact,* but so is its advent, production and becoming; an *acte social total.* This is, in effect, the raison d'etre of Mauss practical and methodological concerns. The technical act should be apprehended throughout its unfolding, for in each of its moments, in each of its forms, in each of its gestures, the social nature of techniques find their expression."
>
> Schlanger 1990: 23

It is the enactment of procedural knowledge as a culturally and socially embedded performance, with specific repertoires of action attached to the performance that results in a consistency of technical action specific to particular repertoires of material culture. This intention of action brings the discussion to the notion of repeated practise, a central element to finding learning strategies in the archaeological record.

3.3.3 Repeated practise

Very importantly for this study it is this consistency of technical action that results in *repeated patterns of practical skill,* or procedural knowledge, originally noted by Arnold (1988) as 'motor habit patterns'. Arnold described these in a very physical way which emphasises the physical and cognitive aspect of procedural knowledge — or 'motor habit' patterns as;

> "...unconscious but customary muscular patterns which result from habitual use of certain muscles which are ultimately strengthened relative to other muscles. Any body posture that does not use those muscles is difficult to maintain and any task that requires muscles other than the habitually strengthened ones is difficult to maintain. Similarly, tools require certain patterns of muscular use and if these patterns are not developed, the tool cannot be used properly, efficiently

> or with ease. Tools that require one set of motor habit patterns can be used by persons who do not have those motor habit patterns only with difficulty. Of the almost unlimited variation of muscular movements, few are restricted by anatomical considerations."
>
> Arnold 1988: 147

It has been argued that 'motor habit patterns' are deeply engrained and extremely difficult for the practitioner to alter (c.f. Goffman 1959; Spier 1967; Arnold 1988; Anderson 1982, 1983, 1987; Arnold 1988; Maynard, Greenfield & Childs 1999; Hacking 2004; Mauss 1935 in Schlanger 2006). Given Arnold's account and the preceding discussion of procedural knowledge as social performance it is not difficult to imagine this scenario. Seitz (2007) argues that "Bodily-kinaesthetic intelligence involves two components: Masterful coordination of one's bodily movements and the ability to manipulate objects in a skilled manner." Moreover, Seitz argues that among the characteristics that define bodily-kinaesthetic intelligence is 'motor logic' and its tendency to be embodied in a symbol system. These characteristics emphasise the physically embedded nature of culturally adopted motor habit patterns.

In Maynard, Greenfield and Childs (1999) case study, they particularly draw attention to the profound difficulty in trying to adopt the working postures of the Zinacantec weavers as their bodies were not 'culturally prepared' to undertake the task required. As Arnold (1988) originally argued, it tends to require significant causal factors to come into play before alterations to physical technique do occur. An example of this would be, the profound social changes faced by Zinacantec weavers which ultimately brought about a change of working technique (Greenfield 2000; Greenfield, Maynard and Childs 2000).

Crown (2001: 452 italics added) notes that "Learning a craft entails moving toward competence in completing a task, including efficiency in executing gestures and *replicability in achieving a desired finished product*". The complexity of being able to achieve this is highlighted by Pétrequin (1993: 69) who draws on a number of examples to illustrate the difficulties involved in adopting technology that is not inherent to a social group and the necessary long apprenticeship that must be involved in being able to produce a desired or anticipated finished product.

The anticipated finished product is encapsulated within the culturally and socially determined idea of what material items to produce or reproduce, and how they should be produced. For social reproduction to take place it is intended that products should be replicated. It is this replication of material categories that gives rise to the appearance of specific types of things that are particular to a certain place and time. This phenomenon forms the basic foundation of typological classification. It is not the place of this research to address the complex arguments (see Fuchs 2001: 15) surrounding typological classification. However, what is critical is the acknowledgement that categories of things (and possibly people) *do* come into existence (Miller 1985). These categories are the product of culturally and socially determined variability and are both the cause and outcome of repeated processes of production — repeated practise.

3.3.4 Clay and the technological signatures of production

It is the very particular physical characteristics of the materials used to produce pottery that make pots a particularly valuable analytical tool. Clay is a plastic additive medium. Because of this every technological action, addition or manipulation of clay, taken in the forming of a pot becomes permanently embedded during the end process of production when pots are fired. For example, the joins made by constructing a pot with either coils of clay or slabs of clay are distinctively different. Not only can the variability between different techniques be observed but so too can the degree of skill exercised in their execution. The variability in skill investment between a 'good' coil join and a 'poor' coil join is observable (Appendix 2). These characteristics are described in detail in the methodology, chapter 4.

Within the present discussion it is of importance to stress that the production of pottery entails a multitude of possible technical options in terms of which materials to use, options of technique, and how to enact procedural knowledge (c.f. Rye 1981; Braun 1983; Miller 1985; Rice 1987; van der Leeuw & Papousek 1992; Sillar 1997, 2000; Gosselain 1998, 1999, 2000; Sillar & Tite 2000; Gosselain & Livingstone Smith 2005). It is the specific choices made as to how to proceed with both these endeavours, the choice of technological materials and the choice of technique, that, once established and embedded within the cultural and social repertoire, determine the range of technological signatures ultimately present within any given vessel type. As argued previously, the choices made, or not made, are as much the outcome of socially understood ways of proceeding as environmental constraints. Every choice made leaves a particular technological signature. The necessary range of choices made to complete all the processes required to produce an entire vessel will result in a range of technological signatures that are unique to the particular circumstance surrounding the production of that vessel type. Again this is discussed in greater detail within the methodology, chapter 4.

Not only are technological signatures observable but so too is variability in the degree of skill invested in each and every technological choice or technical action. These unique characteristics render it possible to observe variability in skill investment (for a specific example of this see Gibson 2003: viii) and deployment in technological characteristics that, because of the *repeated practices of production*, should be constant to particular vessel types situated within a particular social and cultural milieu. The permanent and visible traces of manufacturing technique and the various degrees of skill employed can be understood through reference to a profound understanding of potting processes. These processes are outlined in detail in the methodology (chapter 4).

To recap, it is,

i. the transfer of discursive into non-discursive (procedural) knowledge,
ii. the enactment of procedural knowledge as a socially constituted performance,
iii. the resulting phenomenon of repeated practise,
iv. and finally the combination of these elements with the plastic nature of clay resulting in visible and permanent technological signatures of production,

that allows pottery to become a context for analysis that could be placed as another analytical layer sitting beneath ideas of modes of production, standardisation and specialisation, and the notion of chain opératoire. For this to happen it is necessary to remember that all cultural and social groups are constituted through reference to multiple institutions with both vertical and horizontal relationships and interactions.

It may be expected that an institution related to skill acquisition, as an outcome of learning strategies, will determine the rules of acquiring skill to make pots. As it doesn't stand alone the rules of that institution may be seen to reflect and influence the nature of other institutions and of broader social understandings. To understand what the rules surrounding skill acquisition may be it seems logical to focus on skill itself. As argued, skill, as the outcome of learning strategies, is permanently located within the fabric of a pot. If we consider the investment of skill within pots, and even parts of pots, as determined through institutionalised practices as a central context of learning and place this as another analytical layer sitting beneath locale (for example, household vs. specialist industry) we can get a finer grained picture of learning strategies.

3.4 The role of institutions in constituting learning strategies

The final element in this exploration is to situate learning strategies within an appraisal of institutionalised practices. If repeated practices of production are established through reference to culturally and socially appropriated ways of knowing *what* and *how* to produce an item, and how to enact that process it is important to understand what underpins this. For this it is necessary to form an understanding of the role of institutionalised practices. While it is not possible within the remit of this research to offer a detailed re-appraisal of what constitutes institutionalised practices. What is intended is to offer an appraisal of how the notion of institutions has previously been used within archaeology and the way in which they are perceived within this study.

3.4.1 Archaeological discourse and understandings of institutions

The notion of institutions and institutionalised practices is frequently implicitly referred to throughout archaeological texts. An understanding of what institutions are — how precisely they are constituted — is, however, rarely explicitly addressed within archaeological discourse (Earl 2002; Kristiansen 1999; 2000b, Barrett 1989; Johnson 1989). Rather archaeologists tend to draw on social and philosophical discourse to structure their ideas of institutionalised practices. However, even within these discourses there is much debate and many philosophers and sociologists have used the term without actually offering an entirely explicit definition of what this phenomena amounts to (c.f. Goffman 1959; Wittgenstein 1967; Foucault 1975, Husserl 1913). Hacking (2004: 278) notes, for example, "Of course there is something absolutely missing in Goffman too: an understanding of how the institutions he describes came into being, what there formative structures are". Thompson (1989: 58) also notes "analytical philosophy and interpretative sociology are weak, for they largely neglect problems of institutional and structural analyses".

Equally, understandings of the notion of institutions are inevitably coloured by the relevant position of discourse at historic and political moments in time. As noted, archaeologists have through time variously drawn on the work of a number of key philosophers and sociologists. Consequentially the interpretation by archaeologists of a Marxist view of institutions is very different from one based on the now prevalent ideas of (Giddens 1979, 1981) structuration theory. This isn't just because archaeological accounts of institutional practices are historically influenced but because the very nature of the relationship between the individual and society is fluid, active and recursive and alters through time. Sociologists and philosophers, and archaeologists in their wake, tend to be trying to find a static account of a fluid phenomenon. This criticism extends to Giddens supposedly ahistorical agency theory. Connell (1987: 94) argues that while the "link between structure and agency is a logical one, the form of the link cannot change through history". Thus there is a static element in this construction of the relationship of people with society. As a result of this tendency not to overcome static interpretations arguments tend to lend weight variously to different elements of a construction of institutions at different points in time:

> 'either social structure is taken as the principle object of analysis and the agent is effectively eclipsed, as in the Marxism of Althusser, or individuals are regarded as the only constituents of the social world and their actions and reactions, their reasons, motives and beliefs, are the sole ingredients of social explanation'.
>
> Thompson 1989: 56

The perspective of dynamic nominalism has attempted to get to grips with the problem of a static notion of institutionalised practices. This approach stresses the fluid and historically situated nature of institutionalised practices by arguing that categories of people are historically constituted but also fluid (Hacking 1995; Blake 1999; Chapman 2000). Hacking (1995) argues that 'we "make up people" in a stronger sense than we "make up the world"'...'people and *groups* are constituted by a reflexive historical process' (*ibid.* 241 italics added). Taking an example pertinent to the Bronze Age, the category or institutionalised practise of being 'a soldier' (or warrior) is not the same through time. Hacking (1995: 247), drawing somewhat tentatively on the work of Foucault, argues that Medieval soldiers and Early Modern soldiers are subject to differently constituted institutionalised understanding of what being a 'soldier' is;

equally one might expect this to be true of Bronze Age warriors (or soldiers) — a well recognised category of people in the Bronze Age. The kind of person that constitutes being a soldier at any one of these times is influenced by a historically situated and recursive relationship between the institutional creation of a category of people and the people who then fill that category. Equally, drawing on the work of Wolff (1981) it is argued that the category of being a potter in a post 18th century, industrial, literate, western European society is most probably quite different to the category of 'potter' in the Late Middle Bronze Age of the Carpathian Basin. Equally the category of 'potter' may alter in relation to social stability or instability.

An important aspect of this perspective is the different emphasis it places on knowledge acquisition. Whereas agency theory,

> "... sees human subjects defining themselves through a continuous process of recovery of practical knowledge, Blake argues that self-definition channels the process of knowledge acquisition, providing actions with a description that is already part of the process of self-definition"
>
> Chapman 2000: 172

This places a far more dynamic and fluid construction on culturally and socially constituted institutionalised processes of learning and situates them cogently within a historical framework. The importance of this is that the process of socially performing procedural knowledge, associated with belonging to a particular category of personhood, at a particular historic moment, are situated within the same frame of reference. This is an important element in relation to understanding repeated processes of production as linked to intention, a key component in being able to trace skill investment and deployment in the archaeological record. Hacking argues "...that by and large intentional action is action under a description. So there have to be descriptions. If we can show that descriptions change, some dropping in, some dropping out, then there simply is a change in what we can (as a matter of logic) do or not do" (*ibid.* 247).

Another problem with the notion of institutions, that has a particular influence in Bronze Age studies, is the explicit concern with overarching institutions linked to notions of ideology and hierarchy that run through key texts (Brumfiel & Earle 1987; Kristiansen 2000; Earle 2002; Harding 2000). Rather than thinking about how social practice and institutions are interrelated (Kristiansen 1999) and recursive these texts tend to imply that it is only the dominant institutions that are of significance. In particular there is an emphasis on institutions linked to ideas of economy and chiefdoms (Earl 2002) to demonstrate the notion of the formation of early 'state' systems. There is no doubt of the importance of these perspectives to understandings of the Bronze Age. What is being suggested here is that the overriding concern with hierarchy in the Bronze Age masks opportunities to view empirical data from a different and finer grained perspective.

What must be remembered is that if the notion of institutions is seen as "collective patterns of self referring activity" (Bloor 1997: 33) it is important to recognise that society is constituted of a multitude of these. It should be remembered that these multiple institutionalised groups have cross-cutting vertical and horizontal relationships, and interactions rather than solely thinking about a dominant institution maintaining a hierarchical society. Rogoff (1990: 44) suggests that, "The institutions of culture include not only bureaucratic or hardened institutions, such as schools and economic and political systems, but also informal systems of practices in which people participate".

It may be expected that an institution related to learning would determine the 'rules' or 'conventions' of acquiring skill to make pots. As it doesn't stand alone the rules of that institution may be seen to reflect and influence the nature of other institutions and of broader social understandings. To understand what the rules surrounding skill acquisition may be it seems logical to focus on skill itself. If pots, and even parts of pots, are considered as selected through institutionalised practices to provide a central context of learning and this is placed as another analytical layer sitting beneath locale of production (for example, household vs. specialist industry) we may get a finer grained picture of learning structures.

3.4.2 The notion of institutions in reference to this research

Within this study the concern with institutionalised practices is the role that they play in determining the way in which people, as categories of people, follow certain conventions that are established at a particular place and point in time; are historically constituted.

All social interaction involves the formation of social groups. These groups may operate at many levels and scales. There may be family and kinship ties, geographic ties at local and regional scales, gender or age definitions, or groupings linked with the designation of skill as a craftsman, warrior, and farmer, or through status and wealth. None of these groups stand alone and in any society there will be vertical and horizontal relationships between these groups, and many groups will crosscut and overlap one another. Social interaction, the fabric of society, is negotiated, renegotiated and constrained through the mechanisms adopted by these various groups as they work, either consciously or unconsciously (Barrett 2000), to promote, maintain or renegotiate their particular interests (Giddens 1979; Barrett 2000; Sofaer Derevenski 2000; Sofaer Derevenski & Sørensen 2002). Amongst these mechanisms is the necessity for a group to create some form of self referencing system (Bloor 1997). This requires the appropriation of regularized practices through which its members can understand the parameters of appropriate behaviours and processes that constitute the group to which they belong. They can only understand the notion of belonging and functioning within a group by understanding the regularized practices, rules or structures, that bring that group into existence (Giddens 1979; Joyce 2000) and its juxtaposition to other groups. A particularly visible and well known example here would be that of cast systems (Miller 1985, David 1990). "It is these rules and structures as 'realities' which both limit and support the actions of people" (Barrett 1989b: 113). Such groups and their modes of behaviour or action which are created, maintained and even recreated through consensus (Bloor 1997) may be argued to be the product of institutionalised practices.

Bloor (1997: 33) drawing on the work of Anscombe (1969, 1976, 1978) and Barnes (1983) defines institutions as "a collective pattern of self referring activity". Bloor argues (1997: 29) that it is not the 'thing', in his example, a metal disc designed in a certain way that makes a coin, but the decision of people to call this disc a coin and conceptualise the notion of money — thus people create the institution of money and categories of people become part of the institution of money. To understand the institution of money it is then the social processes involved in creating such an institution, and the reasoning behind such processes as they are adopted by people at a particular moment in time, that must be examined. This is the same for any material item including pottery. It is not the lump of clay that makes a certain kind of vessel, with a certain range of technological signatures but the process of people engaging with this material category in very particular way in order to create a substantive reality for themselves (Sørensen 2000; Sofaer & Sørensen 2006).

Fuchs argues that,

> "A prominent core activity is classification. Classification is "how institutions think" (Douglas 1986: 48). By means of classification, institutions confer identity, establish similarity and difference, and organize meaning in conceptual grids. In very strong, solid, durable institutions, such grids tend to become naturalized or ontological over time. They cease to be mere constructs and turn into natural kinds or essences—as that which can no longer be imagined otherwise because it captures natural order itself".
>
> Fuchs 2001: 287

Fuchs (2001) goes onto argue that as an institution consolidates its classification become complete and an ensuing degree of tautology and circularity are established. As long as the institution (the core in Fuchs' argument) remains stable there is no need to conceptualise another way of proceeding. It is in this way that repeatability comes into force as the understood and accepted way of proceeding, the accepted way of performing procedural knowledge being the case in point,

> "As long as they last, cores do not consider the possibility that there might be a world in which the core no longer applies. This unwillingness or inability to learn, however, is itself a condition for learning, especially for cumulative advances, since learning occurs only if not everything changes at the same time. If it does, there is not progress but breakdown".
>
> Fuchs 2001: 287

The importance of Fuchs argument is that classifications (conventions) sitting at the core of networks of action, as institutionalised practise, give rise to particular ways of doing things; of knowing what to do as discursive knowledge and how to make the correct social enactment of this as procedural knowledge at a particular point in time. It is argued that it is this, which gives rise to motor habit patterns (Arnold 1988: 147) and repeated practices of production and repeated technological signatures. Rogoff (1990:

57) argues that; "institutions of society carry with them prescriptions for skilled performance". Action, as variously skilled performance of procedural knowledge, is indeed central to a notion of institutionalised practices; "Outer actions are necessary if we are to have interaction, and without interaction we have no institutions" (Bloor 1997: 34). Meanwhile, in his discussion of the *longue durée* Barrett (1989b) argues that the structures that create and maintain the *longue durée* are the routine institutions of life and that such "institutions are not things, they are the product of relations between people" (*ibid.* 113). It is the product of these relations that provide the evidence embedded within pots for particular ways of doing things and to various degrees of ability. How skill is invested, or deployed, is a reflection of the institutional practices that determine the nature of learning strategies. Only through such strategies can categories of objects come into existence to facilitate the negotiation and renegotiation of cultural and social identity.

3.5 Conclusion: Finding learning strategies in a prehistoric context

The arguments and critiques put forward in the chapter have aimed to show that if material culture is socially and culturally situated then so are the physical and cognitive processes that allow it to come into existence. Pots, and other material items, are produced within a socially and culturally appropriated frame of reference. The important aspect of institutionalised practices to this research is that they provide the platform for the adoption of particular culturally and socially constituted ways of doing things both in terms of codes of behaviour and codes of practice. This is true of learning strategies and ensuing skill acquisition. The intentionality that lays behind the production of material culture, in this instance pots, results in not only in biologically embedded repeated processes of technical action but repeated classes of material culture that share expected *technological signatures* of production. Used in combination with a deep understanding of the physical characteristics of a particular medium, in this instance clay, it becomes possible to track repeated sequences of technological action and variability of skill investment.

The varying ability of potters to invest skill into a range of vessel types within specific and culturally determined potting repertoires, combined with an understanding of technological signatures of production, makes it possible to see which vessels may have been made by predominately skilled, or less skilled, potters. For example, if all vessel groups within a specific potting repertoire are made only by skilled potters, smaller simpler pots will be far more likely to successfully meet the projected outcome than complex ones (Rye 1981; Rice 1987; Caiger Smith 1995). This should create a quite specific pattern in the archaeological record with a greater frequency of variability being consistently present in more complex vessels, and less variability being present in simple vessels. If, however, pots are produced in an ad-hoc way with everyone 'having a go' a far more random pattern should appear. If a learning strategy is in place where potters learn on simple vessels and progress to more complex vessels as their procedural knowledge (skill) develops, there should be a greater frequency of variability within small vessels, for example simple cups. A lower degree of variability for large or complex forms should also be present as these are in the domain of experienced potters.

Given that learning strategies are embedded within culturally and socially constructed institutionalised practices decisions over how to acquire and invest skill should reflect the nature of those practices. Studying patterns of skill acquisition and investment offers a window through which to view broader social mechanisms. Highly structured learning strategies should promote (or reflect) continuity by preventing innovation and encouraging specialisation. Conversely, liberal learning strategies may encourage (or reflect) change and challenge social norms.

Chapter Four

The Methodology: Rationale and Execution

"However hard one tries, first attempts are seldom right through and through, and the larger the scale the more difficult it is. Doing it over and over again, the details begin to come together, the consistency of the clay, the timing, the pressure of the hand. The scale of the form becomes physically familiar and one gets a clearer sense of the object as a whole. The confidence shows. One feels this assured presence in hand-built pots from communities where people make them all the time and live with them. To reach it, there are no short cuts."

Alan Caiger-Smith 1995: 113

4.1 Introduction

The aim of this methodology is to provide a practical framework through which learning strategies may be explored. It provides a precise understanding of pottery as a plastic additive medium. This allows for the individual components of manufacturing action and resulting technological signatures of production to be explained in detail. It is this that provides the basic platform for an understanding of variability in skill investment. In order to establish variability in skill investment it is also necessary to select a sample of specific vessel groups that will represent varying degrees of technological complexity at Százhalombatta, Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. Finally, the very large size of the assemblages demands a sampling strategy to be put in place. This sampling strategy also endeavours to allow comparison and contrast of the deployment of skill between the classes of pots selected for study over a temporal span. Additionally the sampling strategy ensures that material selected from the settlement and cemetery contexts is comparable.

It has been argued in chapter 3 that all societies have specific ways of passing on knowledge that both stem from and result in culturally and socially constituted learning strategies. This, in turn, means that as potters intentionally aim to meet a pre-determined outcome they work within specific and repeated boundaries of physical and cognitive technique. This results in the repeated production of certain classes of pots. Because the production of pots involves that specific tasks are undertaken in a particular order, and given the additive, plastic nature of clay these result in a range of *technological* *signatures* that are specific to particular vessel groups. It is these technological signatures that are the key to establishing the typical range of expected technological characteristics against which variability may be measured. This chain of events means that specific vessel groups share technological characteristics that can be monitored for variability. In order to understand the precise nature of these processes the following issues are explored; the plastic additive nature of clay and technological signatures, the technical constitutive elements of making a pot and necessary sequences of manufacture, degrees of complexity with regard to manufacture and degrees of skill required to meet intended outcomes

These topics are discussed and then the technological variables for data collection and analysis are introduced through an in-depth discussion of specific potting processes. This provides the, previously mentioned, precise understanding of both the individual components of manufacturing action and the sequences in which they should be employed. Building on the arguments made in chapter 3 an understanding of the socially situated nature of production and the skill required to ensure the success of intended outcomes is necessarily embedded within these discussions.

4.2 The plastic additive nature of clay and technological signatures

The basic structure of clay is lamellar which means that it is made up of tiny, usually, hexagonal platelets. As clay is manipulated these platelets slide and overlap one another lubricated by a molecular-thin layer of water. It is the electrical cohesion between these that allows a mass of clay to maintain a given shape while allowing momentary disturbance by pressure (Fournier 1973: 48; Rice 1987: 53). This is what allows the infinite variety of shapes to be formed that are unique to clay and why it may be described as a 'plastic' additive medium (Rice 1987: 52; Arnold 1988: 6). How well a shape is maintained depends on the type and quality of the clay used, the quality of its preparation, and the skill of the potter, "What limits there are, are set by the skill of the potter in mixing her [sic] materials, building the vessel and firing it, rather than by the inherent nature of the material" (Arnold 1988:6 *citing* Bunzel 1929: 2). Each constitutive stage of production requires either the manipulation of existing clay surfaces or the addition of more clay which is then manipulated to form the desired outcome at every stage of production. Rye (1981: 58) describes the analysis of forming techniques as "...the study of the manner in which pressure was applied to the clay". It is this 'manner' of application and manipulation of clay and clay surfaces that provides unique "evidence for particular social practices" (Barratt 1988: 6).

Of great importance to this research is the fact that each addition of clay, or manipulation of existing surfaces, renders possible the chance of a physical trace of its application being left behind, and of that action becoming permanently embedded within the structure of the pot at the time that it is fired. This is attested to in numerous studies making use of various techniques to trace production related signatures embedded within a temporal range of prehistoric ceramics. Rye (1981: 58–89) in his description of forming methods makes clear the numerous and distinct visible traces, *technological signatures*, left by different forming choices which are observable through close macroscopic inspection. It is well understood that these distinct and visible production-related technological signatures (or patterns as Rye calls them) can be 'read' by other skilled artisans. Rye (1981: 60), for example, notes in his discussion of wall thickness that 'A skilled potter can infer much of the forming process by feeling subtle variations in thickness and [by] reconstructing the finger and hand movements of the maker'.

These technological signatures have an established place within the repertoire of ceramic archaeologists who have regularly made use of them to determine the core (primary) forming methods by which the basic structure of a pot is made (Rice 1987: 128; Rye 1981: 68; Gibson & Woods 1997: 126, 194). Increasingly (secondary) finishing methods such as surface finishes, decoration, and the application of handles, feet and lugs are also commonly traced through the specific signatures that they leave, as are the specific tool types used in secondary and finishing processes (Haith 1997: 147; PCRG 1997; Budden 2002: appendix 2). Recently ceramic archaeologists have become confident enough to extend the use of this practice to include observation of specific technological signatures to identify the unique products of individual potters (Morris in press; Garvey 2003). In addition to being able to witness individual forming or finishing methods both Rye (1981) and Hosler (1996) have argued that where technical options exist it is also possible to identify the sequences of the technical choices made. Thus it becomes possible to detect not just the range of manufacturing choices associated with a particular class of pottery but also the intended sequence of their use further adding to the analytical repertoire. Orton *et al* (1997: 163) highlight both Rye's (1981: 123: 137) and Schuring's (1984: 148) use of this technique to build a picture of the normal practices and sequences involved in producing any particular class of pot; "...it is the successive manipulations taken by the potter — the sequence of steps — which distinguish one 'type' from another" (Orton *et al* 1997: 163). Each manufacturing method and the specific technological signature left by its adoption are outlined within the later discussion of the constitutive elements of making a pot.

As stated, all forming methods will leave distinct technological signatures. These can be observed in a number of different ways. Macroscopic inspection is noted by Rye (1981: 58) to be adequate in many instances. However, microscopic inspection at x10 or x20 magnification with a microscope is recognised as a useful tool (PCRG 1997) as is the use of petrological examination, pioneered by Anna O. Shepard, and photomicrographs (Gibson & Woods 1997: 196). This has most commonly been associated with provenance studies related to establishing local or non-local production (Arnold 1988). Petrology may also be used to observe particle orientation and distribution (Gibson & Woods 1997: 218–219) and the presence of join voids (*ibid.* 195). Meanwhile Magrill & Middleton (1997:73) and Simpson (1997:155) have made use of radiography to establish manufacturing signatures firstly in Magrill & Middleton's case to look at a Canaanite potters Late Bronze Age workshop and then in Simpson's case to look at Early Iron Age rural traditions in Iran.

Technological signatures are argued here to be traceable to culturally and temporally specific classes of pottery. Rye (1981:5) argues that it is possible to observe technological traditions by the high correlations between production sequences. Additionally if potters are making identical vessels using identical techniques and sequences of action (albeit with minor variations) vessels can be grouped into a single category. This tracks back to the notion of repeated practise and it is worth noting that given the supposedly infinite production possibilities that clay lends itself to (Bunzel 1929), within any singular society, very few are ultimately selected. Equally potential procedures that are not selected may relate as strongly to social constraints as environmentally determined ones (Gosselain 1998) Therefore, where specific technological signatures are seen to be constantly repeated they may be considered to represent the chosen production pattern adopted by potters in order to successfully produce a specific class of pottery and meet an intended outcome. This may be the outcome of an individual potter or of a group of potters adhering to an understood pottery repertoire. In either scenario recognisable visual technological signatures are identifiable to a particular finished product. Such technological traits will be underpinned by the need for potters to produce pots with particular socially and / or culturally determined performance characteristics related to the intended function to which a pot will be put (Braun 1983). This function may be pragmatic or relate to complex processes of social signalling on multiple levels (Braun 1983; Sterner 1989; Sillar 1996). Given that such technological and visual signatures are linked to prescribed patterns of process, and repeated practise, it may well be possible to also link them to learning strategies and wider social phenomena.

Within this research each selected technological signature is scored as ‘good’, ‘moderate’ or ‘poor’ depending on the investment of skill observed in its execution. Here it is important to note the necessity to establish a control group (a benchmarking system) for any potting repertoire and each vessel type within it. This ensures that the designations of ‘good’, ‘moderate’ or ‘poor’ relate to how closely each technological signature has come to meeting the proposed outcome. For example, if a particular vessel type is repeatedly produced to have thick and very even walls this is the expected (correct) technological signature and a vessel conforming to this characteristic would score ‘good’ for this technological signature. If however, the wall thickness was extraordinarily variable or very thin it would score as ‘poor’. Within this study the benchmarking system consists of a photographic library accompanied by verbal diagnostic descriptions of what constitutes ‘good’, ‘moderate’ or ‘poor’ for every technological variable analysed. It is important to stress that in this research each vessel is only compared within the technological parameters normal to that vessel group and that the aesthetic value of vessel groups are not compared one with the other. Appendix 1 explains the codes for data collection and Appendix 2 offers descriptions and supporting illustrations as to how each technological signature has been scored.

4.3 The technical constitutive elements of making a pot

All pots require that certain essential and specific technological processes are undertaken in a specific order for a complete and satisfactory object to emerge from the production process. Crown (2001: 456) notes, for example, that “Learning to make pottery requires mastering a complex series of tasks including selecting appropriate materials, mixing them, forming the vessels, drying them sufficiently, finishing the pots by scraping, slipping, and /or decorating them, and firing the vessels". The range of technological processes has been argued to be defined by the potter's pre-determined desire for an intended outcome. It is further argued that in order for a pot to survive all of these various processes and safely reach completion an intrinsic and deep seated understanding, by the potter, of each of the constitutive elements of manufacture is necessary (Peterson 1974: 75). In other words a potter must be technically competent (skilled in the execution of procedural knowledge) to complete all of the required tasks to a standard that results in an intended outcome being met. The constitutive elements of production are bound by technological and social demands to follow a certain order (Rye 1981: 3). This is the case regardless of the specific nature of any class of pottery. For example, burnishing must come after the application of a handle, lug or foot because of the relationship to the hardness of clay. Handles, lugs and other appendages must be applied to tacky still slightly wet clay while burnishing requires at least semi dry (leather hard) or dry clay to be successful. There are many such relationships between individual procedures that must be understood for the successful completion of a pot. These are highlighted within the discussion of each constitutive element of manufacture.

In summary, the constitutive elements of making a pot are seen to be: clay procurement; clay preparation; acquiring and using appropriate tools; undertaking core manufacturing processes; applying handles, lugs or foot-rings; applying surface finishes and / or decoration; drying pots prior to firing; and firing pots (Rye 1981; Rice 1987). Each technical constitutive element of production is discussed later within this chapter. Both social and pragmatic issues highlighted, the specific technological signature (and rare absence of a signature) of each technical process is also duly noted. The intention within this discussion is to demonstrate that knowledge and skill is required at every stage of pottery production; "The potter is a user of natural materials, and has to know which materials to select and how to use them" (Rye 1976: 106). Traditional archaeological studies are used to form this discussion but are further supplemented with ethnographic and contemporary ceramic studies in order to gain the fullest explanation of every process.

4.4 Degrees of skill, degrees of complexity and repeated practise

It has been argued that the execution of each of the necessary sequences of production require skilled decisions which are embedded within culturally and socially constructed ways of proceeding (c.f. Miller 1985; Shanks & Tilley 1987; Barley 1994, 1997; Barrett 1989; Roux 1990; Dobres 1994, 1995, 2000; Sillar & Tite 2000; Chapman 2000; Schlanger 2006). In addition, skilled action at every stage of manufacture is required for the successful repeated production of a given pottery repertoire to be secured. This is a factor of critical importance to all communities (Wallaert Pêtre 1998). As Schiffer & Skibo (1987) note, even innovation relies on a foundation of previous understanding. Error at any stage of production may result in failure to meet the intended outcome; constant error and failure of a community to pass on appropriate skills may jeopardise the continuity of an entire potting tradition and destabilise social continuity.

Potters are seen, in a pragmatic sense, to make decisions as to how they may best proceed through reference to understood and agreed technological methods that relate to both social and pragmatic concerns (Arnold 1988; Barratt 1988; Barley 1994; Dobres 1994, 1995; Sillar 1996). Once such choices have been made they are argued to become part of a technological potting repertoire that is "embedded within wider social practices" (Sillar & Tite 2000: 10). The discussion in chapter 3 indicates that owing to the complex nature of learning processes technological repertoires are unlikely to change; unless significant causal factors come into being (Arnold 1988; Rice 1987, Sillar & Tite 2000). Thus skill is linked to the repetition (the repeated practice) of such a technological repertoire. From a potters perspective Caiger-Smith (1995; 78) asks "Can any skill be acquired without repetition? It seems unlikely…" and argues that "Control (of the raw materials and techniques) depends upon skill and skill upon repetition and it cannot be dodge" (Caiger Smith 1995: 138). Peterson (1974: 160) in examination of the nature of Shoji Hamada's work notes that "No matter how many times the actions are repeated, there is vitality. Each pot is new, but part of an ancient and ongoing process"; in other words renewal should not be viewed as an entirely static process.

An ability to be able to adhere to the technical constitutive elements of production, that will effectively and successfully facilitate the production of the intended product, may then be argued to be a sign of a significant acquisition of skill. Thus when such adherence fails to be present it is argued that the following factors may be involved:

1. A lack of care is present
2. An attempt to innovate (reinvent rather than renew) is present
3. A learning strategy is operation resulting in skill variability being present across the range of vessels being produced.

It is of course necessary to be able to distinguish between these factors. If a lack of care is present it is suggested that arbitrary manufacturing errors would occur across a diverse range of vessels. Lack of care is also a tenuous argument for poorly skilled manufacture. As Crown (2001) notes people who do not wish to pot or who cannot develop the necessary skills simply do not pot. The idea that lack of care is associated with the need for haste, for example, to produce cemetery ware is also argued as unlikely on two counts. First, specifically with regard to the Bronze Age, it seems unlikely that a society known to have multiple sophisticated institutions and highly structured social mechanisms rely on a system for burial that requires the potter to 'dash off' a quick burial urn. The second point returns again to the embedded nature of procedural knowledge which suggests that even in haste a skilled potter will have an ingrained knowledge of the manufacturing process that will enable him or her to produce a sound vessel.

If, meanwhile, innovation is occurring it would be expected that new shapes, products and raw materials would accompany the observable downturn in technological skill as potters struggle to find new technological solutions (Kramer 1985: 93; Schiffer & Skibo 1987: 595). If learning strategies are, however, the cause of repeated error it is suggested that these will occur in a way that a pattern of learning may be visible, for example, as *recurring* irregularities of wall thickness, poor symmetry of form, poor application of handles, uneven rims and the presence of many join voids. Additionally there may be poor mixing of the clay resulting in air pockets and uneven particle (temper) distribution. These irregularities are also more likely to occur on a selected range of vessels (Rye 1981; Rice 1987; Caiger Smith 1995), for example, small vessels that are a good starting point for learners. As noted in chapter 3 no community of potters is likely to exist as either skilled or unskilled practitioners. If skill is being passed on through a learning strategy then there will be a continuum of variously skilled practitioners present.

The varying ability of potters to invest skill into a range of vessel types within specific and culturally determined potting repertoires, combined with an understanding of technological signatures of production, makes it possible to see which vessels may have been made by predominately skilled — or less skilled — potters. For example, if all vessel groups within a specific potting repertoire are made only by skilled potters, smaller simpler pots will be far more likely to successfully meet the projected outcome than complex ones.

To be able to distinguish between the above and read the presence of skill variability as practice it must also be understood that not all pots require the same level of skill to produce. Rye (1981: 58) notes that "Variations will be smaller if the potter is highly skilled than if he [sic] is less skilled". He also suggests that "easier" forms will have a tendency to show less variation than "difficult" ones when made by a skilled artisan. Thus smaller pots with simple unexaggerated forms, smaller rim circumference, lower walls and little embellishment are easier to construct and should be less prone to error when made by a skilled artisan. These easier forms may be considered as a good starting point for apprentice potters who will have more chance to succeed at the intended task, in other words to succeed in producing a particular pot to a pre-determined and intended ideal.

This idea seems to hold true for Wallaert Pêtre's (1998: 10) case study of apprenticeship strategies among Faro potters in Cameroon. The corollary of this is that large pots, such as urns, and pots with exaggerated morphologies, such as the complex tripartite vessels of the Koszider period, require an extra investment of skill. Caiger-Smith (1995: 109–110) notes, for example, "...that considerable skill is required to control the clay as a form widens as even small irregularities will become exaggerated as the pot grows in size and cause failure." Large pots are prone to 'slump', warp, or crack at various stages of manufacture unless considerable skill is invested in their production (Rice 1987: 227). This suggests that the more complex and large forms found within assemblages are more likely to represent the work of skilled potters capable of meeting the challenge of producing technically complex forms to a competent standard that will result the intended ideal for that class of pot being met. However, the production of complex and / or large pots still requires an episode of learning to come into play and at this time error may expected to occur. How skill variability manifests itself is seen as the key to linking degrees skill and / or error to learning strategies.

Another important issue with regard to skill is to question whether a craftsperson can 'unlearn' skill. The arguments presented in chapter 3 surrounding the complex processes involved in skill acquisition (c.f. Anderson 1982, 1983, 1987; Arnold 1988, Hacking 2004; Schlanger 2006) suggested that the more frequently procedural knowledge is performed the more deeply embedded technique becomes until the technique becomes innate to the performer of the task. The execution of the skill speeds up and is 'hard wired' into the performers neurological and physical make-up, and is never lost. These combined arguments suggest that under usual circumstances performative skill (technique) cannot be unlearnt (Mauss 1935 *in* Schlanger) but rather becomes cumulatively and more competently incorporated into practices of manufacture through time. Thus, even should the need arise for pots to be produced quickly, or with materials of a poorer quality, the skilled potter will almost certainly produce an article with technological signatures that demonstrate clear technical competence. This does not mean that potters or other artisans cannot learn new skills but these should be seen as overlaying previous skills and as a foundation for new skills to emerge rather than a mere replacement of one skill with another (Roux & Gosselain pers. com.)

Finally, there is the issue of age. Are pots that exhibit low degrees of skill possibly the products of aged potters who with increasingly frailty produce substandard pots? The first argument offered against this concept is that if procedural knowledge is innate and cannot be unlearnt then elderly potters retain the knowledge for basic skilled action. They continue to understand and articulate the necessary performance required to produce a satisfactory vessel (Crown 2001 453-454). Crown (2001) notes this as being the case with elderly Pueblo potters who continue to make high quality vessels until they die (*ibid* 454). Meanwhile, Kramer (1985) and Stark & Longacre (1993) note a tendency for older potters to produce more complex items because of incremental increase in skill with age and experience. It is certainly well documented that Shoji Hamada, the greatest known potter of the 20th century, continued to make highly skilled pots well into his old age. It is also worth returning to the idea that it is not in best interests of potters to produce poorly made vessels (Longacre *et al* 2000). Crown (2001) in her discussion surrounding reasons for poorly executed pottery also notes that once potters could no longer satisfy the necessary criteria for production they simply stopped potting.

4.5 Technological variables for data collection and analysis

The selection of the following variables for analysis is determined through reference to the preceding observations and bears direct relation to the constitutive elements of production. It represents the criteria seen as most likely to afford the observation of both intended outcome (normal practise) and error. Again, it is important to stress that while this study is looking for error this can only be achieved by determining the deviation from observed normal criteria for any class of pottery and therefore from the intended outcome for that class of pottery. Thus should it prove 'normal' for a handle to be placed at an angle or for pots to be only partially burnished then this would not be observed as error. The technological criteria selected for data collection are in summary: vessel form; clay preparation and appropriate use of tempering materials; manufacturing processes to form the body of the pot; the applications of additions such as handles, lugs, and foot-rings; interior surface treatments, exterior surface treatments; decoration; rim deviation on the horizontal plane; wall thickness; rim symmetry; handle symmetry; profile symmetry; drying and firing. These variables and the accompanying coding system are located in Appendix 1. Each variable analysed will be coded as being of 'good', 'moderate' or 'poor' depending on the degree of technological skill seen as present, or absent, in its execution. This system of grading is entirely related to the execution of technology so that a vessel type will be fit to perform its intended function and has no relationship with notions of aesthetics. Vessel groups are not compared one with the other for this grading exercise. So, for example, the criteria for a domestic vessel are separate to the criteria required for fineware. A complete verbal description of what is entailed for each variable to be graded in this way is available as Appendix 2. For example, the characteristics of 'good' burnishing as a surface treatment may be that the surface has a high sheen without striations or gaps present and that the tool to carry out the task has not left indentations or 'scoring' marks because the clay has been too dry at the time the task was executed. There is also a photographic database of technological characteristics used to support these verbal descriptions where appropriate.

4.5.1 Clay procurement, cleaning and preparation

4.5.1.1 Procurement

Potters must select clay appropriate to their intended task and then transport it, where necessary, to their place of work. Acquiring good clay that has sufficient plasticity and a suitable firing range to make it viable to produce pots to a desired intended outcome is a primary concern for potters (Sinopoli 1991: 15–16) and is related to complex social mechanisms (Gosselain 2005). Cooper (2000: 12–13) notes that the technical success of Athenian and Corinthian potters of ancient Greece is related to fine quality clays which were, in this case, readily available. Great value is placed on sources of clay which are in many circumstances carefully guarded. Leach (1975:100) gives an example from feudal Japan where kilns were erected near to good clay deposits and strict control was maintained over preparation and recipes to avoid secret materials being revealed to neighbouring fiefs. Arnold's (1988: 57) model of procurement suggests that potters will rarely travel more than 1 – 7 kilometres from their base location to procure clay. Cooper (2000), however, highlights two examples of clay procurement which have involved clay being moved considerable distances with the necessary logistics and expense being clearly viewed as worthwhile. "The Pueblo potters of Zuni in the south-western mesas of North America carried clay from the top of a mountain because of its workable qualities" (Cooper 2000: 12–13) and in the seventeenth century clay was taken from East Anglia in England to Holland by Delft potters because of its particular suitability for the production of maiolica.

As Sinopoli (1991: 16) notes, the acquisition of raw materials is dependent on accessibility, availability, ownership, and the culturally perceived value of the item and cost. Peterson (1974: 37) observes that at the workshop of Shoji Hamada, a 20th century potter of such renown that he is recognised within Japan as a 'national treasure', the Mashiko clay is pick-axed from the mountain side but its poor quality meant immense care was required in its preparation. Many days of labour (and teamwork) were involved in refining and removing all impurities and then wedging the clay by hand and by feet (*ibid* 183), irregularities of consistency and air were removed until the clay was considered as perfect for its task. However, even with all this effort it was necessary for Hamada to blend the Mashiko clay with clays from further away in order to get the required plasticity for larger pieces.

4.5.1.2 Cleaning and preparation

Cooper (2000: 13) notes that all clays require "careful preparation". It is essential that clay is cleaned of foreign objects such as stones and roots. If this is not done the pot walls may crack in either the drying or the firing process; stones and detritus may well explode from within the clay fabric and cause breakage or spalling (Hosler 1996). Foreign objects or pebbles, left in the clay as unintended inclusions, may also protrude through the finished surface of the pot impeding the task of decoration or of applying a surface finish. Such inclusions may also decrease resistance to surface abrasion and diminish the overall strength and longevity of the pot.

Once clay has been cleaned it must be wedged (as at Hamada's workshop). This process ensures an even distribution of water throughout the clay. This is important as the clay is given even working consistency that prevents uneven shrinkage during either drying or firing. Without this necessary step there is a danger that the pot will warp and become misshapen as it dries prior to firing, or even crack as additional stresses come into play (Rice 1987). Wedging also removes pockets of air from the clay (Rye 1981; Rice 1987; Peterson 1974) that would expand during the firing process causing the pot to either crack or even explode (spall) the wall of the pot. Such air pockets may be visible, either macroscopically or at x10 microscopic magnification, not only by the damage they cause but as intact voids within the clay fabric. Air remaining within the clay structure may also lessen its mechanical strength.

Wedging clay is a skilled task which determines the quality of clay and aids the likelihood of a potter being able to meet a desired technological outcome. In Japan it was for a long time considered the task of one generation to prepare the cay for the next and at Mashiko Hamada's son, Shinsaku, argues that it is best "...to keep a mountain of wet plastic clay ... as that way a lot of clay ages together and remains homogenous" (Peterson 1974: 39). Meanwhile, Caiger-Smith (1995: 141) acknowledges that the blending of clays and the understanding of the properties, variable characteristics and empirical properties of clay is all bound to local knowledge. Without the wedging process the technical integrity of a pot may be compromised. Competent wedging ensures the even distribution of naturally occurring or deliberately added inclusions throughout the clay. How well sorted tempering materials are through the clay matrix is also a reflection of how well wedged the clay is.

4.5.1.3 Inclusions and Temper

The addition of deliberately added inclusions, temper, may be carried out as a technological necessity, or socially desirable, need to add deliberately selected tempering material (in addition to any naturally occurring inclusions). In pragmatic terms, the addition of tempering material may be necessary as an opening agent to increase the wet strength of clay, particularly for the production of larger vessels; temper will make the clay more workable and controllable, and help to prevent the walls slumping as more layers of clay are added (Cooper 2000:13; Rice 1987: 227). It may also be a necessary addition in order to reduce problems related to shrinkage (Rice 1987: 408) and to improve thermal shock properties both at the time of firing and for pots intended as cooking vessels. The use of tempering materials "...that steady clay and lessen the risk of cracking..." (Caiger-Smith 1995: 117) and consideration of thermal shock properties is an integral part of clay preparation and is well documented within archaeological and ethnographic literature (Rye 1981; Rice 1987; Barley 1994; Gibson & Woods 1997). It has become increasingly clear to archaeologists that tempering practices may also be influenced by social and cultural concerns and be part of historically embedded repeated practices of production (Rice 1987: 409; Sillar 1996: 265–271; Jones 2000: 130; Livingstone Smith 2000: 38; Stilborg 2001: 398; Kreiter 2007: 234-274).

Irrespective of the rationale lying behind the addition of tempering materials their use requires an understanding of how they will affect the performance of the finished pot (Rye 1976, 1981; Schiffer & Skibo 1987). Various tempering materials are understood to offer different advantages, for example, the addition of rock in reasonable quantities will aid the wet strength of large vessels and be highly successful at absorbing thermal shock (Rye 1981; Arnold 1988). Equally, they may present specific problems requiring skilled knowledge of how to manipulate them. For example, Rye (1976: 120) explains that while calcite and shell are notoriously popular as tempering materials in Melanesia their use is surrounded by the technical problem of re-hydration causing later degradation of pots. In order to overcome this problem an understanding of suitable firing temperatures is required. Additionally, it appears that the use of seawater to wet the clay acts to stabilise the calcite or shell but also causes possible problems regarding the plasticity of the clay which may be diminished by the sodium content. Inappropriate use of calcitic tempers will result in voids appearing across the vessel surface and eventually in the fabric beginning to slake apart. This causes degradation of the vessel surface through time and may lessen its effectiveness in functional terms and its longevity. Thus, very complex decisions surrounding the issue of tempering choices is not uncommon. Rice (1987: 407) provides a useful comparison chart of various temper types. It is important for this study to understand that significant deviation from understood or normal tempering practices may alter the behaviour of clay with the possibility of resulting error occurring (Rye 1976; Braun 1983; Kramer 1985; Stilborg 2001). It is then, usual for appropriate tempering materials to be selected depending on the intended use of a vessel. Where this does not appear to be the case it may be that access to resources is limited in some way, the clay has not been cleaned of inappropriate but naturally occurring inclusions or the tempering practice has been carried out in an inexperienced way.

A fabric series is used to provide additional insight into clay preparation. It will allow for the observation of choices related to fabric type and vessel type and, therefore, the appropriate selection of tempering materials. Consideration is also given to sorting and size ranges of inclusions as a textural analysis, (Orton *et al* 1997: 141). This is expressed as 'textural types' and provides a further aid to the degree of skill that has gone into the making of each clay body. The criterion for coding of textural types is located in Appendix 1. The coding system will allow this aspect of fabric analysis to draw out relationships between the nature of clay preparation and skill variability, specific vessel groups and each of the study sites.

Thus with regard to clay selection and preparation the following aspects offer the possibility for variability in skill investment. These are; the possibility of no error occurring; spalling occurring; observation of air pockets trapped within the clay matrix; random (and unintended) inclusions breaking the finished surface of the pot. These possibilities are listed in Appendix 1 and described in Appendix 2. If any one of the above mentioned errors occurs the pot is in danger of being weakened but if there is more than one error or multiple errors then the pot is compromised to an even greater degree. No error implies careful consideration of clay preparation — and is seen as 'good', a single error is recorded as 'moderate' and two or more errors will be seen as 'poor' with regards to clay preparation. In addition, variability in the skilled use of tempering materials and textural types is established through reference to the fabrics series.

4.5.2 Manufacturing processes

Manufacturing processes are traditionally divided into primary and secondary forming methods (Rye 1981; Rice 1987), however, this distinction is argued here as being awkward to maintain and of little value with regards to this research. Some techniques straddle the boundary primary and secondary forming methods. An example is the paddle and anvil technique which may be both a primary forming method and a means of surface finish and decoration such as that found during the Navatu phase of Fijian prehistory (Marshall *et al* 2003). A similar situation exists with regard to burnishing which may be argued to have technical advantages (Rice 1987) as well as visual advantages (Longacre *et al* 2000; Budden 2002). In relation to this research the techniques used are entirely related to hand-building processes of manufacture. Among the processes used to create the basic form of a pot the principle and most well documented methods are; pinching, coil-building, ring building (a variant of coiling), slab-building, the paddle and anvil technique and the use of simple moulds (Rye 1981; Rice 1987; Cooper 2000:13, 200–213). It seems worth noting here that a general assumption of archaeologists is that hand-building pots requires less skill than the use of the potters wheel and is, therefore, easier to master as a technique. This is seen here as a dubious proposition that undermines the importance and necessity of learning mechanisms. Cardew (1969: 87) argues that potters skilled in both techniques attest that "hand-building is more difficult to master than throwing; and as a training in coordination and of sense of form, it is probably superior", this is certainly also the authors experience.

There has been a tendency in archaeological literature to view manufacturing techniques as an 'either / or' choice (Haith 1997:147). Consideration also needs to be given to the idea that these processes may have been used in combination (Rice 1987). Cooper (2000: 208) notes the combined use of coiling and 'pulling clay from a lump' in rural West Africa while Peterson (1974: 217) draws attention to Shoji Hamada's method of combining coiling and throwing, a technique documented in ethnographic literature by Barley (1997: 141). Also, within Bronze Age urns Százhalombatta, Hungary, observation has been made regarding the combination of slab building and coiling techniques (Kreiter, Sofaer & Budden 2006). It is clear from a wide source of available literature that, owing to the plastic nature of clay and the additive nature of production previously discussed that each of these techniques leaves distinct and visible traces (Rye 1981).

Once the core form of a pot has been produced it is necessary to make any additions such as adding pedestal feet (common to certain Early Bronze Age, Nagyrév, forms at Százhalombatta), the application of handles and lugs, and the making of holes for sieves. Surface finishes and embellishments of decoration are also integral to meeting the intended ideal outcome. These processes are as important for the successful completion of a pot as the initial forming methods selected and must be carried out at appropriate times in the history of the pots construction. They are part of well understood and rehearsed sequences, adherence to which is essential if the intended outcome is to be met. For example, the application of handles or lugs must be done at a point when the clay is not too wet but is still tacky to touch. Once the clay has dried beyond this tacky stage the handle will not adhere properly and may crack in firing or fail at a later stage in use. Such concerns are equally important to execution of decorative elements. The application of plastic decoration, such as bosses or finger impressed cordons must be carried out at an appropriate stage of drying. Equally the dryness of the vessel will affect the appearance of incised decoration and its likely success.

Each forming process and the technological signature left by its adoption are discussed in detail below.

4.5.2.1 Pinching / pulling

Pinch pots are made, as the name suggests, by pinching out a shape from a single piece (ball) of clay. Pinch pots are generally associated with "the production of the simplest of small round-bodied vessels" (Orton *et al* 1997: 118) and Rye (1981: 70) suggests a most likely maximum size of 20cm for pots made by pinching. The author's own experience has shown that this depends to some extent on the size of the potters hand and finger spread. Because pots made by this method are formed from a single lump of clay the most distinctive signature of their production will be a complete absence of join voids. Other distinguishing characteristics may be finger indentations on interior surfaces (Leach 1945: 64; Rye 1981: 70). With inexperienced production these may be erratic and of an uneven nature where to much pressure is applied causing severe indentations that introduce a weakness to the vessel wall. The successful production of a pinch pot relies on the artisan's ability to maintain the symmetry of the form being produced as the clay is incrementally pinched (and spreads) into the desired form (Fournier 1973: 171–172). Thus the most likely error, reflecting inexperience, would seem to be that of severe asymmetry and erratically uneven wall thickness where the clay is pressed too hard or with uneven pressure around either the body or the circumference of the pot, leaving uneven finger indentations. Additionally, Leach (1945: 63) also points out that if too long a length of time is taken in producing a pinch pot the clay will dry and split, vertically, at the rim from the warmth of the potters hand and over-manipulation of the clay, "the freshness and quality is soon lost by over-manipulation".

The process of pulling (or drawing) a pot is described by Rye (1981: 72), Barley (1994: 24) and Rice (1987:125). As with pinching there will be no joining marks or join voids but there may be vertical striations resulting from drawing the clay upwards (in some instances against a former) with the fingers. This technique may also incorporate the addition of coils but joins are most likely obliterated by the severe manipulation of the clay and the common use of the paddle and anvil technique as a finishing process (Rye 1981). Likely observable error will be as for pinch pots. With both forming methods inexperience may also lead to excessive or erratic wall thickness and a pot of excessive weight for its volume.

4.5.2.2 Coiling and ring building

Coiling, and its variant ring building, are the product of long "ropes or sausages" of clay being rolled out or extruded through the potters hand (Leach 1945; Barley 1994; Gibson &Woods 1997). Each coil is incrementally added to the pot and then smoothed to seal the joins and make the pot both watertight and mechanically sound. Pots made by this technique will often show either spiralling or parallel ridges internally where joins have been sealed together.

Coiling and ring building are, very probably, the most highly documented manufacturing techniques discussed within archaeological and ethnographic literature (c.f. Rye 1981; Rice 1987; Sinopoli 1991; Barley 1994; Gibson &Woods 1997; Orton *et al* 1997; Varndell and Freestone 1997). Interestingly this may not only reflect the high rate of usage of this hand-building technique but also an easily observable technological signature of error where coils are "poorly bonded" (Rice 1987: 128). Badly joined coils or rings create a weakness in the pots structure that results in detectable hairline cracks and "distinctive patterns of breakage". These are observable as join voids that archaeologists are well used to observing both macroscopically and microscopically (Barley 1994; Gibson &Woods 1997; Orton *et al* 1997).

Rye (1981: 68) suggests that joins characteristic of a coiling technique may fracture in an irregular and meandering pattern. Meanwhile Rice (1987: 128) discusses the likelihood of breakage as occurring along parallel planes, either horizontally or gently spiralling. The different breakage patterns (horizontal or spiralling) most probably reflect the slight technical variant of coiling or ring building (Fournier 1973: 50–51). Fournier suggests that ring building may offer a better chance of achieving symmetry, than coiling, in the production of larger pots. Meanwhile, observation has been made of very specific types of coil join on the pots from the Neolithic settlement site of Crossiecrown, Orkney. Here the coil joins associated with Grooved Ware are of a mortise and tenon design (Andrew Jones; personal communication).

Of particular significance to this study is the implication that the repeated incidence of visible join voids, of whatever specific nature, may be seen to reflect error because it is obviously not in the interest of a skilled artisan to produce an item that is liable to crack as it dries, is fired, or as mechanical stresses come into being through use. A particular cause of poorly bonded coil joins may again be the over manipulation of clay causing the clay (and coils) to become tired and leathery rather than moist and plastic causing problems at the bonding stage: this is an error seen repeatedly by the author when teaching pottery to beginners. An additional problem with coiling or ring building may be that of slumping. Caiger-Smith (1995: 109–110) notes that in coiling large pots in damp climates the potter must wait for previous sections of work to stiffen or the pot will slump under the added weight of clay. He stresses that considerable skill is required to control the clay as a form widens as even small irregularities will become exaggerated as the pot grows in size and cause failure. With coiling methods inexperience may also lead to excessive or erratic wall thickness and a pot of excessive weight for its volume.

4.5.2.3 Slab-building

In slab building pieces of clay are flattened by rolling or patting them to a desired thickness and shape, these are then joined together to form the pot. This technique is not confined to the production of rectangular pots and may be used to produce "the squashy round forms of plastic clay building" (Fournier 1973: 207). Slab building is generally associated with the production of larger vessels (Rye 1981: 71; Rice 1987: 125; Orton *et al* 1997:118). Fracture patterns associated with this technique are argued by Rye (1981) to be difficult to observe as secondary smoothing processes act to destroy their presence. However, he also suggests that where present they will follow the tiered nature of production as each slab is laid offset against both preceding and following additions of clay — as larger pieces of clay are used join fractures may be expected to be fewer and further apart. This will create a pattern dissimilar to that of coiling or ring building. At Százhalombatta, Hungary it has been noted by Sofaer (personal communication) that distinctive slab fracture patterns are characteristic of some of the larger vessel groups such as urns.

A disproportionate number of join voids and cracks between joins may again, for the same reasons given above with regards to coiling and ring building, be taken to represent lack of skill. This technique requires the manipulation of larger pieces of malleable clay at one time and is associated with the production of larger vessels. It is argued as probable that slumping of the walls as more layers of clay are added (Cooper 2000: 13; Rice 1987: 227) and lack of symmetry may again be seen to be likely areas of skill variability. As with coiling and slab-building methods inexperience may also lead to excessive or erratic wall thickness and a pot of excessive weight for its volume.

4.5.2.4 Paddle and anvil

Pots produced by the paddle and anvil method will, like pinch pots, fail to exhibit join fractures as they are generally formed from a single lump of clay — where this technique is used as the originating forming method. In this case the process involves taking a single sphere of clay and using the anvil to slowly beat out the shape against a simple mould. The shape is then extended by using a paddle on the exterior and rhythmically beating it against an anvil held internally. This characteristically results in highly compacted and thin vessel walls and pots that are remarkably light with an often highly symmetrical appearance (Rice 1987: 137; Barley 1994: 32); such pots also have exceptionally desirable thermal conductivity (Sinopoli 1999: 122) making them exceptionally effective as cooking pots. Rye (1981: 85) and Rice (1987: 136) additionally note the characteristic signature of paddle and anvil use as being dimples on the interior surface and flattish facets left on the exterior by the beater. Where this technique is used to complete pots that have originated from coiled or pulled vessels (Rye 1981; Rice 1987) the same distinctive characteristics are noted. In this case coil and slab joins may be obliterated by the subsequent action of the paddle and anvil technique (Rice 1987).

A rhythmic variation in wall thickness relates to the flat surface of the paddle beating against the inner anvil; this beating of the clay causes distinct stresses and both Gibson & Woods (1997: 216) and Rye (1981: 85) note laminar sherd edge fractures as a technological signature related to this technique. Rye (1981) further notes that this stress can result in complete lens shaped pieces breaking away from the surface, meanwhile, broken cross sections will display a "very strong orientation [of particles] parallel to the surfaces and a characteristic laminar appearance" (Rye 1981: 85). Another phenomenon characteristic of this technique is the star-shaped cracks that may appear round large inclusions (or temper) where the beating breaks the clay away from the edges of the inclusions. These are likely to become exaggerated in the firing process and will weaken the exterior surface of the pot. Again, inexperience may also lead to excessive or erratic wall thickness and a pot of excessive weight for its volume.

4.5.2.5 Simple moulds

In the simplest versions of this method clay is pressed firmly into a simple former which may be either concave or convex. Such moulds may be a previously made pot (Orton *et al* 1997: 119, figure 10.1), a hollow scooped from the ground or be made of leather, basketry or plaster (Rice 1987: 125; Sinopoli 1991: 17; Barley 1994: 29; Orton *et al* 1997: 119). Such moulds are often implicated in production at a partial level as with the paddle and anvil technique and as Rye (1981: 82) shows also used in conjunction with thrown vessels. In terms of their technological signature moulded vessels will have a uniform appearance, especially on whichever surface has had direct contact with the mould and any flaws from the mould are carried over to the new vessel. By necessity simple forms are produced that have no undercuts thus allowing them to be successfully removed from the mould (see Rye 1981: 81, figure 65a). Additionally a parting agent is necessary to prevent the clay sticking to the mould (Leach 1945: 64) and this may be manifested as a layer of fine inclusions impressed into the surface (see Rye 1981: 81, figure 65c).

Moulding cuts out many problems associated with achieving uniformity and symmetry resulting in less chance of observing variability or error. In most cases where error does occur it will happen prior to firing, for example if clay is left on a convex mould for too long it will crack as it dries and the pot will not be completed. Uneven application of clay to the mould may result in uneven walls prone to break through mechanical stress. Meanwhile, inexpertly made joins where composite manufacture is in progress may produce the opportunity to observe skill variability.

4.5.2.6 Patching

Patching is not in itself a building technique. It is, however, an expedient way for potters to repair flaws that may occur during any of the processes just discussed. The potter applies a small pad of clay over weak areas of production. For example, patches may be used where the potter has introduced a thin patch on the wall of a pinch pot by pressing to hard with his or her fingertips. They may be used to ‘shore up’ a poorly affixed handle, especially on the upper join. Or, they may be used to conceal a poorly bonded coil or slab join. If patches are not expertly moulded into the fabric of the vessel, or the clay used does not have the correct degree of moisture, the patch will be obvious as an inexpert effort to repair a flaw.

4.5.3 Additions: feet, handles and lugs

Once the core body of the pot has been formed it may be that the intended outcome demands the addition of such things as lugs, feet and handles. Application of such additions requires both an acquired understanding of how to form the desired item and of when it is appropriate, within the drying stages of a pot, to join it to the body of the pot.

Handles are commonly accepted among contemporary potters as being a hard element of pottery manufacture to master (Cardew 1969: 112). There are numerous variations on the way in which a handle may be produced (Leach 1945: 88–89), however, of key significance is the need for the clay from which the handle is made to be of the same clay paste as the body of the pot and of the correct consistency. The pot to which it will be attached must also be at the correct stage of dryness. If the clay for the handle is too wet or the body of the pot to dry cracks will appear at the joined surfaces in the worst case scenario they will split apart as the pot dries, or is fired (Leach 1945). This is also true for added foot-rings, pedestal bases or lugs. Equally, if the clay for the handle is too wet it will be impossible for the handle to hold its given shape and it will droop and become disfigured. Conversely, if the clay is too dry or 'short', meaning it has lost its plasticity from being overworked, the arch of the handle will crack as it is formed. It is desirable for handles (unless purely decorative) to be of a size and form that allows the object to be held comfortably and safely thus facilitating use of the vessel. To this end they also need to be aligned vertically to the pot and not be off centre from top to bottom of the handle. Where handles are an integral part of the overall technological specifications of any class of pot they may be expected to adhere to certain intended design specifications. An example of this would be the elaborate handles found on Rákospalota jugs by the end of the Vatya period at Százhalombatta (see chapter 2, section 2.4.2, Figures 2.9 & 2.13).

Lugs, foot-rings or pedestal bases are also moulded from plastic clay and must again be added to the pot at the appropriate stage of production and follow the form appropriate to the intended outcome. With foot-rings or pedestal bases it is required that they do not adversely affect the vessels stability. It is generally preferable that such additions are made prior to smoothing or the execution of other surface treatments so that they do not hinder the processes of smoothing, burnishing, or decorating the pot and can be included in surface treatments thus ensuring further bonding and integration to the intended form. Also many of these techniques require the pot to be at a drier stage 'leather hard' whereas the clay should still be slightly tacky when additions are added.

4.5.4 Surface treatments and decoration

It is difficult to determine between surface treatments and decoration as distinctly different enterprises. Many treatments that are carried out provide both visual display and technological advantage (Braun 1983; Barley 1994; Haith 1997; Longacre *et al* 2000). Thus they are dealt with here as an integrated topic. Surface treatments and decoration are well documented as being an important element in pottery production (Rye 1981; Braun 1983; Rice 1987; Barley 1994; Longacre *et al* 2000). Although these finishes may not at first appear to impact on the final physical integrity of a pot, in the sense of it surviving a firing as an intact article, they are a key element of meeting an intended outcome. As such their successful execution is essential to the pots physical and visual performance. The primary surface treatments are variants on either smoothing or texturing the clay surface. Choices made may work to increase various properties deemed desirable to any particular vessel group.

Within the smoothing repertoire gradients are: smoothing, polishing and burnishing. These are all achieved by rubbing the clay surface at various points in its drying stages. Where straightforward smoothing is in operation the archaeologist might expect to see very fine striations, or a scratched surface, made by the use of organic material such as grass (Rice 1987; Haith 1997) or even finer marks made by the potter's fingers. Contrary to Rye's (1981: 90) description it is argued here that this grade of smoothing must be carried out while the clay is still slightly tacky and works to bond surfaces and even out blemishes from the forming process, a matt surface remains. Polishing, meanwhile, is carried out at a slightly drier stage, when the pot is leather hard. Tools may be the potters hand, or possibly wool, leather or bone. Again, manufacturing blemishes may be reduced but in this case a gently lustrous surface is created. Polishing is not included in this study as there has been no evidence of it observed during preliminary observation of the assemblages to be studied.

The most widely observed smoothing technique is that of burnishing. Burnished surfaces are achieved by rubbing a hard tool repeatedly against the now dry, or very nearly dry, surface of the pot leaving a highly lustrous surface. Tool marks are often visible as fine, concave striations that are observable as the pot is moved against the light. Tools may be pebbles, bone, horn, seeds or even bead necklaces (Rice 1987; David 1990; Barley 1994). Complex patterns can be created by rubbing against the surface in various directions and by omitting areas to remain untreated. As well as the stunning visual effects that burnishing is associated with (Cardew 1969: figures 12 & 13; Lunt 1988: 493) it also has technical advantages and disadvantages. Burnishing helps to reduce permeability, especially where additional post-firing finishing treatments such as fats being rubbed into the post fired surface are adopted (Barley 1994). It is disadvantageous, however, in that a high burnish is entirely inappropriate for use on cooking vessels where escaping steam cannot permeate through the wall of

the pot and thus spalling occurs (Skibo & Blinman 1999: 178–179).
In opposition to smoothing techniques are texturing techniques. Here the clay surface is deliberately roughened by brushing, striating, combing or impressing the surface with organic matter, the fingers or a tool. These techniques are commonly associated with utilitarian pots where texturing allows for a firmer grip to be taken on the pot as it is used and helps to enhance heat transfer for cooking vessels (Rice 1987: 138). The correct application of these techniques may, therefore, bear directly upon meeting the intended outcome of producing a satisfactory workaday vessel. In each case a certain effect is intended and failure to create that effect may be seen as skill variability. All of these techniques must be carried out before the pot reaches the leather hard stage. In the case of striating, generally known in Hungary as rustication, coarse grasses or straw are randomly brushed across the pots surface with the intention of leaving significant but random striations embedded in the pots surface. This process must necessarily take place while the clay is still tacky (Rice 1987: 140).

Alternatively a self-slip, that is a slip made from the same clay body as the pot, may be applied to leather hard – but not bone dry – clay and then have the selected texturing effect applied. This kind of slip should not be confused with decorative, coloured slips, slips for casting, or engobe slips for glazing (Leach 1945: 43–59). Other techniques, such as striating, combing and the use of roulettes may be carried out when the vessel is a little drier but if clay dries too much and hardens their application becomes increasingly difficult. Striating, combing and the use of roulettes are more likely to combine a decorative order with pragmatic concern and thus there may be the possibility of identifying a preference for the tool type used. Combs, for example, may be used to create a random pattern but may also be expected to have a specific number of teeth, spaced in a certain way thus creating a constantly repeated effect integral to the overall design.

Of a slightly more complex nature are the techniques that come closer to the spectrum of decoration: these may include incised, impressed, carved or applied plastic decoration (Rye 1981: 90). Applied plastic decoration can be in the form of applied cordons, bosses or moulded decoration. Glazed and painted decoration is not discussed as their presence is not applicable to this study. As before part of the successful execution of these effects is determined by carrying them out at the correct phase of the pots drying stages. Each technique has characteristic technological signatures related to how it is implemented. Incised decoration may, for example, be made into tacky plastic clay, leather hard clay or even very dry clay. But incision into very dry clay is hard to achieve with good results. Each choice will leave distinctly different technological signatures (Rye 1981: 67). As well as this technological variable an infinite range of designs, of varying degrees of complexity, may be executed. In any given social setting a repertoire of chosen usage is generally understood to be usual (Arnold 1988). All surface treatments are seen to involve choice and skilled execution as part of the overall ability to produce an intended outcome. While a reasonable degree of deviation from the norm may be expected exaggerated difference from the selected repertoire may negatively impact both on the pragmatic performance of a vessel and any intended visual role. For example, inadequate rustication may lead to reduced heat exchange properties and reduced safety in handling the pot during use while poor burnishing may reduce the visual performance of a pot implicated in maintaining ideas of status.

4.5.5 Vessel form

It has been stated previously that potters make conscious choices when engaging in the production of pots and that these choices are deeply enmeshed within an understood cultural and social frameworks. The form that pots take is not arbitrary but connected to both pragmatic and social understandings: "Pottery shape is influenced by a large number of factors. The decision made by the potter, the tools and materials available and his [*sic*] skill (or otherwise) in manipulating them all contribute to the final product" (Orton *et al* 1997: 152).

At a pragmatic level it may be that one form is preferential to another in order for an intended function to be adequately catered for (Skibo 1992). For example, vessel form affects resistance to thermal shock. Pots with sharp angles and changes of direction are noted as being both harder to fire successfully and less able to withstand the constant thermal stresses associated with cooking (Rye 1981). Conversely, cooking pots are generally considered to perform better where they are round bottomed with simple body contours (Rye 1981; Braun 1983; Rice 1987; Skibo & Schiffer 1995). However, within this broad definition considerable variation will result from the specific ideas and needs of the community producing such pots (Rice 1987: 239). Quite naturally a pot with a small orifice will be preferential where storage of liquids is concerned such as those produced by the Hausa of Northern Nigeria (Cardew 1969: 92). The small orifice is essential to prevent spillage and to allow stoppers to be used for long distance transportation (such as the use of amphorae). However, a small orifice will hamper access for dry storage. An open orifice or completely open shape will, meanwhile, be better suited to the serving, consumption and display of food. A low centre of gravity will act as an aid to pouring and provide stability for jugs and cups; this is an equally desirable characteristic for dry storage vessels and cooking pots. Rice (1987: 238, table 7.2) gives a useful précis of some of the likely forms associated with utilitarian concerns.

It may be preferable for a cooking pot to have certain physiological characteristics that will allow it to survive repeated episodes of heating but it may still have "morphological characteristics unique to a certain group of households or region and therefore symbolise group membership" (Skibo 1992: 34). This dualism is an accepted phenomenon. Although determined by certain pragmatic concerns it is also accepted that form is influenced by cultural and social understandings (Miller 1985). Such understandings are dynamic, thus changes in social circumstances may result in changing ideas and a requirement to innovate resulting in new or adapted forms. This is demonstrated in Braun's (1983) Neolithic Woodlands example. Equally circumstances may demand stasis. Change, meanwhile, need not necessarily manifest itself in a rapid or dramatic way. At Százhalombatta the final exaggerated elaboration of forms that originate in the Vatya I period does not occur until *c.* 200 years later in the Koszider period (see Figures 2.8 & 2.9 chapter 2).

As noted in chapter 3 the significant and well documented relationship of form to particular cultural dimensions, both temporally and geographically, has indeed been one of the foundation stones of ceramic archaeology and the basis for defining typologies and relative chronologies (Gibson & Woods 1997: 7). Despite the various arguments surrounding which paradigms are appropriate to adopt in the use of form as an analytical tool (Arnold 1988; Orton *et al* 1997; Fuchs 2001: 15) there is no doubt that adherence to the production of specific intended forms at particular times and in particular places is undeniable. These categories have been argued to be the product of culturally and socially determined variability and are both the cause and outcome of repeated processes of production — repeated practise. Being able to produce the appropriate form is seen then as being socially as well as technically important, and as being essential to the potter's vested interest of meeting a certain set of intended criteria (Longacre *et al.* 2000).

Significant deviation from the normal parameters of a proposed form, associated with a particular class of pottery, may be considered as variability in skill investment. Severe compromise in producing the proposed vessel form will ultimately adversely affect the rim and profile symmetry. This not only affects the visual characteristics of the vessel but may also compromise its technological integrity and longevity. Leach (1976: 33) argues that "Every part of a good pot should be in perfect relationship to every other part. Is it so very different from the poise of a dancer's foot on which the stance of the body depends?" Indeed, Leach's statement has much truth in it as severe asymmetry of form will render a vessel unstable and unwieldy certainly making it a poor tool in a secular sense and possibly a poor tool with regard to any sacred use that appeals to a visual performance criteria. Critically, any deviation introduced into the vessel form early on becomes increasingly exaggerated as production proceeds (Caiger-Smith 1995). Larger forms will be more inclined to such manufacturing problems (Rice 1987; Caiger-Smith 1995). The larger the vessel the more exaggerated and noticeable the skill variability, the inability of the potter to execute the forming process, becomes. Therefore, lack of skill in producing the vessel form will also be reflected in the symmetry of the circumference and deviation of the rim on the horizontal plane.

4.5.6 Wall-thickness

Vessel wall thickness is again not an arbitrary event. Put most simply "The thickness of vessel walls is related to the size of the container and its intended use" (Rice 1987: 227). However, certain requirements are met by varying wall thickness. Braun (1983: 118) suggests three aspects of mechanical performance that are affected by "wall-sectional shape". They are thermal conductivity, resistance to thermal shock and flexural strength (breakage load). The first two of these are important in relation to vessels intended for cooking purposes where it is preferable to have thin walled vessels. Many pots made using the paddle and anvil method produce excellent thin walled vessels used for cooking (Marshall 1985; Skibo & Schiffer 1995). Skibo & Schiffer also highlight the technical skill required to produce such pots. Meanwhile, flexural strength is a measurement of a pots ability to withstand the daily stresses involved in its use without distorting or breaking prematurely. This is accommodated by a thicker walled vessel. Another aspect that requires attention is the wet strength of clay. Rice (1987:227) and Caiger-Smith (1995: 109–110) both note the problems associated with producing large pots. During the construction of large pots the walls must serve as a structural support and be strong enough to support increasing additions of clay or the pot will distort and / or slump during production. Thus large vessels may be expected to have thicker walls for structural support. Wall thickness may be moderated or adjusted by the way in which a pot is tempered thus these broadly accepted understandings gain another complex dimension. An essential element of wall thickness is that of consistency. Where wall thickness shows gross variation throughout the pot it can be accepted that significant weakness will be present (Rye 1981). Additionally potters must consider both the intended appearance and function of the vessel (Rice 1987: 227). It may be necessary for rims to be thickened to avoid undue breakage in use, for certain areas to be modified in order to accept the weight bearing stress of having handles added, or for cordons to be added either to give extra flexural strength and / or for visual embellishment. Correct vessel wall thickness is reliant on skilled manufacture and on appropriate choices being made.

4.5.7 Drying

In preparation for firing finished pots must be dried to remove as much water content as possible. This exact nature of this task will be dependent on a number of variables; climate, tradition, size of and type of pots, "Potters become aware of the appropriate drying rates for the materials they use and employ this knowledge in conjunction with observation of microclimate to minimize damage" (Rye 1981: 24). Gaimster & Freestone (1997: 14) suggest that typically days or even weeks are required for pots to dry sufficiently to allow firing to proceed. Caiger-Smith (1995), in reference to large coil pots, states that if they are inadequately, or inappropriately, dried prior to firing they will warp, crack or blow up. "It is no accident that the best coil pots come from warm, dry climates in which the clay stiffens rapidly as the form expands making it easier to control i.e. the Neolithic funery jars from Kansu in northwest China" (Caiger-Smith 1995: 110). Although drying pots correctly is a key stage in the constitutive elements of production error at this stage will be indistinguishable from that of firing error — with the possible exception of warping which may occur if pots are dried too quickly or with uneven access to the heat source, for example, one side is in searing heat and the other in shade. It is unlikely that incorrectly dried pots will make it to the firing stage as warping will cause fractures during the drying process.

4.5.8 Firing

It is only once clay is fired to a temperature that allows the destruction of clay-mineral crystals that its composition as ceramic is irreversible. The temperature required to achieve this varies between different clay types but the firing range is generally between 500° and 800° (Rye 1981: 96). Firing is also necessary to drive of the remaining (chemical) water bound within the clay fabric. The early stage of firing pots is fraught with difficulty. If water evaporates too quickly through too rapid a rise in temperature explosions, known as spalling, will occur (Rye 1981: 131) and hairline fractures may occur (Rice 1987: 87). Peterson (1974: 72) talks of the long slow firing of bisque ware at Hamada's workshop in order to drive of chemical water and avoid breakage caused by thermal shock. Meanwhile Barley (1997:143) notes the high failure rate of bonfire fired pots in rural West Africa because of severely fluctuating ambient air temperatures.

Control of the final firing temperature is also vital. Firing temperature has a direct impact on the nature of a pots finished strength. High firing temperatures will bring resistance to impact breakage while low temperatures provide better thermal shock properties (Skibo & Schiffer 1995:82) thus a technological choice may come into play depending on the type of vessel being produced. Beyond the manipulation of temperature to gain an intended outcome there are even greater concerns. If the firing temperature rises above suitable parameters for any given clay type over-vitrification will occur. In this case pots are more friable and brittle than would be desired and may even distort. The worse case scenario in this instance is the complete collapse of the pot within the fire setting (Rye 1981: 112; Rice 1987: 94; Gibson & Woods 1997: 273). Over-vitrified pottery is recognisable by its glassy, brittle texture and the likely presence of bloating (expanded, irregular air pockets possibly initiated by poor clay preparation) within the vessels walls (Rye 1981: 109). Low firing temperatures are also problematic in that the clay will fail to convert properly into ceramic and through time and use will simply slake or dissolve back into something close to its original state (Rye 1981: 111). Very low, under-fired fired, pottery is characterised by its soft, powdery and crumbly texture. Pots that are under fired will be prone to early damage and breakage. Abrasion of surface finishes is likely to occur and they are, in general, unlikely to perform well in functional terms. Meanwhile, Peterson (1974: 173) and Rye (1981: 109) both stress that a successful firing is also dependent on an understanding of heat-work and cooling of the kiln. This is of especial note given that all pots in prehistoric societies were fired by 'eye' and 'colour'. Leach (1945: 260) demonstrates the complexity of this with his table of comparisons between firing colour and Seiger cones which are designed to melt across a range of temperatures. Firing by colour is in itself a skill which requires constant attention of the people involved and knowledge of the fine difference in colour that will result in major differences in firing outcomes (Leach 1945; Fournier 1973)

Firing temperature alone is not always enough to secure a finished product. Rice (1987: 80) correctly notes that it is the combination of temperature, firing duration and kiln atmosphere (oxidised or non-oxidised) that determines the final outcome.
For clay to become successfully fired it is generally understood that temperature on its own is inadequate. It is a combination of temperature and the length of time that the heat has to 'soak' into the clay fabric that facilitates the successful firing of pottery. This is called heat-work. It is important that heat-work within a kiln is as even as possible (Fournier 1973: 113). Meanwhile unregulated cooling may well result in fine hairline cracks in pots that will manifest themselves through use or complete breakage of a pot where thermal shock has been too great for the vessel to withstand. Moreover, cooling is as significant in determining the 'finished character of the ware' (Fournier 1973) as is the firing.

This outcome is further dependent on the acquisition of fuel and the skilled manipulation of that fuel, as a firing episode to successfully complete the intended task. Many studies have shown that both the selection of fuel and firing process, as other forms of technique, are deeply embedded within social understandings (David 1990; Barley 1994; Pool 2000; Sillar 2000; Budden 2002). Barley (1994: 44) describes firing choices as being related to "maps of knowledge" and draws attention to the refusal of the Dowayo potters of North Cameroon to adopt a semi-kiln method because their traditional firing techniques work to maintain an ideological parallel between firing and the open threshing floor where millet is processed. Meanwhile Pool (2000: 61) stresses that, "The benefits of one ceramic firing technology over another are not absolute, but depend upon the interaction of multiple environmental, economic and social factors, as well as the specific design of firing facilities". Where firing circumstances are bound by cultural understanding fuel must be manipulated in such a way as to ensure the intended outcome is met, for example, to ensure the production of black pots by creating a 'reducing' atmosphere (David 1990; Longacre *et al* 2000; Budden 2002) or conversely by producing red wares by ensuring a rush of oxygen through the fire setting (Nicholson & Wendrich 1994). The deliberate manipulation of firing episodes to attain certain appearances is attested to in the archaeological record at Százhalombatta. There is a range of various outcomes (firing characteristics) at particular phases of the sites history. For example, the firing of Nagyrév pots results in a quite different appearance to that prevalent at the final Koszider phase of the Vatya where the fine Rákospalota vessels are regularly reduction fired and consistently black (Budden 2002: 64).

The selection of fuel may not always be as simple as finding any available combustible material. Rather it may be seen as a complex business tied to physical properties of fuel and the pragmatic desired outcome (Rice 1987) or deeply embedded ideological concerns. Caiger-Smith (1995: 24, 27, 28) discusses the need for careful collection and curation of wood for firing and citing Cipriano Piccolpasso, a 16th century potter and author of *The three Books of the Potters Art*, notes that clean, light fuels such as willow and poplar are best for the production of maiolica and earthenware. Meanwhile, Barley (1994: 66) notes that "the firing of pots must be carefully controlled in time and space to avoid supernatural sanctions such as the disturbance of the rain or the destruction of the pots". Sillar (2000: 44) meanwhile draws attention to the complex nature of dung as fuel and the social as well as pragmatic factors influencing its selection as a fuel resource for pottery production in the Andean Highlands. Experiments in Hungary (Budden 2002: 62) have demonstrated that the inappropriate selection of fuel can have a disastrous effect on the desired outcome: in this case with sticky accretions from sap being deposited on the interior surfaces of the pots rendering them unusable.

At Hamada's workshop the curation of fuel for the five chamber kiln was a serious matter. Wood was cut from specific pine trees from December to January when the least sap was circulating within the wood and before new green wood was forming; trees of 40 years old were considered as best. These are then stored for two years to cure the wood; any longer will make it too dry for the firing purposes (Peterson 1974: 167). For traditional (and prehistoric) potters working without pyrometric aids a further consideration is the ability of potters to read the kiln temperature by colour alone, "To be able to gauge the temperature of a fire by eye in increments of ten or twenty degrees is an unbelievable skill that can only come from very long experience in burning kilns in this traditional way" (Peterson 1974: 168). This is a surprisingly accurate way of gauging kiln temperature and was used at the author's pottery studio for many years.

With regards to firing processes unacceptable variability is considered most likely to manifest itself in the following ways: as spalling, bloating, distortion and a hard glassy texture — impossible to scratch with anything other than metal associated with over-firing. Or vessels may be crumbly, have a soft 'cheesecake' texture and be easily scratched with just a fingernail, additionally the clay may have begun to slake apart during deposition — these are under-fired vessels. These descriptions fit broadly with Peacock's (1977) adaptation of Mohs scale of hardness. A fingernail equalling Mohs (2 or 2.5) and a steel blade equalling Mohs (6) (see Orton *et al* 1997: 138) and are applied as the rationale for designating pots into either over-fired (high), normally fired (normal), or under-fired (soft).

4.6 The sampling strategy

The first decision rests on the quantity and quality of available material and the nature of this investigation. The very large size of the assemblages, Százhalombatta, Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő to be examined makes a sampling strategy necessary. Enough pottery is available that there is no requirement to examine every available sherd for any given class of pottery. Moreover given the nature of the data required it is desirable to only examine diagnostic sherds, partial profiles, whole profiles and whole pots within each selected class of pottery. These offer the greatest opportunity to observe the technological signatures of production. A précis of the technological signatures to be explored is offered below in Table 4.1.

The sampling strategy is further determined by the need to represent a range of technical complexity. Bearing in mind the preceding discussion of skill the sample will consist of a selected range of vessel groups that have varied degrees of technical complexity attached to their manufacture (Table 4.2). The groups to be selected are; cups, domestic vessels, urns and fineware. It may be, for example, that a greater degree of error will be found to be present on simpler vessels that require less skilled manufacture while complex vessels remain in the preserve of skilled artisans. For example, the ubiquitous, small drinking cups, temporally present across the whole assemblage are seen to represent the simplest and therefore least skilled forms to produce. Meanwhile, the highly burnished, handled, Nagyrév 'pedestal' pots and the complex tripartite Vatya and Rákospalota jugs, with their highly exaggerated forms and additional embellishments are argued as far more complex to produce. Urns, again temporally present across the entire assemblage, with their significantly large proportions (and increasingly exaggerated forms through time) are also seen to be representative of highly complicated and technically challenging pots to produce. Finally the domestic vessels are generally less exaggerated forms and of a moderate size. These are seen to fall between the cups and the exotic household items, and urns in terms of complexity. Thus the sample will include these classes of pots. In this way a complete range of technical complexity and, therefore, technical competence or skill will be represented.

Table 4. 1 Possibilities for examination of skill variability within twelve key technological variables.

Technological signatures	**Précis of some possibilities for observations determining skill variabilty**
Clay preparation	Possible variability may include: no error, air pockets are in the clay matrix, surface voids or inclusions are unintentionally breaking the finsihed surface of the pot, deliberate inclusions have been poorly mixed through the clay matrix
Manufacturing	The degree to which the selected maunfacturing method (pinching, coiling, slab building) has been successfully executed. Possible variabilty may include: splitting at the rim, slumping, uneven finger indentations, poor coil / slab joins, coil/slab join fractures, additional clay patches, fracturing of the clay surface, excessive weight.
Wall thickness	The possibilities are: no error or varying degrees of innapropriate fluctuation in wall thickness.
Additions	The degree to which handles, foot-rings or lugs have been applied in a manner that meets the proposed outcome. Possible variability may include: appendages incorrectly aligned, poorly formed, not strong enough for the intended purpose, or joining errors.
Interior surface treatment	Possible variabilty is refelected in the degree to which, wiping, smoothing, rustication or burnishing has been executed so as to meet the proposed outcome.
Exterior surface treatment	Possible variabilty is refelected in the degree to which, wiping, smoothing, rustication or burnishing has been executed so as to meet the proposed outcome.
Decoration	Possible variabilty is refelected in the degree to which the decorative technique has been executed so as to meet the proposed outcome.
Rim deviation on the horizontal plane	Possible variabilty is refelected in the degree to which the rim circumfrence is level on the horizontal plane
Rim symmetry	Possible variabilty is refelected in the degree to which the rim symmetry in maintained so as to reflect the proposed outcome. (Clearly not all vessels are intended to be round).
Handle symmetry	Possible variabilty is refelected in the degree to which the handle symmetry in maintained so as to reflect the proposed outcome. Handles may be required to be aligned vertically or horizontally and in relation to 'partner' handles.
Profile symmetry	Possible variabilty is refelected in the degree to which profile symmetry in maintained so as to reflect the proposed outcome.
Firing	Possible variability is reflected in the degree to which vessels have met the desired firing outcome. Potential variables are under or over firng, or normal firing.

Table 4.2 Précis of vessel complexity for vessel groups used in this study

Vessel type	*Characteristics*	*Degree of technical complexity*
Cups	small, ubiquitous vessels the majority of which are simple shapes	easiest
Domestic vessels	generally moderate in size with comparatively neutral shapes	intermediate
Urns	often large with complex profiles additions and embellishments	very technically demanding - as complex as fineware and owing to size may in some instances require a greater degree of skill than fineware
Fineware	tripartite forms with highly exaggerated morphology, complex handles and exaggerated embellishments - fine wall thickness	very technically demanding

Comparative material will be selected from the settlement assemblages, Százhalombatta and Dunaújváros-Kosziderpadlás, and the cemetery assemblage Dunaújváros-Duna-dűlő. The settlement and cemetery assemblages will be subjected to comparison and contrast to establish whether learning strategies are represented differently in these two contrasting social contexts through time. It may be, for example, that learning lies more clearly in the domain of daily activity and that only specialist potters can work on pots associated with the dead.

The sample will also endeavour to select enough pots from each temporal phase so that any changes to learning strategies that may be played out across the time span studied can be observed. There may be problems with this endeavour as the greater numbers of available pots are recovered during the Vatya phase (central to the time span studied – see chapter 2, Table 2.1) than at the Nagyrév phase of the site (Poroszlai 2000: 24). This reflects the notable increase in pottery production throughout time and particularly at the height of Vatya occupation (Vicze 2001; Bona 1992c) and is not a reflection of poor recovery technique.

Finally, in order to safeguard the quality of data collected a system of repeatability was set up. This entailed a system of backtracking on a daily basis to repeat the inspection of earlier data to ensure that observations were made to the same standard. The records returned to were always selected on a random basis with no pre-determined knowledge so that bias was further avoided.

Chapter Five

Data Results

5.1 Introduction

Primary data was collected from 3 sites in Hungary. Two of these are settlement sites, Százhalombatta and Dunaújváros-Kosziderpadlás, and one is a cemetery, Dunaújváros-Duna-dűlő. The cemetery site is the burial ground of the Dunaújváros-Kosziderpadlás community. A total of 717 vessels have been examined (Table 5.1).

Table 5.1 Primary data, total numbers of vessels examined

Site name	Site type	Cups	Dom-estic	Fine-ware	Urns	Total
Százhalombatta	**settlement**	140	55	97	63	355
Dunaújváros-Duna-dűlő	**cemetery** (belonging to Dunaújváros-Kosziderpadlás)	48	42	54	56	200
Dunaújváros-Kosziderpadlás	**settlement**	52	42	38	30	162

Four vessel groups were selected based on the comparative degrees of technological complexity that they represent; the rationale for this is situated in the methodology (chapter 4) and précised in Table 4.2. Cups form the first group and are seen to represent the least complex unit of production. Domestic wares form the second group. This group comprises large domestic bowls, storage / cooking vessels, fish-dishes and strainers. These vessels have been argued to be technically more complex to produce than cups but easier than the final two groups. Fineware bowls and jugs form the third group and are technically complex owing to their highly exaggerated forms, fine wall thickness, and the technical exactness that may be argued as necessary for these pots to perform in a visual as well as a pragmatic sense. Urns form the final group and are seen as being always at least as technically complex as the fine-ware group but in many instances of greater technical complexity. This is justified on the grounds that they are often not only of a far greater size, which places demands of skill upon the potter, but also of equally exaggerated forms as the fine-wares. Data is also presented for all vessels grouped together as All Vessels to allow overall comparisons to be made between the three sites.

Twelve technological variables were analysed. These are: clay preparation; manufacturing (the body of the pot); wall thickness; additions (handles, foot-rings and lugs); interior and exterior surface treatments; decoration; rim deviation on the horizontal plane; rim symmetry; handle symmetry; profile symmetry and firing These variables were graded, based on the degree of technological competence and placed in 'good', 'moderate' or 'poor' skill categories. The discussion surrounding this procedure is based within the methodology, chapter 4, and précised in Table 4.1. Analysis of the technological variables is presented firstly as an observation of differences between the three assemblages and then as differences within each assemblage with regard to each vessel group. The data is presented descriptively with stacked bar charts illustrating percentage frequencies and tables showing number frequencies. The data was also analysed using the Chi square test ($p \leq 0.05$) to explore differences between the three sites and the four vessel groups within each site. Chi square results are presented within the text in brackets or at the end of each section in table format. Contingency tables are located in Appendix 3.

In addition to analysis of the technological variables a fabric series has been created and the relationship between the fabric groups, textural types of fabrics, the three study sites, and the vessel groups have been analysed.

5.2 The technological variables; differences between the three assemblages

The results presented here reflect differences for each technological variable and vessel group between each of the three assemblages studied. Percentage frequencies represent numbers of sample sherds and do not include samples that were not applicable for a given variable. This has been done in order to visually show variability between technological signatures for each assemblage. Numeric data is included beneath each chart to show the robustness of the data. Results of chi square tests are précised at the end of this section in tables 2a, 2b, 2c and 2d.

5.2.1 Clay preparation

5.2.1.1 *Cups* (Figure 5.1)

At Százhalombatta 48% of cups fall in the 'good' category, 34% in the 'moderate' category and 18% in the 'poor' category. At Dunaújváros-Kosziderpadlás 44% of cups are in the 'good' category, 37% in the 'moderate' and 19% in the 'poor' category. These differences are not significant ($\chi^2 = 0.212$; $p \leq 0.889$). At Dunaújváros-Duna-dűlő, the cemetery, 29% of cups are in the 'good' category, 50% in the 'moderate' category and 21% in the 'poor' category. The results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 5.648$; $p \leq 0.059$), but the result borders on significant. The difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás is not significant ($\chi^2 = 2.634$; $p \leq 0.268$). The results indicate that there is no significant difference in the investment of skill for clay preparation for cups between any of the assemblages. Within all three assemblages percentage frequencies in the 'good' category are low.

5.2.1.2 *Domestic vessels* (Figure 5.1)

At Százhalombatta 65.5% of domestic vessels are in the 'good' category, 25.5% in the 'moderate' category and 9% in the 'poor' category. At Dunaújváros-Kosziderpadlás 50% are in the 'good' category, 26% in the 'moderate' category and 24% in the 'poor' category. This is not significant ($\chi^2 = 4.307$; $p \leq 0.116$). Dunaújváros-Duna-dűlő, the cemetery, has 17% of domestic vessels in the 'good' category, 43% in the 'moderate' category and 40% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 27.074$; $p \leq 0.000$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás ($\chi^2 = 10.868$; $p \leq 0.004$). The results indicate a strong tendency for a high investment of skill for clay preparation within both the settlement assemblages but a very low investment of skill within the cemetery assemblage.

5.2.1.3 *Fineware* (Figure 5.1)

Százhalombatta has 85% of fineware vessels in the 'good' category, 12% in the 'moderate' category and 3% in the 'poor' category. At Dunaújváros-Kosziderpadlás 79% of fineware are in the 'good' category, 13% in the 'moderate' category and 8% in the 'poor' category. There differences are not significant ($\chi^2 = 1.533$; $p \leq 0.465$*). At

Dunaújváros-Duna-dűlő 20% of fineware vessels are in the 'good' category, 58% in the 'moderate' category and 22% in the 'poor' category. These values indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 56.648$; $p \leq 0.000$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás ($\chi^2 = 30.928$; $p \leq 0.000$). The results indicate a strong tendency for a high investment of skill for clay preparation within both the settlement assemblages but a very low investment of skill within the cemetery assemblage.

5.2.1.4 *Urns* (Figure 5.1)

At Százhalombatta 75% of urns fall in the 'good' category, 17% in the 'moderate' category and 8% in the 'poor' category. At Dunaújváros-Kosziderpadlás 53.3% of urns are in the 'good' category, 33.3% in the 'moderate' category and 13.3% in the 'poor' category. These differences are not significant ($\chi^2 = 4.236$; $p \leq 0.120$*). At Dunaújváros-Duna-dűlő 26% of urns are in the 'good' category, 54% in the 'moderate' category and 20% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 28.386$; $p \leq 0.000$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás ($\chi^2 = 5.909$; $p \leq 0.052$), however, the result for Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás is close to the level of significance. This combination of results indicates that there is no significant difference in the investment of skill between the two settlement sites. However, the fact that there is a significant difference between Százhalombatta and Dunaújváros-Duna-dűlő but not between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő ($\chi^2 = 5.909$; $p \leq 0.052$) indicates that a marginally lower investment of skill at Dunaújváros-Kosziderpadlás compared with Százhalombatta. The lowest investment of skill for clay preparation for urns is at Dunaújváros-Duna-dűlő.

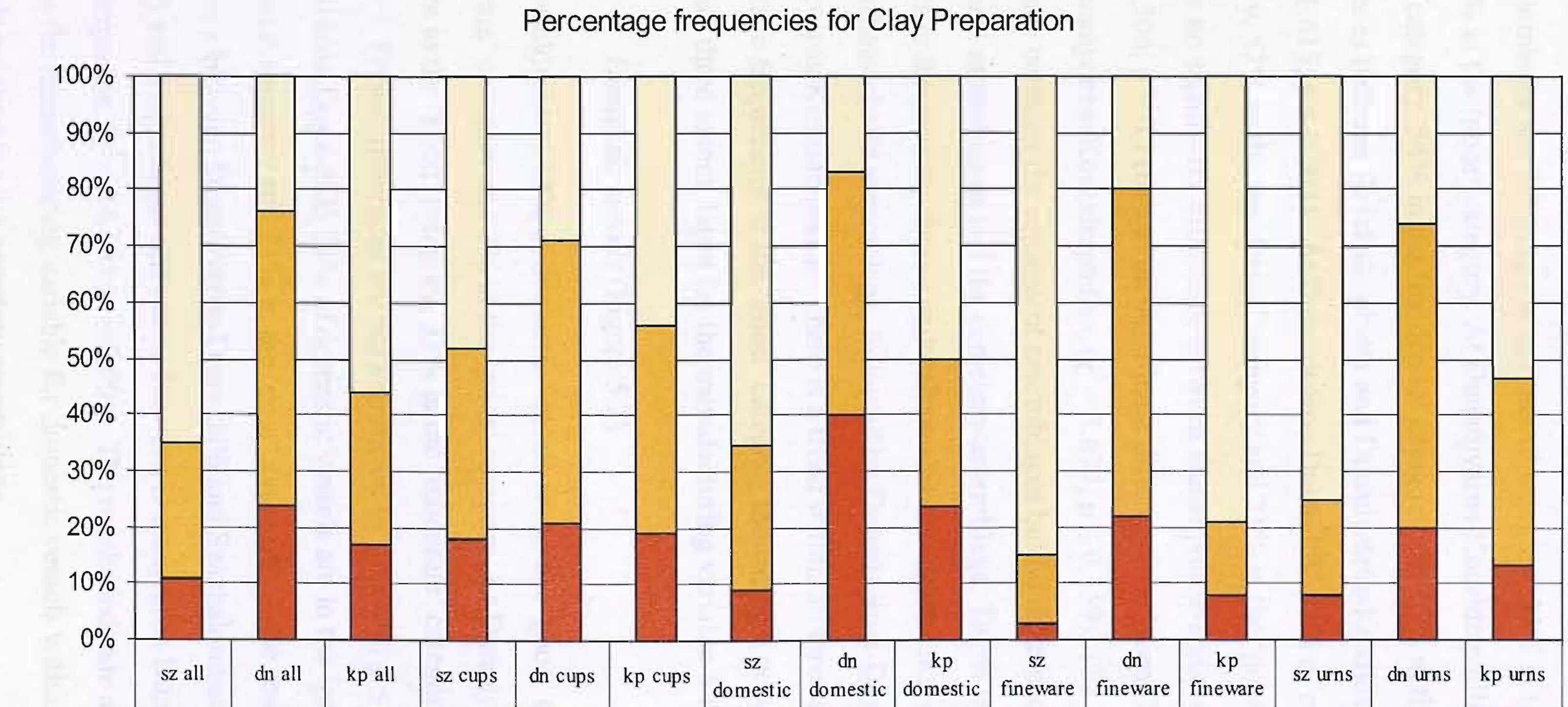
5.2.1.5 *All vessels* (Figure 5.1)

Százhalombatta has 65% of all vessels falling into the 'good' category, 24% in the 'moderate' category and 11% in the 'poor' category. At Dunaújváros-Kosziderpadlás 56% of all vessels are in the 'good' category, 27% in the 'moderate' category and 17% in the 'poor' category. These differences are not significant (χ^2 5.176; $p \leq 0.075$). At Dunaújváros-Duna-dűlő 24% of all vessels are in the 'good' category, 52% in the 'moderate' category and 24% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 90.805$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 37.588$; $p \leq 0.000$). The results indicate that the settlement sites share a very similar investment of skill but that the cemetery is subject to a lower investment of skill for clay preparation for all vessels.

5.2.1.5 Clay preparation, Summary

With regard to cups there is no difference in the investment of skill for clay preparation between any of the three assemblages. For domestic vessels there is higher investment of skill within the settlements compared to the cemetery. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns the differences are more complex with the results indicating the highest investment of skill in the Százhalombatta assemblage, followed by a very slightly lower investment of skill in the Dunaújváros-Kosziderpadlás assemblage and the lowest investment of skill in the Dunaújváros-Duna-dűlő assemblage. This result is accounted for by there being a significant difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference, as a borderline result ($\chi^2 = 5.909$; $p \leq 0.052$), between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. The settlements share a slightly differing but higher investment of skill than the cemetery (Tables 5.2a, 5.2b, 5.2c, 5.2d). For all vessels group the results indicate that the settlement sites share a very similar investment of skill but that the cemetery is subject to a lower investment of skill.

Figure 5.1. Percentage and Numeric frequency for Clay Preparation at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
□ good	65%	24%	56%	48%	29%	44%	65.5%	17%	50%	85%	20%	79%	75%	26%	53.3%
□ moderate	24%	52%	27%	34%	50%	37%	25.5%	43%	26%	12%	58%	13%	17%	54%	33.3%
■ poor	11.0%	24%	17%	18%	21%	19%	9%	40%	24%	3%	22%	8%	8%	20%	13.3%

Numeric frequencies for Clay Preparation

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	232	49	90	67	14	23	36	7	21	82	11	30	47	15	16
moderate	84	103	45	47	24	19	14	18	11	12	31	5	11	30	10
poor	39	48	27	26	10	10	5	17	10	3	12	3	5	11	4

5.2.2 Manufacturing

5.2.2.1 *Cups* (Figure 5.2)

Százhalombatta has 37% cups in the 'good' category, 35% in the 'moderate' category and 28% in the 'poor' category. At Dunaújváros-Kosziderpadlás 33% of cups are in the 'good' category, 54% in the 'moderate' category and 13% in the 'poor' category. The differences between Százhalombatta and Dunaújváros-Kosziderpadlás are significant ($\chi^2 = 11.615$; $p \leq 0.003$). At Dunaújváros-Duna-dűlő 27% of cups are in the 'good' category, 52% in the 'moderate' category and 21% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 4.306$; $p \leq 0.116$) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 3.674$; $p \leq 0.159$). The results show a significant difference between the settlement assemblages but no differences between either of the settlement assemblages and the cemetery assemblage. Taken in combination with the percentage frequencies these results show that the highest investment of skill is within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás. There is a trend within all three assemblages for low percentage frequencies in the 'good' category indicating a poor investment of skill across all three assemblages for the manufacturing variable for cups.

5.2.2.2 *Domestic vessels* (Figure 5.2)

At Százhalombatta 62% of domestic vessels are in the 'good' category, 36% in the 'moderate' category and 2% in the 'poor' category. At Dunaújváros-Kosziderpadlás 62% are in the 'good' category, 33% in the 'moderate' category and 5% in the 'poor' category. These differences are not significant ($\chi^2 = 0.730$; $p \leq 0.694$*). At Dunaújváros-Duna-dűlő 24% of domestic vessels are in the 'good' category, 55% in the 'moderate' category and 21% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 19.656$; $p \leq 0.000$*) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 14.395$; $p \leq 0.001$). The results indicate a higher investment of skill for the manufacturing variable for domestic vessels within both settlement assemblages than for the cemetery assemblage.

5.2.2.3 *Fineware* (Figure 5.2)

At Százhalombatta 68% of fineware vessels are in the 'good' category, 29% in the 'moderate' category and 3% in the 'poor' category. At Dunaújváros-Kosziderpadlás 76% are in the 'good' category, 19% in the 'moderate' category and 5% in the 'poor' category. These differences are not significant ($\chi^2 = 1.762$; $p \leq 0.414$*). At Dunaújváros-Duna-dűlő 22% of fineware vessels are in the 'good' category, 45% in the 'moderate' category and 33% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 39.353$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszideрpadlás, ($\chi^2 = 29.049$; $p \leq 0.000$). The results indicate a high investment within the settlement assemblages and a low investment of skill within the cemetery assemblage for the manufacturing variable for fineware vessels.

5.2.2.4 *Urns* (Figure 5.2)

At Százhalombatta 75% of urns are in the 'good' category, 22% in the 'moderate' category and 3% in the 'poor' category. At Dunaújváros-Kosziderpadlás 67% are in the 'good' category, 33% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 2.102$; $p \leq 0.350$*). At Dunaújváros-Duna-dűlő 50% of urns are in the 'good' category, 39% in the 'moderate' category and 11% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 8.208$; $p \leq 0.017$*) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.373$; $p \leq 0.112$*). The results show no significant difference between the settlement assemblages. The difference observed between Dunaújváros-Duna-dűlő and Százhalombatta indicate a higher investment of skill at Százhalombatta. The fact that there is no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás taken in combination with the percentage frequencies reveals a marginally higher investment of skill at Százhalombatta compared to Dunaújváros-Kosziderpadlás. Meanwhile the lowest investment of skill for the manufacturing variable for urns lies within the cemetery assemblage.

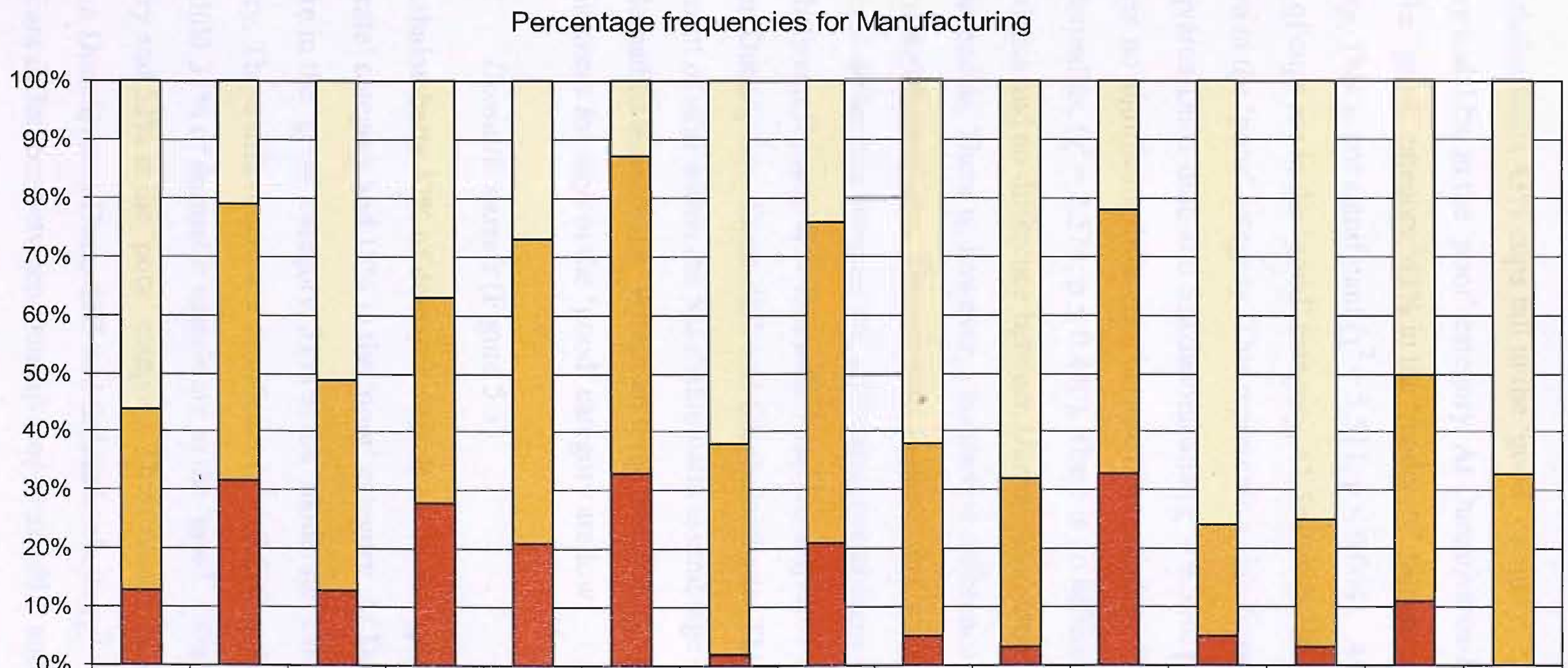
5.2.2.5 *All vessels* (Figure 5.2)

At Százhalombatta 56% of all vessels fall into the 'good' category, 31% in the 'moderate' category and 13% in the 'poor' category. At Dunaújváros-Kosziderpadlás 51% are in the 'good' category, 36% in the 'moderate' category and 13% in the 'poor' category. These differences are not significant ($\chi^2 = 1.502$; $p \leq 0.472$). At Dunaújváros-Duna-dűlő 21% of all vessels are in the 'good' category, 47% in the 'moderate' category and 32% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 31.754$ $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 14.297$; $p \leq 0.001$). The results show that for the manufacturing variable there is a distinction to be drawn between the two settlement assemblages and the cemetery assemblage with a higher investment of skill observed in the settlement assemblages.

5.2.2.6 Manufacturing, Summary

For cups the results show a significant difference between the settlement assemblages but no differences between either of the settlement assemblages and the cemetery assemblage. Taken in combination with the percentage frequencies these results show that the highest investment of skill is within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás. The results show a trend within all three assemblages for low percentage frequencies in the 'good' category indicating a poor investment of skill across all three assemblages. For domestic vessels there is higher investment of skill within the settlements compared to the cemetery. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns both settlement assemblages' show a high investment of skill. For urns the results reveal a marginally higher investment of skill at Százhalombatta compared to Dunaújváros-Kosziderpadlás. Meanwhile the lowest investment of skill for the manufacturing variable for urns lies within the cemetery assemblage. For the all vessels group the results show that for the manufacturing variable there is a distinction to be drawn between the two settlement assemblages and the cemetery assemblage with a higher investment of skill observed in the settlement assemblages (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.2 Percentage and Numeric frequencies Manufacturing at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	56%	21%	51%	37%	27%	13%	62%	24%	62%	68%	22%	76%	75%	50%	67%
moderate	31%	47%	36%	35%	52%	54%	36%	55%	33%	29%	45%	19%	22%	39%	33%
poor	13%	32%	13%	28%	21%	33%	2%	21%	5%	3%	33%	5%	3%	11%	0%

Numeric frequencies for Manufacturing

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	199	43	82	52	13	7	34	10	26	66	12	29	47	28	20
moderate	111	94	59	49	25	28	20	23	14	28	24	7	14	22	10
poor	45	63	21	39	10	17	1	9	2	3	18	2	2	6	0

5.2.3 Wall thickness

5.2.3.1 *Cups* (Figure 5.3)

At Százhalombatta 43% cups fall in the 'good' category, 25% in the 'moderate' category and 32% in the 'poor' category. At Dunaújváros-Kosziderpadlás 31% of cups are in the 'good' category, 43% in the 'moderate' category and 26% in the 'poor' category. This is not significant ($\chi^2 = 5.511$; $p \leq 0.064$). At Dunaújváros-Duna-dűlő 41.5% of cups are in the 'good' category, 41.5% are in the 'moderate' category and 17% are in the 'poor' category. This represents a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 6.306$; $p \leq 0.043$). The results represent no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 2.574$; $p \leq 0.440$). There is no difference between the settlement assemblages and no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás. There is, however, a borderline difference between Dunaújváros-Duna-dűlő and Százhalombatta. These results suggests that despite there being no observable significant difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Kosziderpadlás assemblage. Within all three assemblages percentage frequencies for wall thickness for cups in the 'good' category are low.

5.2.3.2 *Domestic vessels* (Figure 5.3)

At Százhalombatta 47% of domestic vessels are in the 'good' category, 35% in the 'moderate' category and 18% in the 'poor' category. At Dunaújváros-Koszidérpadlás 24% are in the 'good' category, 31% in the 'moderate' category and 45% in the 'poor' category. These differences are significant ($\chi^2 = 9.590$; $p \leq 0.008$). At Dunaújváros-Duna-dűlő 31% of domestic vessels are in the 'good' category, 17% in the 'moderate' category and 52% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 13.036$; $p \leq 0.001$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszíderpadlás, ($\chi^2 = 2.440$; $p \leq 0.295$). The results show that for wall thickness there is a difference between the two settlement assemblages representing a slightly higher investment of skill at Százhalombatta. This accounts for there being a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Koszidерpadlás and the Dunaújváros-Duna-dűlő. The highest investment of skill is at Százhalombatta, followed by Dunaújváros-Koszidерpadlás and then Dunaújváros-Duna-dűlő.

5.2.3.3 *Fineware* (Figure 5.3)

At Százhalombatta 66.3% of fineware is in the 'good' category, 26.3% in the 'moderate' category and 7.3% in the 'poor' category. At Dunaújváros-Koszidерpadlás 84% of fineware vessels are in the 'good' category, 11% in the 'moderate' category and 5% in the 'poor' category. These differences are not significant ($\chi^2 = 4.498$; $p \leq 0.106$*). At Dunaújváros-Duna-dűlő 29% of fineware vessels are in the 'good' category, 31% are in the 'moderate' category and 40% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 28.363$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidерpadlás, ($\chi^2 = 30.108$; $p \leq 0.000$). There is no difference between the two settlement assemblages for the wall thickness variable but there is a difference between the settlements and the cemetery assemblage. The results show a higher investment of skill within the settlement assemblages in comparison to the cemetery assemblage.

5.2.3.4 *Urns* (Figure 5.3)

At Százhalombatta 64% of urns are in the 'good' category, 22% in the 'moderate' category and 14% in the 'poor' category. At Dunaújváros-Koszidерpadlás 73.3% are in the 'good' category, 13.3% in the 'moderate' category and 13.3% in the 'poor' category. These differences are not significant ($\chi^2 = 1.138$; $p \leq 0.556$*). At Dunaújváros-Duna-dűlő 52% of urns are in the 'good' category, 26% in the 'moderate' category and 22% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.866$; $p \leq 0.393$) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidерpadlás, ($\chi^2 = 3.838$; $p \leq 0.0.147$).The results show that there is no significant difference between any of the assemblages for urns in relation to the wall thickness variable.

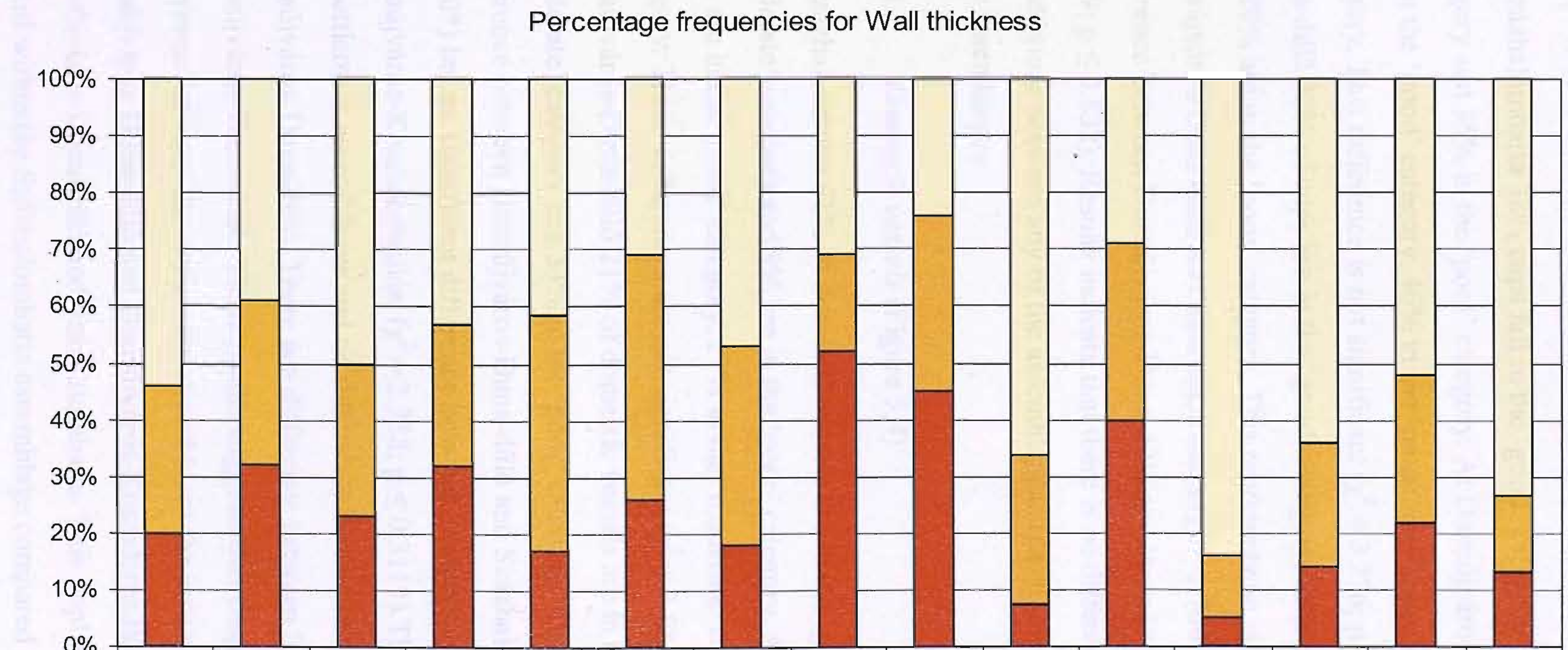
5.2.3.5 All vessels (Figure 5.3)

Százhalombatta has 54% of all vessels falling in the 'good' category, 26% in the 'moderate' category and 20% in the 'poor' category. At Dunaújváros-Kosziderpadlás 50% of all vessels are in the 'good' category, 27% in the 'moderate' category and 23% in the 'poor' category. These differences are not significant (χ^2 1.081; $p \leq 0.582$). At Dunaújváros-Duna-dűlő 39% of all vessels are in the 'good' category, 29% in the 'moderate' category and 32% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 13.879$; $p \leq 0.001$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidérpadlás ($\chi^2 = 4.885$; $p \leq 0.087$). There is no difference between the settlement assemblages and no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidérpadlás but there is a difference between Dunaújváros-Duna-dűlő and Százhalombatta. These results suggests that despite there being no observable difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidérpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Koszidérpadlás assemblage.

5.2.3.5 Wall thickness, Summary

For cups there is little or no difference in investment of skill, which is low, for wall thickness for all of the assemblages. For domestic vessels the results show that for wall thickness there is a difference between the two settlement assemblages representing a slightly higher investment of skill at Százhalombatta. This accounts for there being a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Koszidérpadlás and the Dunaújváros-Duna-dűlő. The highest investment of skill is at Százhalombatta, followed by Dunaújváros-Koszidérpadlás and then Dunaújváros-Duna-dűlő. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns the results show that there is no significant difference between any of the assemblages in relation to the wall thickness variable indicating a similarly high investment of skill across all three assemblages. For the all vessels group the results show the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidérpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Kosziderpadlás assemblage and a lower investment of skill within the cemetery assemblage compared to the settlement assemblages (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.3 Percentage and Numeric frequencies for Wall Thickness at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
□ good	54%	39%	50%	43%	41.5%	31%	47%	31%	24%	66.3%	29%	84%	64%	52%	73.3%
■ moderate	26%	29%	27%	25%	41.5%	43%	35%	17%	31%	26.3%	31%	11%	22%	26%	13.3%
■ poor	20%	32%	23%	32%	17%	26%	18%	52%	45%	7.3%	40%	5%	14%	22%	13.3%

Numeric frequencies for Wall Thickness

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	187	76	80	58	20	16	26	13	10	63	15	32	40	28	22
moderate	92	57	43	34	20	22	19	7	13	25	16	4	14	14	4
poor	69	63	38	43	8	13	10	22	19	7	21	2	9	12	4
N/A	7	4	1	5	0	1	0	0	0	2	2	0	0	2	0

5.2.4 Additions

5.2.4.1 *Cups* (Figure 5.4)

At Százhalombatta 38% cups fall in the 'good' category, 27% in the 'moderate' category and 35% in the 'poor' category. At Dunaújváros-Kosziderpadlás 31% of cups are in the 'good' category, 46% in the 'moderate' category and 23% in the 'poor' category. This difference is not significant ($\chi^2 = 3.276$; $p \leq 0.194$). At Dunaújváros-Duna-dűlő 32% of cups are in the 'good' category, 39% are in the 'moderate' category and 29% are in the 'poor' category. This represents no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.766$; $p \leq 0.413$) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 0.369$; $p \leq 0.832$). Results indicate that there is no difference in the investment of skill for additions between any of the assemblages. The investment of skill is low within all three assemblages.

5.2.4.2 *Domestic vessels* (Figure 5.4)

At Százhalombatta 61% of domestic vessels are in the 'good' category, 30% are in the 'moderate' category and 9% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 46% are in the 'good' category, 27% in the 'moderate' category and 27% in the 'poor' category. These differences are not significant ($\chi^2 = 2.088$; $p \leq 0.352$*). At Dunaújváros-Duna-dűlő 21% of domestic vessels are in the 'good' category, 46% in the 'moderate' category and 33% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 9.169$; $p \leq 0.010$*) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 2.338$; $p \leq 0.311$*).There is no difference between the settlement assemblages and no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. There is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. These results suggests that despite there being no observable difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Kosziderpadlás assemblage for the additions variable for domestic vessels and a lower investment of skill at Dunaújváros-Duna-dűlő.

5.2.4.3 *Fineware* (Figure 5.4)

At Százhalombatta 69% of fineware is in the 'good' category, 23% in the 'moderate' category and 8% in the 'poor' category. At Dunaújváros-Kosziderpadlás 85% of fineware vessels are in the 'good' category, 15% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant (χ^2 =2.632; p $\leq$ 0.268*). At Dunaújváros-Duna-dűlő 31% of fineware vessels are in the 'good' category, 38% are in the 'moderate' category and 31% are in the 'poor' category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta (χ^2 = 13.139; p $\leq$ 0.001*) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, (χ^2= 14.882; p $\leq$ 0.001*). The results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage for the additions variable for fineware.

5.2.4.4 *Urns* (Figure 5.4)

At Százhalombatta 65% of urns are in the 'good' category, 31% in the 'moderate' category and 4% in the 'poor' category. At Dunaújváros-Kosziderpadlás 81% are in the 'good' category, 19% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant (χ^2 = 2.122; p $\leq$ 0.346*). At Dunaújváros-Duna-dűlő 64% of urns are in the 'good' category, 27% in the 'moderate' category and 9% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta (χ^2 = 0.695; p < or = 0.706*) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, (χ^2= 2.256; p < or = 0.324*). There is no difference to be observed for between any of the assemblages. Within all assemblages the trend is for a high investment of skill for the additions variable for urns.

5.2.4.5 *All vessels* (Figure 5.4)

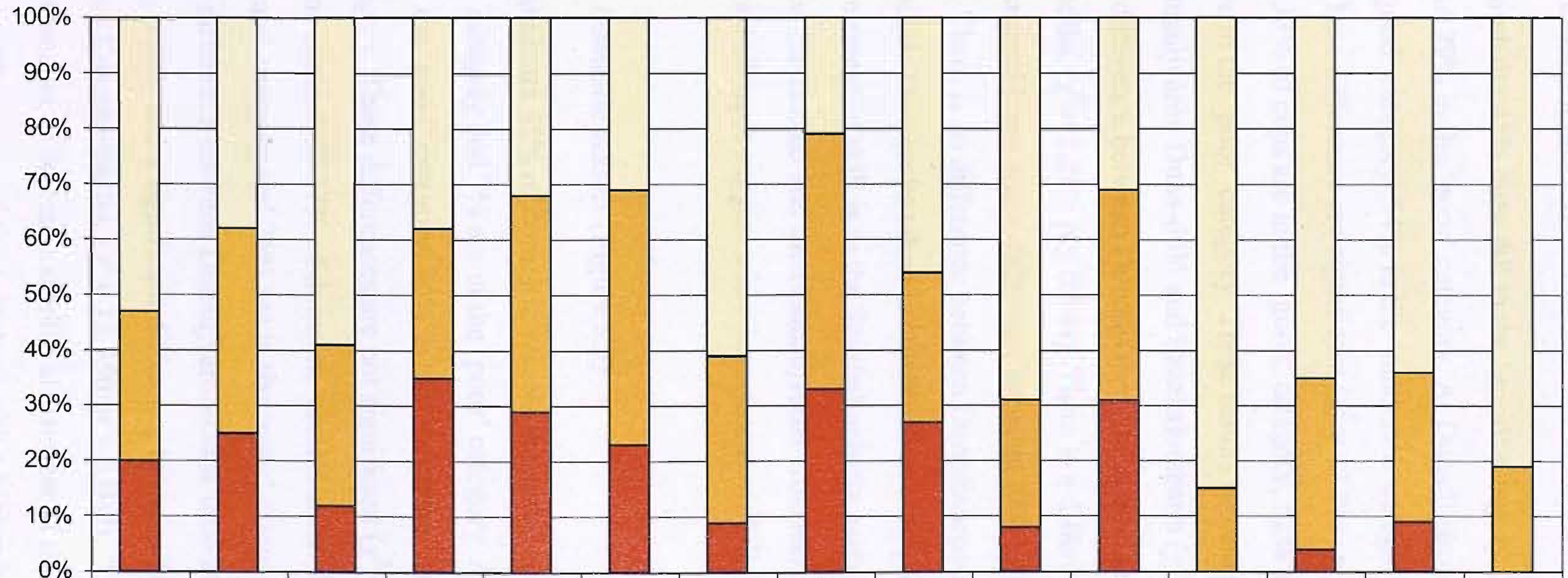
At Százhalombatta 53% of all vessels fall in the 'good' category, 27% in the 'moderate' category and 20% in the 'poor' category. At Dunaújváros-Kosziderpadlás 59% of all vessels are in the 'good' category, 29% are in the 'moderate' category and 12% are in the 'poor' category. These differences are not significant (χ^2 2.416; p $\leq$ 0.299). At Dunaújváros-Duna-dűlő 38% of all vessels fall in the 'good' category, 37% are in the 'moderate' category and 25% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 6.685$; $p \leq 0.035$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 9.180$; $p \leq 0.010$). The results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage for the additions variable for the all vessels group.

5.2.4.6 Additions, Summary

With regard to cups the results indicate that there is no difference in the investment of skill for additions between any of the assemblages. The investment of skill is low within all three assemblages. For domestic vessels the results show no difference between the settlement assemblages and no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő but a difference between Százhalombatta and Dunaújváros-Duna-dűlő indicating that the highest investment of skill is at Százhalombatta. For fineware the results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage. For urns there is no difference to be observed between any of the assemblages with a high investment of skill across all assemblages. For the all vessels group the results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.4 Percentage and Numeric frequency for Additions at all sites

Percentage frequencies for Additions



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	53%	38%	59%	38%	32%	31%	61%	21%	46%	69%	31%	85%	65%	64%	81%
moderate	27%	37%	29%	27%	39%	46%	30%	46%	27%	23%	38%	15%	31%	27%	19%
poor	20%	25%	12%	35%	29%	23%	9%	33%	27%	8%	31%	0%	4%	9%	0%

Numeric frequencies for Additions

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	9	21	43	34	12	8	14	5	5	42	9	17	15	21	13
moderate	54	46	21	25	15	12	7	11	3	14	11	3	7	9	3
poor	40	31	9	32	11	6	2	8	3	5	9	0	1	3	0
N/A	157	76	89	49	10	26	32	18	31	36	25	18	40	23	14

5.2.5 Interior surface treatments

5.2.5.1 *Cups* (Figure 5.5)

At Százhalombatta 45% cups fall in the 'good' category, 26% in the 'moderate' category and 29% in the 'poor' category. At Dunaújváros-Kosziderpadlás 21% of cups are in the 'good' category, 54% in the 'moderate' category and 25% in the 'poor' category. These difference are significant ($\chi^2 = 12.711$; $p \leq 0.002$). At Dunaújváros-Duna-dűlő 33% of cups are in the 'good' category, 52% are in the 'moderate' category and 15% are in the 'poor' category. These results represent a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 10.984$; $p \leq 0.004$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 1.217$; $p \leq 0.544$). There is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás. The results taken in combination with percentage frequencies show the highest investment of skill is in the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás. Percentage frequencies across all assemblages suggest a low investment of skill for cups for interior surface treatments.

5.2.5.2 *Domestic vessels* (Figure 5.5)

At Százhalombatta 55% of domestic vessels are in the 'good' category, 38% are in the 'moderate' category and 7% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 52% are in the 'good' category, 36% in the 'moderate' category and 12% are in the 'poor' category. These differences are not significant ($\chi^2 = 0.611$; $p \leq 0.737$*). At Dunaújváros-Duna-dűlő 17% of domestic vessels are in the 'good' category, 57% are in the 'moderate' category and 26% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 17.249$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 12.550$; $p \leq 0.002$). There is no difference between the two settlements, reflecting a similar investment of skill. There is a difference between the settlements and the cemetery with a higher investment of skill for interior surface treatment within the settlement assemblages for domestic vessels.

5.2.5.3 Fineware (Figure 5.5)

At Százhalombatta 75% of fineware falls in the 'good' category, 18% in the 'moderate' category and 7% in the 'poor' category. At Dunaújváros-Kosziderpadlás 68% of fineware vessels are in the 'good' category, 24% in the 'moderate' category and 8% in the 'poor' category. These differences are not significant ($\chi^2 = 0.729$; $p \leq 0.695$*). At Dunaújváros-Duna-dűlő 39% of fineware vessels are in the 'good' category, 39% are in the 'moderate' category and 22% are in the 'poor' category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 19.786$; $p \leq 0.000$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 8.455$; $p \leq 0.015$). There is no difference between the two settlement assemblages. There is a difference between the settlements and the cemetery with a higher investment of skill for interior surface treatment within the settlement assemblages.

5.2.5.4 Urns (Figure 5.5)

At Százhalombatta 54% of urns are in the 'good' category, 41% in the 'moderate' category and 5% in the 'poor' category. At Dunaújváros-Kosziderpadlás 57% are in the 'good' category, 33% in the 'moderate' category and 10% in the 'poor' category. These differences are not significant ($\chi^2 = 1.222$; $p \leq 0.543$*). At Dunaújváros-Duna-dűlő 59% of urns are in the 'good' category, 39% in the 'moderate' category and 2% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 0.940$; $p \leq 0.625$*) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 3.037$; $p \leq 0.219$*). The results show that there is no difference between any of the assemblages for interior surface treatment for urns. Within all assemblages the investment of skill is high.

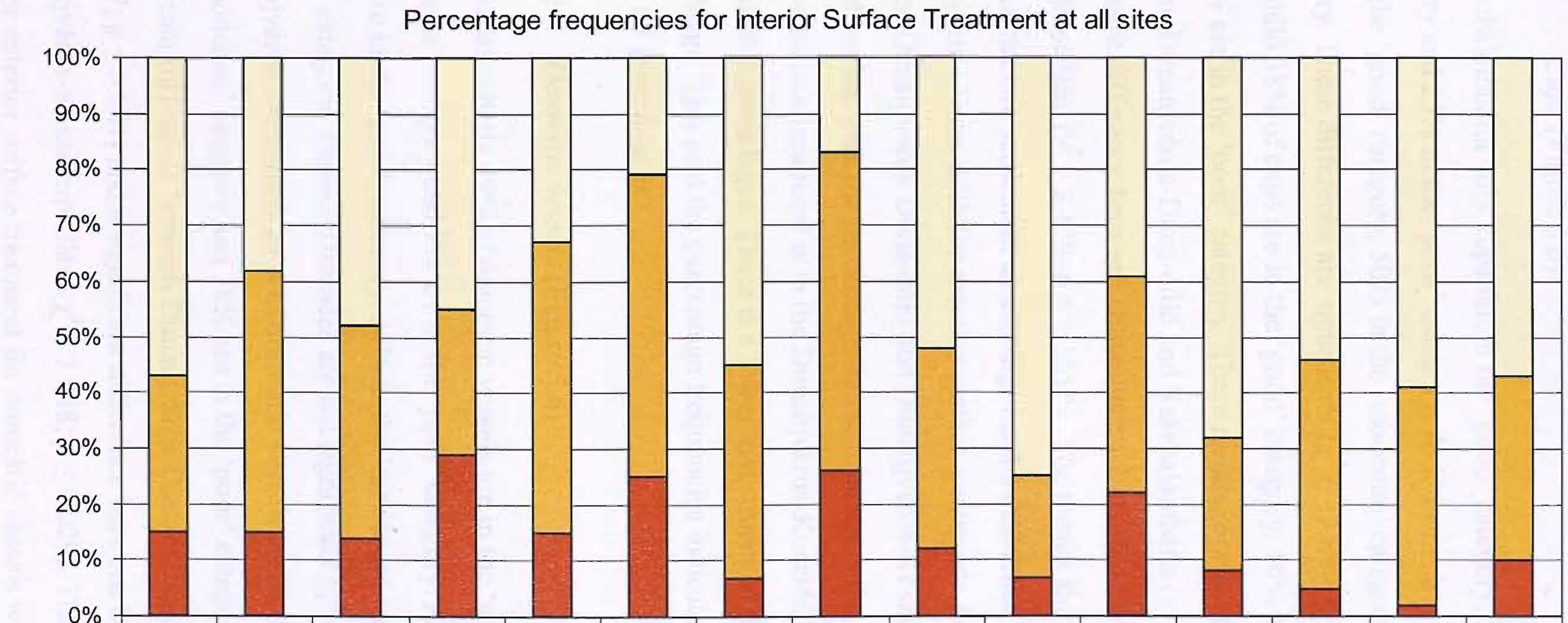
5.2.5.5 All vessels (Figure 5.5)

At Százhalombatta 57% of all vessels fall in the 'good' category, 28% in the 'moderate' category and 15% in the 'poor' category. At Dunaújváros-Kosziderpadlás 48% of all vessels are in the 'good' category, 38% are in the 'moderate' category and 14% are in the 'poor' category. These differences are not significant ($\chi^2 = 4.976$; $p \leq 0.083$). At Dunaújváros-Duna-dűlő 38% of all vessels fall in the 'good' category, 47% are in the 'moderate' category and 15% are in the 'poor' category. There is a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 19.632$; $p \leq 0.000$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 3.428$; $p \leq 0.180$). The results suggests that despite there being no observable difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Koszideipadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. Taken in combination with the percentage frequencies this implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Koszideipadlás assemblage. Meanwhile, there is a lower investment of skill within the cemetery assemblage compared to the settlement assemblages.

5.2.5.6 Interior surface treatments, Summary

With regard to cups there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszideipadlás. The results show that for interior surface treatment for cups the highest investment of skill is in the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Koszideipadlás. Percentage frequencies across all assemblages suggest a low investment of skill. For domestic vessels there is a higher investment of skill for interior surface treatments within the settlement assemblages compared to the cemetery assemblage. For fineware there is a far higher investment of skill for interior surface treatment within the settlement assemblages. For urns the results show no difference between any of the assemblages for interior surface treatment. The investment of skill is high for urns across all assemblages. For the all vessels group the results suggests that despite there being no observable difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Koszideipadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Koszideipadlás assemblage and a lower investment of skill within the cemetery assemblage compared to the settlement assemblages (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.5 Percentage and Numeric frequencies for Interior Surface Treatments at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	57%	38%	48%	45%	33%	21%	55%	17%	52%	75%	39%	68%	54%	59%	57%
moderate	28%	47%	38%	26%	52%	54%	38%	57%	36%	18%	39%	24%	41%	39%	33%
poor	15%	15%	14%	29%	15%	25%	7%	26%	12%	7%	22%	8%	5%	2%	10%

Numeric frequencies for Interior Surface Treatments

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	22	62	78	57	16	13	30	7	22	73	21	26	34	33	17
moderate	97	92	62	33	25	28	21	24	15	17	21	9	26	22	10
poor	51	31	22	37	7	11	4	11	5	7	12	3	3	1	3
N/A	13	0	0	13	0	0	0	0	0	0	0	0	0	0	0

5.2.6 Exterior surface treatments

5.2.6.1 Cups (Figure 5.6)

At Százhalombatta 40% cups fall in the 'good' category, 35% in the 'moderate' category and 25% in the 'poor' category. At Dunaújváros-Kosziderpadlás 46% of cups are in the 'good' category, 50% in the 'moderate' category and 4% in the 'poor' category. These difference are significant (χ^2 = 13.859; p $\leq$ 0.001). At Dunaújváros-Duna-dűlő 38% of cups are in the 'good' category, 56% are in the 'moderate' category and 6% are in the 'poor' category. These results represent a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta (χ^2 = 11.348; p $\leq$0.003) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, (χ^2 = 3.370; p $\leq$ 0.185*). The results show that there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for exterior surface treatments for cups. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás. These results taken in combination with the percentage frequencies show the highest investment of skill for exterior surface treatment is in the Dunaújváros-Kosziderpadlás and the Dunaújváros-Duna-dűlő assemblages. There is a lower investment of skill in the Százhalombatta assemblage. This said the percentage frequencies indicate a low investment of skill across all assemblages.

5.2.6.2 Domestic vessels (Figure 5.6)

At Százhalombatta 49% of domestic vessels are in the 'good' category, 42% are in the 'moderate' category and 9% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 48% are in the 'good' category, 35% in the 'moderate' category and 17% are in the 'poor' category. These differences are not significant (χ^2 =1.331; p $\leq$ 0.514). At Dunaújváros-Duna-dűlő 24% of domestic vessels are in the 'good' category, 38% are in the 'moderate' category and 38% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta (χ^2 = 13.687; p $\leq$ 0.001) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, (χ^2 = 7.048; p $\leq$ 0.029). There is a higher investment of skill for exterior surface treatment for domestic vessels within the settlement assemblages compared to the cemetery assemblage.

5.2.6.3 *Fineware* (Figure 5.6)

At Százhalombatta 82% of fineware falls in the 'good' category, 11.5% in the 'moderate' category and 6.5% in the 'poor' category. At Dunaújváros-Kosziderpadlás 84% of fineware vessels are in the 'good' category, 11% in the 'moderate' category and 5% in the 'poor' category. These differences are not significant ($\chi^2 = 0.078$; $p \leq 0.962$*). At Dunaújváros-Duna-dűlő 41% of fineware vessels are in the 'good' category, 42% are in the 'moderate' category and 17% are in the 'poor' category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 27.153$; $p \leq 0.000$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 17.421$; $p \leq 0.000$*). There is no difference between the two settlement sites for exterior surface treatment for fineware but there is a difference between the settlement assemblages and the cemetery. There is a far higher investment of skill within the settlement assemblages.

5.2.6.4 *Urns* (Figure 5.6)

At Százhalombatta 70% of urns are in the 'good' category, 17% in the 'moderate' category and 13% in the 'poor' category. At Dunaújváros-Kosziderpadlás 70% are in the 'good' category, 30% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 5.296$; $p \leq 0.071$*). At Dunaújváros-Duna-dűlő 59% of urns are in the 'good' category, 39% in the 'moderate' category and 2% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 10.306$; $p \leq 0.006$*) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 1.348$; $p \leq 0.500$*). There is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő but there is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill than Százhalombatta. Therefore, taken in combination with the percentage frequencies the results show the highest investment of skill for exterior surface treatment is at Százhalombatta, followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő.

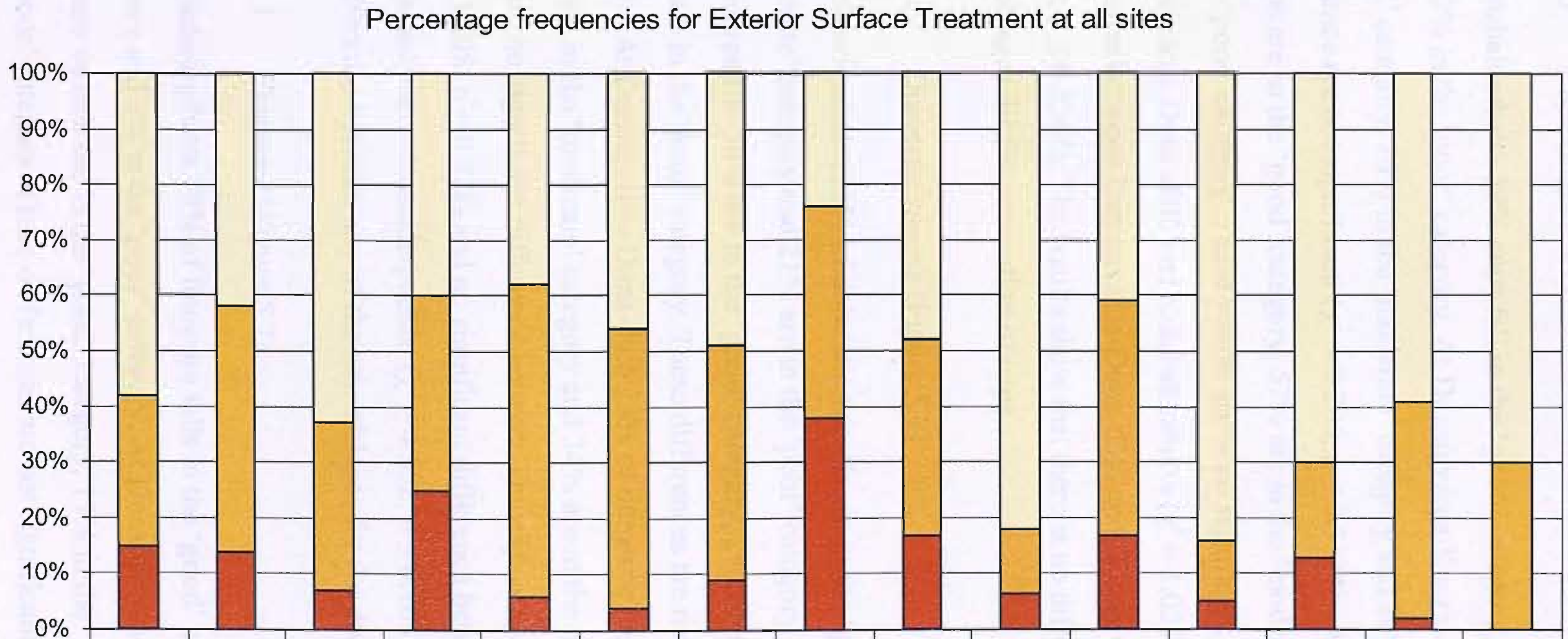
5.2.6.5 All vessels (Figure 5.6)

At Százhalombatta 58% of all vessels fall in the 'good' category, 27% in the 'moderate' category and 15% in the 'poor' category. At Dunaújváros-Koszíderpadlás 63% of all vessels are in the 'good' category, 30% are in the 'moderate' category and 7% are in the 'poor' category. These differences are significant ($\chi^2 = 7.789$; $p \leq 0.020$). At Dunaújváros-Duna-dűlő 42% of all vessels fall in the 'good' category, 44% are in the 'moderate' category and 14% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 18.700$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 17.614$; $p \leq 0.000$). The results show that there is a difference between all three sites for exterior surface treatments for the all vessels group. The results, taken in combination with percentage frequencies, suggest the highest deployment of skill within the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta, and the lowest investment of skill in the Dunaújváros-Duna-dűlő assemblage.

5.2.6.6 Exterior surface treatment, Summary

With regard to cups the results show that there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for exterior surface treatments for cups. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás. These results taken in combination with the percentage frequencies show the highest investment of skill for exterior surface treatment is in the Dunaújváros-Kosziderpadlás and the Dunaújváros-Duna-dűlő assemblages. There is a lower investment of skill in the Százhalombatta assemblage. This said the percentage frequencies indicate a low investment of skill across all assemblages. For domestic vessels there is a higher investment of skill within the settlement assemblages. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery. For urns there is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő but there is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill than Százhalombatta. Therefore, taken in combination with the percentage frequencies the results show the highest investment of skill for exterior surface treatment is at Százhalombatta, followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő. The results for the all vessels group show that there is a difference between all three sites for exterior surface treatments (Tables 5.2a, 5.2b, 5.2c, 5.2d). The results, taken in combination with percentage frequencies, suggest the highest deployment of skill within the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta, and the lowest investment of skill in the Dunaújváros-Duna-dűlő assemblage.

Figure 5.6 Percentage and Numeric frequencies for Exterior Surface Treatments at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
□ good	58%	42%	63%	40%	38%	46%	49%	24%	48%	82%	41%	84%	70%	59%	70%
□ moderate	27%	44%	30%	35%	56%	50%	42%	38%	35%	11.5%	42%	11%	17%	39%	30%
■ poor	15%	14%	7%	25%	6%	4%	9%	38%	17%	6.5%	17%	5%	13%	2%	0%

Numeric frequencies for Exterior Surface Treatments

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	205	83	102	55	18	29	27	10	20	79	22	32	44	33	21
moderate	93	88	49	48	27	21	23	16	15	11	23	4	11	22	9
poor	53	29	11	34	3	2	5	16	7	6	9	2	8	1	0
N/A	4	0	0	3	0	0	0	0	0	1	0	0	0	0	0

5.2.7 Decoration

5.2.7.1 *Cups* (Figure 5.7)

At Százhalombatta 59% cups fall in the 'good' category, 4% in the 'moderate' category and 37% in the 'poor' category. At Dunaújváros-Kosziderpadlás 50% of cups are in the 'good' category, 20% in the 'moderate' category and 30% in the 'poor' category. These difference are not significant ($\chi^2 = 2.206$; $p \leq 0.332$*). At Dunaújváros-Duna-dűlő 43% of cups are in the 'good' category, 57% are in the 'moderate' category and there is 0% in the 'poor' category. These results show no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.027$; $p \leq 0.598$*) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 2.181$; $p \leq 0.336$*). The results show that there is no difference between any of the assemblages for the decoration of cups.

5.2.7.2 *Domestic vessels* (Figure 5.7)

At Százhalombatta 38% of domestic vessels are in the 'good' category, 41% are in the 'moderate' category and 21% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 56% are in the 'good' category, 24% in the 'moderate' category and 20% are in the 'poor' category. These differences are not significant ($\chi^2 = 2.285$; $p \leq 0.319$). At Dunaújváros-Duna-dűlő 28% of domestic vessels are in the 'good' category, 38% are in the 'moderate' category and 34% are in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.698$; $p \leq 0.428$) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.552$; $p \leq 0.103$). The results show that there is no difference between any of the assemblages for the decoration of domestic vessels.

5.2.7.3 *Fineware* (Figure 5.7)

At Százhalombatta 70% of fineware falls in the 'good' category, 24% in the 'moderate' category and 6% in the 'poor' category. At Dunaújváros-Kosziderpadlás 75% of fineware vessels are in the 'good' category, 17% in the 'moderate' category and 8% in the 'poor' category. These differences are not significant ($\chi^2 = 0.570$; $p \leq 0.752$*). At Dunaújváros-Duna-dűlő 49% of fineware vessels are in the 'good' category, 35% in the 'moderate' category and 16% in the 'poor' category. The results show there is no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 5.026$;

$p \leq 0.081$*) and no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.184$; $p \leq 0.123$*). The results show that there is no difference between any of the assemblages for the decoration of fineware.

5.2.7.4 *Urns* (Figure 5.7)

At Százhalombatta 65% of urns are in the 'good' category, 32% in the 'moderate' category and 3% in the 'poor' category. At Dunaújváros-Koszinderpadlás 79% are in the 'good' category, 16% in the 'moderate' category and 5% in the 'poor' category. These differences are not significant ($\chi^2 = 1.702$; $p \leq 0.427$*). At Dunaújváros-Duna-dűlő 55% of urns are in the 'good' category, 31% in the 'moderate' category and 14% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 2.573$; p < or = 0.276) or between Dunaújváros-Duna-dűlő and Dunaújváros-Koszinderpadlás, ($\chi^2 = 3.303$; $p \leq 0.192$*). The results show that there is no difference between any of the assemblages for the decoration of urns.

5.2.7.5 *All vessels* (Figure 5.7)

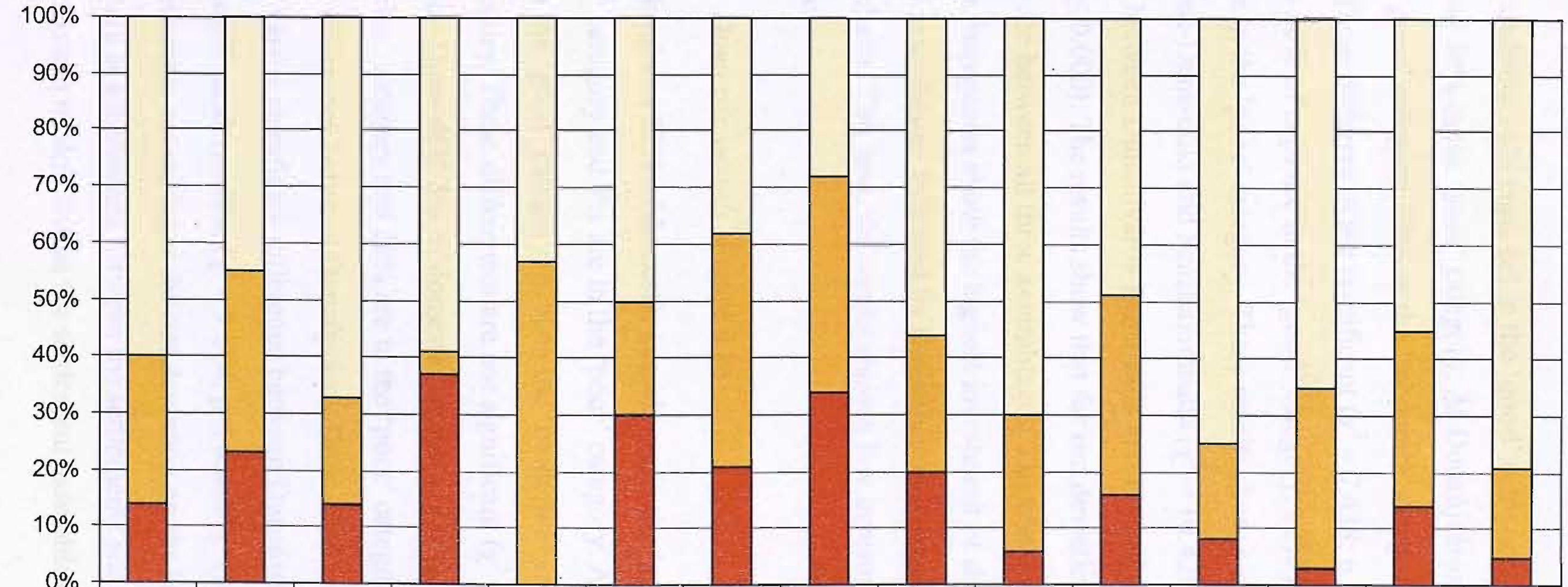
At Százhalombatta 60% of all vessels fall in the 'good' category, 26% in the 'moderate' category and 14% in the 'poor' category. At Dunaújváros-Koszinderpadlás 67% of all vessels are in the 'good' category, 19% are in the 'moderate' category and 14% are in the 'poor' category. These differences are not significant ($\chi^2 = 1.504$; $p \leq 0.471$). At Dunaújváros-Duna-dűlő 45% of all vessels fall in the 'good' category, 32% are in the 'moderate' category and 23% are in the 'poor' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 6.278$; $p \leq 0.043$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Koszinderpadlás, ($\chi^2 = 8.730$; $p \leq 0.013$). The results for the all vessels group show a higher investment of skill for decoration in the settlement assemblages compared to the cemetery assemblage.

5.2.7.6 *Decoration, Summary*

The results show that for decoration there is no difference between any of the sites for cups, domestic vessels, fineware or urns. The results for the all vessels group show a slightly higher investment of skill for decoration in the settlement assemblages compared to the cemetery assemblage (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.7 Percentage and numeric frequencies for Decoration at all sites

Percentage frequencies for Decoration at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
□ good	60%	45%	67%	59%	43%	50%	38%	28%	56%	70%	49%	75%	65%	55%	79%
□ moderate	26%	32%	19%	4%	57%	20%	41%	38%	24%	24%	35%	17%	32%	31%	16%
■ poor	14%	23%	14%	37%	0%	30%	21%	34%	20%	6%	16%	8%	3%	14%	5%

Numeric frequencies for Decoration at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	91	52	52	14	3	5	13	8	14	44	18	18	20	23	15
moderate	40	37	15	1	4	2	14	11	6	15	13	4	10	13	3
poor	21	26	11	9	0	3	7	10	5	4	6	2	1	6	1
N/A	203	85	84	116	41	42	21	13	17	34	17	14	32	14	11

5.2.8 Rim deviation on the horizontal plane

5.2.8.1 *Cups* (Figure 5.8)

At Százhalombatta 16% cups fall in the 'good' category, 54% in the 'moderate' category and 30% in the 'poor' category. At Dunaújváros-Kosziderpadlás 27% of cups are in the 'good' category, 38% in the 'moderate' category and 35% in the 'poor' category. These differences are significant ($\chi^2 = 7.438$; $p \leq 0.024$*). At Dunaújváros-Duna-dűlő 30% of cups are in the 'good' category, 62% are in the 'moderate' category and 8% are in the 'poor' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 10.429$; $p \leq 0.005$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 20.668$; $p \leq 0.000$). The results show that for rim deviation on the horizontal plane there is a difference between all three assemblages. The results taken in combination with percentage frequencies show the highest investment of skill is in the Dunaújváros-Duna-dűlő assemblage, followed by Dunaújváros-Kosziderpadlás and then Százhalombatta. This said, the results show a low investment of skill for all assemblages

5.2.8.2 *Domestic vessels* (Figure 5.8)

At Százhalombatta 22% of domestic vessels are in the 'good' category, 69% are in the 'moderate' category and 9% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 25% are in the 'good' category, 67% in the 'moderate' category and 8% are in the 'poor' category. These differences are not significant ($\chi^2 = 0.121$; $p \leq 0.941$*). At Dunaújváros-Duna-dűlő 3% of domestic vessels are in the 'good' category, 69% are in the 'moderate' category and 28% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 8.913$; $p \leq 0.012$*) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 9.284$; $p \leq 0.010$*). There is no difference between the two settlement assemblages for rim deviation on the horizontal plane for domestic vessels. There is a difference between the settlements and the cemetery. This reflects a higher investment of skill within the settlement assemblages.

5.2.8.3 *Fineware* (Figure 5.8)

At Százhalombatta 50% of fineware falls in the 'good' category, 40% in the 'moderate' category and 10% in the ‘poor’ category. At Dunaújváros-Kosziderpadlás 74% of fineware vessels are in the ‘good’ category, 22% in the ‘moderate’ category and 4% in the ‘poor’ category. These differences are not significant ($\chi^2 = 4.685$; $p \leq 0.096$*). At Dunaújváros-Duna-dűlő 10% of fineware vessels are in the ‘good’ category, 62% in the ‘moderate’ category and 28% in the ‘poor’ category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 22.605$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 32.817$; $p \leq 0.000$). There is no difference between the two settlement assemblages for rim deviation on the horizontal plane for fineware. There is a difference between the settlements and the cemetery. This reflects a higher investment of skill for fineware within the settlement assemblages.

5.2.8.4 *Urns* (Figure 5.8)

At Százhalombatta 41% of urns are in the ‘good’ category, 53% in the ‘moderate’ category and 6% in the ‘poor’ category. At Dunaújváros-Kosziderpadlás 50% are in the ‘good’ category, 50% in the ‘moderate’ category and 0% in the ‘poor’ category. These differences are not significant ($\chi^2 = 1.418$; $p \leq 0.492$*). At Dunaújváros-Duna-dűlő 20% of urns are in the ‘good’ category, 69% in the ‘moderate’ category and 11% in the ‘poor’ category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 3.843$; $p \leq 0.146$*) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 6.702$; $p \leq 0.035$*). There is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Százhalombatta is closer to Dunaújváros-Duna-dűlő in terms of skill than Dunaújváros-Kosziderpadlás. These results taken in combination with the percentage frequencies show that the highest deployment of skill for rim deviation on the horizontal plane for urns is in the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta and then Dunaújváros-Duna-dűlő.

5.2.8.5 *All vessels* (Figure 5.8)

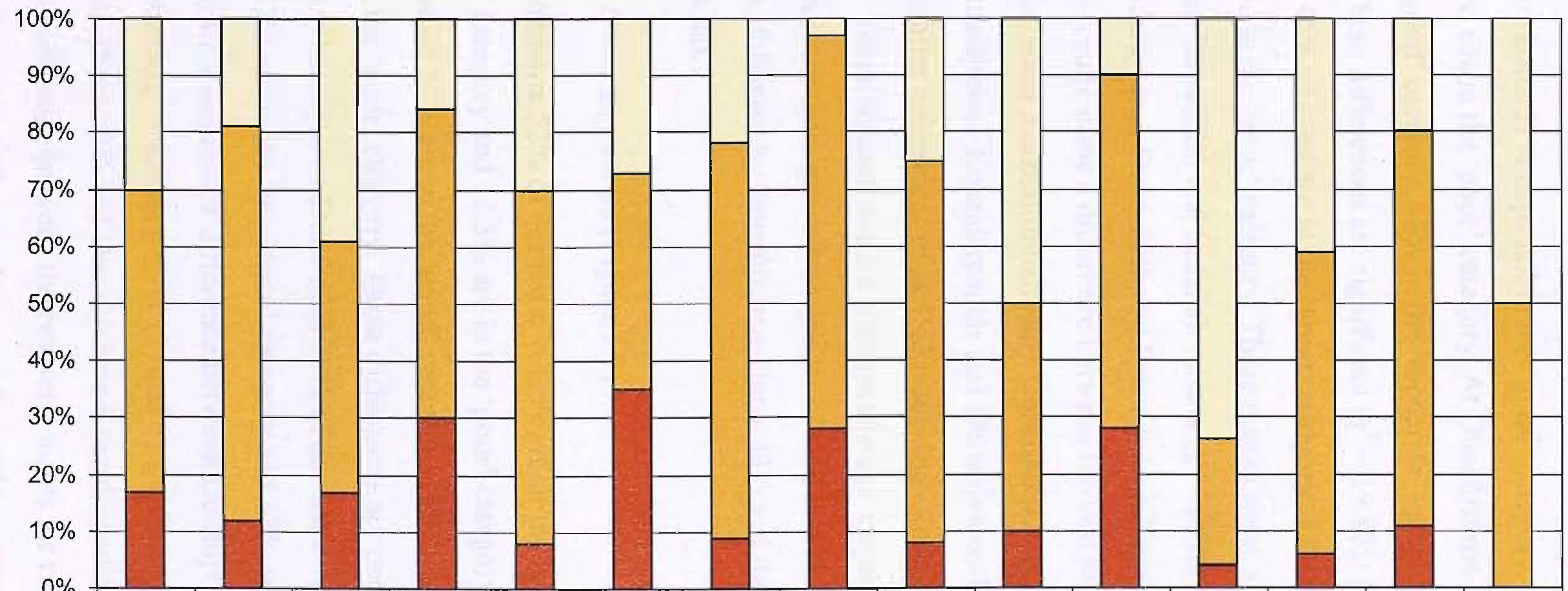
At Százhalombatta 30% of all vessels fall in the ‘good’ category, 53% in the ‘moderate’ category and 17% in the ‘poor’ category. At Dunaújváros-Kosziderpadlás 39% of all vessels are in the 'good' category, 44% are in the 'moderate' category and 17% are in the 'poor' category. These differences are not significant ($\chi^2 = 3.293$; $p \leq 0.193$). At Dunaújváros-Duna-dűlő 19% of all vessels fall in the 'good' category, 69% are in the 'moderate' category and 12% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 10.611$; $p \leq 0.005$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 18.729$; $p \leq 0.000$). The results show that for rim deviation on the horizontal plane there is no difference between the two settlements but a difference between the settlements and the cemetery. There is a higher investment of skill within the settlement assemblages.

5.2.8.6 Rim deviation on the horizontal plane, Summary

With regard to cups the results show that for rim deviation on the horizontal plane there is a difference between all three assemblages with a higher investment of skill at Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás compared to Százhalombatta. For domestic vessels there is no difference between the two settlement assemblages but there is a difference between the settlements and the cemetery, reflecting a higher investment of skill within the settlement assemblages. For fineware there is no difference between the two settlement assemblages for rim deviation on the horizontal plane but there is a difference between the settlements and the cemetery, reflecting a higher investment of skill for fineware within the settlement assemblages. For urns there is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Százhalombatta is closer to Dunaújváros-Duna-dűlő in terms of skill than Dunaújváros-Kosziderpadlás (Tables 5.2a, 5.2b, 5.2c, 5.2d). These results taken in combination with the percentage frequencies show that the highest deployment of skill for rim deviation on the horizontal plane for urns is in the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta and then Dunaújváros-Duna-dűlő. For the all vessels groups the results show a higher investment of skill within the settlement assemblages compared to the cemetery.

Figure 5.8 Percentage and Numeric frequencies for Rim Deviation on the Horizontal Plane at all sites

Percentage frequencies for Rim Deviation on the Horizontal Plane at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	30%	19%	39%	16%	30%	27%	22%	3%	25%	50%	10%	74%	41%	20%	50%
moderate	53%	69%	44%	54%	62%	38%	69%	69%	67%	40%	62%	22%	53%	69%	50%
poor	17%	12%	17%	30%	8%	35%	9%	28%	8%	10%	28%	4%	6%	11%	0%

Numeric frequencies for Rim Deviation on the Horizontal Plane at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	73	25	43	14	12	7	10	1	9	35	5	20	14	7	10
moderate	127	100	47	49	25	10	32	22	24	28	29	6	18	24	10
poor	40	29	19	27	3	9	4	9	3	7	13	1	2	4	0
N/A	115	46	53	50	8	26	9	10	6	27	7	11	29	21	10

5.2.9 Rim symmetry

5.2.9.1 *Cups* (Figure 5.9)

At Százhalombatta 51% cups fall in the 'good' category, 43% in the 'moderate' category and 6% in the 'poor' category. At Dunaújváros-Kosziderpadlás 25% of cups are in the 'good' category, 36% in the 'moderate' category and 39% in the 'poor' category. These differences are significant ($\chi^2 = 19.821$; $p \leq 0.000$*). At Dunaújváros-Duna-dűlő 46% of cups are in the 'good' category, 33% are in the 'moderate' category and 21% are in the 'poor' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 6.680$; $p \leq 0.035$*) but no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.204$; $p \leq 0.122$). The results show a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results indicate a similar investment of skill Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. Taken in combination with percentage frequencies these results show that for rim symmetry the highest deployment of skill is within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás.

5.2.9.2 *Domestic vessels* (Figure 5.9)

At Százhalombatta 52% of domestic vessels are in the 'good' category, 35.5% are in the 'moderate' category and 12.5% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 57% are in the 'good' category, 30% in the 'moderate' category and 13% are in the 'poor' category. These differences are not significant ($\chi^2 = 0.245$; $p \leq 0.885$*). At Dunaújváros-Duna-dűlő 26% of domestic vessels are in the 'good' category, 37% are in the 'moderate' category and 37% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 8.966$; $p \leq 0.011$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 7.865$; $p \leq 0.020$). There is no difference between the two settlements for rim symmetry for domestic vessels but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages.

5.2.9.3 *Fineware* (Figure 5.9)

At Százhalombatta 74% of fineware falls in the 'good' category, 20% in the 'moderate' category and 6% in the 'poor' category. At Dunaújváros-Kosziderpadlás 63% of fineware vessels are in the 'good' category, 29% in the 'moderate' category and 8% in the 'poor' category. These differences are not significant ($\chi^2 = 1.149$; $p \leq 0.563$*). At Dunaújváros-Duna-dűlő 40% of fineware vessels are in the 'good' category, 33% in the 'moderate' category and 27% in the 'poor' category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 17.120$; $p \leq 0.000$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.948$; $p \leq 0.102$). The results show no difference between the settlement assemblages and no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás for rim symmetry for fineware. There is a difference between Dunaújváros-Duna-dűlő and Százhalombatta. The results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill deployment than Százhalombatta. Taken in combination with the percentage frequencies the results show the highest investment of skill is in the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő.

5.2.9.4 *Urns* (Figure 5.9)

At Százhalombatta 62.5% of urns are in the 'good' category, 30% in the 'moderate' category and 7.5% in the 'poor' category. At Dunaújváros-Kosziderpadlás 56% are in the 'good' category, 44% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 1.910$; $p \leq 0.385$*). At Dunaújváros-Duna-dűlő 56% of urns are in the 'good' category, 34% in the 'moderate' category and 10% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 0.368$; $p \leq 0.832$*) or between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 1.489$; $p \leq 0.397$*). There is no difference between any of the sites for rim symmetry for urns. The investment of skill at all sites is high.

5.2.9.5 *All vessels* (Figure 5.9)

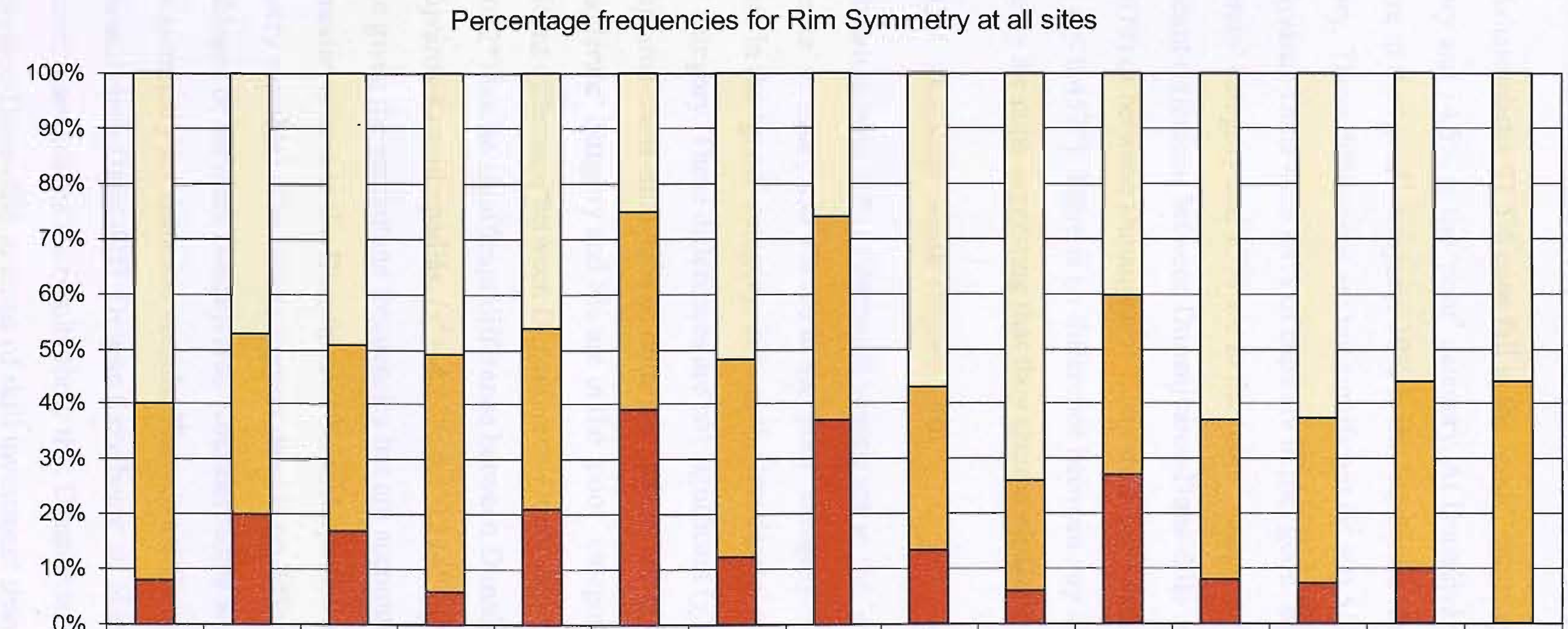
At Százhalombatta 60% of all vessels fall in the 'good' category, 32% in the 'moderate' category and 8% in the 'poor' category. At Dunaújváros-Kosziderpadlás 49% of all vessels are in the 'good' category, 34% are in the 'moderate' category and 17% are in the 'poor' category. These differences are significant ($\chi^2 = 7.657$; $p \leq 0.022$). At Dunaújváros-Duna-dűlő 47% of all vessels fall in the 'good' category, 33% are in the 'moderate' category and 20% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 23.977$; $p \leq 0.000$) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 1.657$; $p \leq 0.437$). There is a difference between the settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for rim symmetry for the all vessels group. There is no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results taken in combination with the percentage frequencies show the highest investment of skill is within the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő which share a similar investment of skill.

5.2.9.6 Rim symmetry, Summary

With regard to cups the results show that for rim symmetry there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. Taken in combination with percentage frequencies these results show the highest deployment of skill within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás.
For domestic vessels there is a higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For fineware the results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill deployment than Százhalombatta. Taken in combination with the percentage frequencies the results show the highest investment of skill is in the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő.
For urns there is no difference between any of the sites for rim symmetry suggesting that they share a similarly high investment of skill. For the all vessel group there is a difference between the settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for rim symmetry. There is no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results taken

in combination with the percentage frequencies show the highest investment of skill is within the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő which share a similar investment of skill (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.9 Percentage and Numeric frequencies for Rim Symmetry at all sites



	sz all	dn all	kp all	sz cups	dn cups	kpcups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	60%	47%	49%	51%	46%	25%	52%	26%	57.0%	74%	40%	63%	62.5%	56%	56%
moderate	32%	33%	34%	43%	33%	36%	35.5%	37%	30.0%	20%	33%	29%	30%	34%	44%
poor	8%	20%	17%	6%	21%	39%	12.5%	37%	13.3%	6%	27%	8%	7.5%	10%	0%

Numeric frequencies for Rim Symmetry at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	152	71	48	43	20	7	25	9	17	59	19	15	25	23	9
moderate	81	57	33	36	14	10	17	13	9	16	16	7	12	14	7
poor	19	39	17	5	9	11	6	13	4	5	13	2	3	4	0
N/A	103	33	64	56	5	24	7	7	12	17	6	14	23	15	14

5.2.10 Handle symmetry

5.2.10.1 Cups (Figure 5.10)

At Százhalombatta 51.5% cups fall in the 'good' category, 34% in the 'moderate' category and 14.5% in the 'poor' category. At Dunaújváros-Kosziderpadlás 59% of cups are in the 'good' category, 30% in the 'moderate' category and 11% in the 'poor' category. These differences are not significant ($\chi^2 = 0.511$; $p \leq 0.775$*). At Dunaújváros-Duna-dűlő 44% of cups are in the 'good' category, 41% are in the 'moderate' category and 15% are in the 'poor' category. These results show no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 0.775$; $p \leq 0.679$) or between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 1.567$; $p \leq 0.457$*). There is no difference between any of the assemblages for handle symmetry for cups suggesting that they share a similarly modest investment of skill.

5.2.10.2 Domestic vessels (Figure 5.10)

At Százhalombatta 80% of domestic vessels are in the 'good' category, 16% are in the 'moderate' category and 4% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 80% are in the 'good' category, 20% in the 'moderate' category and 0% are in the 'poor' category. These differences are not significant ($\chi^2 = 0.467$; $p \leq 0.792$*). At Dunaújváros-Duna-dűlő 42% of domestic vessels are in the 'good' category, 50% are in the 'moderate' category and 8% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 7.649$; $p \leq 0.022$*) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.335$; $p \leq 0.114$*). (*note: these results seem strange given the percentage frequencies but are accounted for by the very low number of domestic vessels in the Dunaújváros-Kosziderpadlás assemblage for the handle symmetry variable). The results suggest there is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő for handle symmetry for domestic vessels. There is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. Despite there being no observable difference between the settlement assemblages the results show that Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta. Therefore, taken in combination with the percentage frequency the results suggest a higher investment of skill in the settlement assemblages.

5.2.10.3 Fineware (Figure 5.10)

At Százhalombatta 81% of fineware falls in the 'good' category, 12% in the 'moderate' category and 7% in the 'poor' category. At Dunaújváros-Koszideipadlás 88% of fineware vessels are in the 'good' category, 12% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 1.482$; $p \leq 0.477$*). At Dunaújváros-Duna-dűlő 72% of fineware vessels are in the 'good' category, 21% in the 'moderate' category and 7% in the 'poor' category. The results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.145$; $p \leq 0.564$*) or between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidetpadlás, ($\chi^2 = 1.362$; $p \leq 0.506$*). The results show that there is no difference between any of the assemblages for handle symmetry for fineware. This suggests a similar investment of skill across all three assemblages.

5.2.10.4. Urns (Figure 5.10)

At Százhalombatta 82% of urns are in the 'good' category, 14% in the 'moderate' category and 4% in the 'poor' category. At Dunaújváros-Koszidetpadlás 94% are in the 'good' category, 6% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 1.359$; $p \leq 0.507$*). At Dunaújváros-Duna-dűlő 67% of urns are in the 'good' category, 22% in the 'moderate' category and 11% in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 1.646$; $p \leq 0.439$*) or between Dunaújváros-Duna-dűlő and Dunaújváros-Koszidetpadlás, ($\chi^2 = 4.494$; $p \leq 0.106$*). The results show that there is no difference between any of the assemblages for handle symmetry for urns. This suggests a similarly high investment of skill across all three assemblages.

5.2.10.5 All vessels (Figure 6.10)

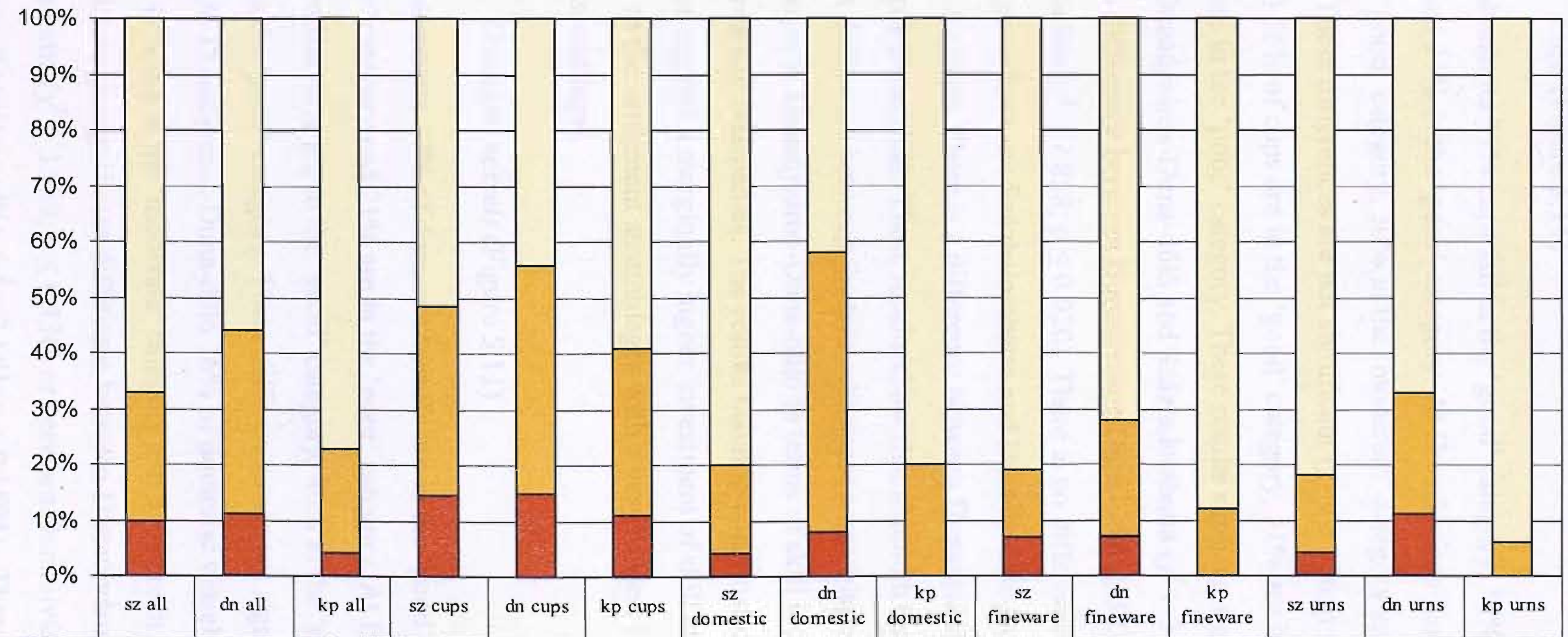
At Százhalombatta 67% of all vessels fall in the 'good' category, 23% in the 'moderate' category and 10% in the 'poor' category. At Dunaújváros-Koszidetpadlás 77% of all vessels are in the 'good' category, 19% are in the 'moderate' category and 4% are in the 'poor' category. These differences are not significant ($\chi^2 = 2.805$; $p \leq 0.246$). At Dunaújváros-Duna-dűlő 56% of all vessels fall in the 'good' category, 33% are in the 'moderate' category and 11% are in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 4.508$;

$p \leq 0.101$) but a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 8.032$; $p \leq 0.018$). There is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő for the all vessels group for handle symmetry. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the settlement assemblages Százhalombatta is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. Therefore, the results taken in combination with the percentage frequencies suggest the highest investment of skill is at Dunaújváros-Kosziderpadlás followed by Százhalombatta and then Dunaújváros-Duna-dűlő.

5.2.10.6 Handle symmetry, Summary

With regard to cups there is no difference between any of the assemblages for handle symmetry for cups suggesting that they share a similarly modest investment of skill. The results suggest there is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő for handle symmetry for domestic vessels. There is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. Despite there being no observable difference between the settlement assemblages the results show that Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta. Therefore, taken in combination with the percentage frequency the results suggest a higher investment of skill in the settlement assemblages. The results show that there is no difference between any of the assemblages for handle symmetry for urns or fineware. The results suggest a similarly high investment of skill across all three assemblages for these two vessel groups. For the all vessels group there is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the settlement assemblages Százhalombatta is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. Therefore, the results (Tables 5.2a, 5.2b, 5.2c, 5.2d), taken in combination with the percentage frequencies suggest the highest investment of skill is at Dunaújváros-Kosziderpadlás followed by Százhalombatta and then Dunaújváros-Duna-dűlő.

Figure 5.10 Percentage and Numeric frequencies for Handle Symmetry at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
good	67%	56%	77%	51.5%	44%	59%	80%	42%	80%	81%	72%	88%	82%	67%	94%
moderate	23%	33%	19%	34%	41%	30%	16%	50%	20%	12%	21%	12%	14%	22%	6%
poor	10%	11%	4%	14.5%	15%	11%	4%	8%	0%	7%	7%	0%	4%	11%	0%

Numeric frequencies for Handle Symmetry at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	131	72	53	46	17	16	20	10	8	47	21	15	18	24	15
moderate	44	42	14	30	16	8	4	12	2	7	6	2	3	8	1
poor	19	14	3	13	6	3	1	2	0	4	2	0	1	4	0
N/A	161	72	92	51	9	25	30	18	32	39	25	21	41	20	14

5.2.11 Profile symmetry

5.2.11.1 Cups (Figure 5.11)

At Százhalombatta 39% cups fall in the 'good' category, 38% in the 'moderate' category and 23% in the 'poor' category. At Dunaújváros-Kosziderpadlás 33% of cups are in the 'good' category, 30% in the 'moderate' category and 37% in the 'poor' category. These differences are not significant ($\chi^2 = 2.976$; $p \leq 0.226$). At Dunaújváros-Duna-dűlő 36% of cups are in the 'good' category, 51% are in the 'moderate' category and 13% are in the 'poor' category. These results show no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 3.585$; $p \leq 0.167$) but a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás ($\chi^2 = 7.858$; $p \leq 0.020$). There is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő for profile symmetry for cups. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable significant difference between the two settlement assemblages Százhalombatta is slightly closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. The results taken in combination with the percentage frequencies suggest a marginally higher investment of skill at Dunaújváros-Duna-dűlő compared to the settlement assemblages with a very modest investment of skill across all three assemblages.

5.2.11.2 Domestic vessels (Figure 5.11)

At Százhalombatta 37% of domestic vessels are in the 'good' category, 42% are in the 'moderate' category and 21% are in the 'poor' category. At Dunaújváros-Kosziderpadlás 40% are in the 'good' category, 40% in the 'moderate' category and 20% are in the 'poor' category. These differences are not significant ($\chi^2 = 0.024$; $p \leq 0.988$*). At Dunaújváros-Duna-dűlő 16% of domestic vessels are in the 'good' category, 47% are in the 'moderate' category and 37% are in the 'poor' category. These results indicate no significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 3.989$; $p \leq 0.136$) or between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 3.681$; $p \leq 0.159$*). There are no significant differences between any of the assemblages for profile symmetry for domestic vessels.

The results taken in combination with the percentage frequencies show that the investment of skill is modest within all three assemblages.

5.2.11.3 Fineware (Figure 5.11)

At Százhalombatta 78% of fineware falls in the 'good' category, 15% in the 'moderate' category and 7% in the 'poor' category. At Dunaújváros-Kosziderpadlás 92% of fineware vessels are in the 'good' category, 0% in the 'moderate' category and 8% in the 'poor' category. These differences are not significant ($\chi^2 = 2.137$; $p \leq 0.343$*). At Dunaújváros-Duna-dűlő 38% of fineware vessels are in the 'good' category, 38% in the 'moderate' category and 24% in the 'poor' category. The results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 17.255$; $p \leq 0.000$) and between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 11.203$; $p \leq 0.004$*). There is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. The results show there is a higher investment of skill within both settlement assemblages for profile symmetry for fineware.

5.2.11.4 Urns (Figure 5.11)

At Százhalombatta 65% of urns are in the 'good' category, 19% in the 'moderate' category and 16% in the 'poor' category. At Dunaújváros-Kosziderpadlás 89% are in the 'good' category, 11% in the 'moderate' category and 0% in the 'poor' category. These differences are not significant ($\chi^2 = 2.159$; $p \leq 0.340$*). At Dunaújváros-Duna-dűlő 49% of urns are in the 'good' category, 47% in the 'moderate' category and 4% in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 7.290$; $p \leq 0.026$*) but no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 4.936$; $p \leq 0.085$*). There is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő for profile symmetry for urns. There is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta. Taken in combination with the percentage frequencies the results show the greatest investment of skill is in the

Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő assemblages followed by Százhalombatta.

5.2.11.5 *All vessels* (Figure 5.11)

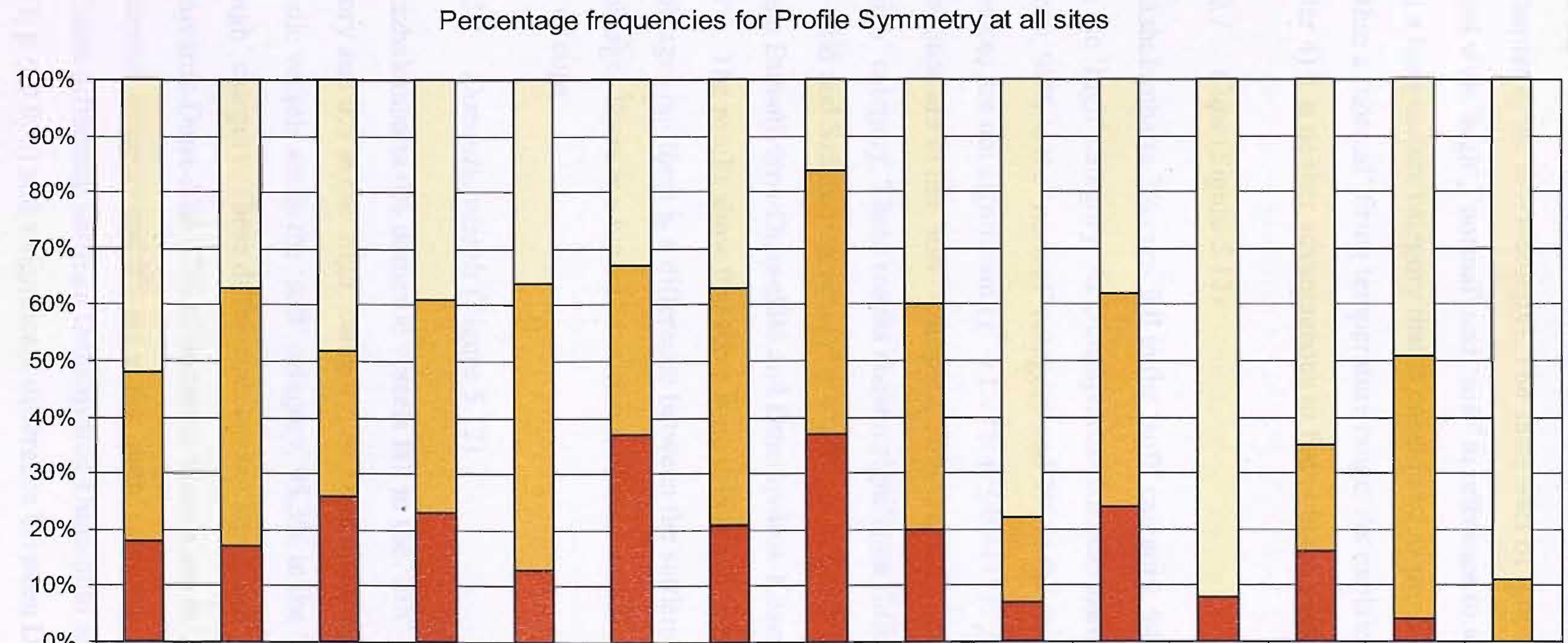
At Százhalombatta 52% of all vessels fall in the 'good' category, 30% in the 'moderate' category and 18% in the 'poor' category. At Dunaújváros-Kosziderpadlás 48% of all vessels are in the 'good' category, 26% are in the 'moderate' category and 26% are in the 'poor' category. These differences are not significant ($\chi^2 = 2.130$; $p \leq 0.345$). At Dunaújváros-Duna-dűlő 37% of all vessels fall in the 'good' category, 46% are in the 'moderate' category and 17% are in the 'poor' category. These results indicate a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 11.735$; $p \leq 0.003$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 8.773$; $p \leq 0.012$). The results for the all vessels group shows that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for profile symmetry.

5.2.11.6 *Profile symmetry, Summary*

With regard to cups the results show that although there is no observable significant difference between the two settlement assemblages Százhalombatta is slightly closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. The results taken in combination with the percentage frequencies suggest a marginally higher investment of skill at Dunaújváros-Duna-dűlő compared to the settlement assemblages with a very modest investment of skill across all three assemblages.
For domestic vessels there are no differences between any of the assemblages for profile symmetry. The investment of skill for domestic vessels is low within all three assemblages. For fineware there is a higher investment of skill within both settlement assemblages compared to the cemetery assemblage for profile symmetry for fineware. For urns the results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta (Tables 5.2a, 5.2b, 5.2c, 5.2d). Taken in combination with the percentage frequencies the results show the greatest investment of skill is in the Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő assemblages followed by Százhalombatta. The results for the all vessels

group shows that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for profile symmetry.

Figure 5.11 Percentage and Numeric frequencies for Profile Symmetry at al sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
□ good	52%	37%	48%	39%	36%	33%	37%	16%	40%	78%	38%	92%	65%	49%	89%
□ moderate	30%	46%	26%	38%	51%	30%	42%	47%	40%	15%	38%	0%	19%	47%	11%
■ poor	18%	17%	26%	23%	13%	37%	21%	37%	20%	7%	24%	8%	16%	4%	0%

Numeric frequencies for Profile Symmetry at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
good	116	65	39	45	17	15	9	5	6	45	18	11	17	25	8
moderate	67	81	22	43	24	14	10	15	6	9	18	0	5	24	1
poor	40	31	21	27	6	17	5	12	3	4	11	1	4	2	0
N/A	132	23	80	25	1	6	31	10	27	39	7	26	37	5	21

5.2.12 Firing

The firing variable is of a somewhat different nature to the other technological groups (see chapter 4, the methodology). The categories of 'good', 'moderate', and 'poor' are replaced with 'high', 'normal' and 'soft' in reference to whether vessels have been fired within a temperature category that is considered as providing a durable finished article — within a 'normal' firing temperature range. As explained within the methodology (chapter 4) it is neither advantageous to fire pots too softly or too highly.

5.2.12.1 Cups (Figure 5.12)

At Százhalombatta 2% cups fall in the 'soft' category, 94% in the 'normal' category and 4% in the 'high' category. At Dunaújváros-Kosziderpadlás 0% of cups are in the 'soft' category, 98% in the 'normal' category and 2% in the 'high' category. These differences are not significant ($\chi^2 = 1.776$; $p \leq 0.411$*). At Dunaújváros-Duna-dűlő 50% of cups are in the 'soft'' category, 50% are in the 'normal' category and 0% are in the 'high' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 67.291$; $p \leq 0.000$*) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 34.615$; $p \leq 0.000$*). The results show that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for firing of cups.

5.2.12.2 Domestic vessels (Figure 5.12)

At Százhalombatta 0% domestic vessels fall in the 'soft' category, 100% in the 'normal' category and 0% in the 'high' category. At Dunaújváros-Kosziderpadlás 2.3% of domestic vessels are in the 'soft' category, 95.3% in the 'normal' category and 2.3% in the 'high' category. These differences are not significant ($\chi^2 = 2.674$; $p \leq 0.236$*). At Dunaújváros-Duna-dűlő 37% of domestic vessels are in the 'soft'' category, 63% are in the 'normal' category and 0% are in the 'high' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 56.952$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 34.434$; $p \leq 0.000$*). The results show that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for firing of domestic vessels.

5.2.12.3 Fineware (Figure 5.12)

At Százhalombatta 1% fineware vessels fall in the 'soft' category, 96% in the 'normal' category and 3% in the 'high' category. At Dunaújváros-Kosziderpadlás 0% of fineware vessels are in the 'soft' category, 100% in the 'normal' category and 0% in the 'high' category. These differences are not significant ($\chi^2 = 0.418$; $p \leq 0.812$*). At Dunaújváros-Duna-dűlő 56% of fineware vessels are in the 'soft'' category, 44% are in the 'normal' category and 0% are in the 'high' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 66.515$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 33.497$; $p \leq 0.000$*). The results show that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for firing of fineware vessels.

5.2.12.4 Urns (Figure 5.12)

At Százhalombatta 1.5% urns fall in the 'soft' category, 95% in the 'normal' category and 3.5% in the 'high' category. At Dunaújváros-Kosziderpadlás 0% of urns are in the 'soft' category, 100% in the 'normal' category and 0% in the 'high' category. These differences are not significant ($\chi^2 = 1.428$; $p \leq 0.490$*). At Dunaújváros-Duna-dűlő 25% of urns are in the 'soft'' category, 75% are in the 'normal' category and 0% are in the 'high' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 16.087$; $p \leq 0.000$*) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 8.680$; $p \leq 0.002$*). The results show that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for firing of urns.

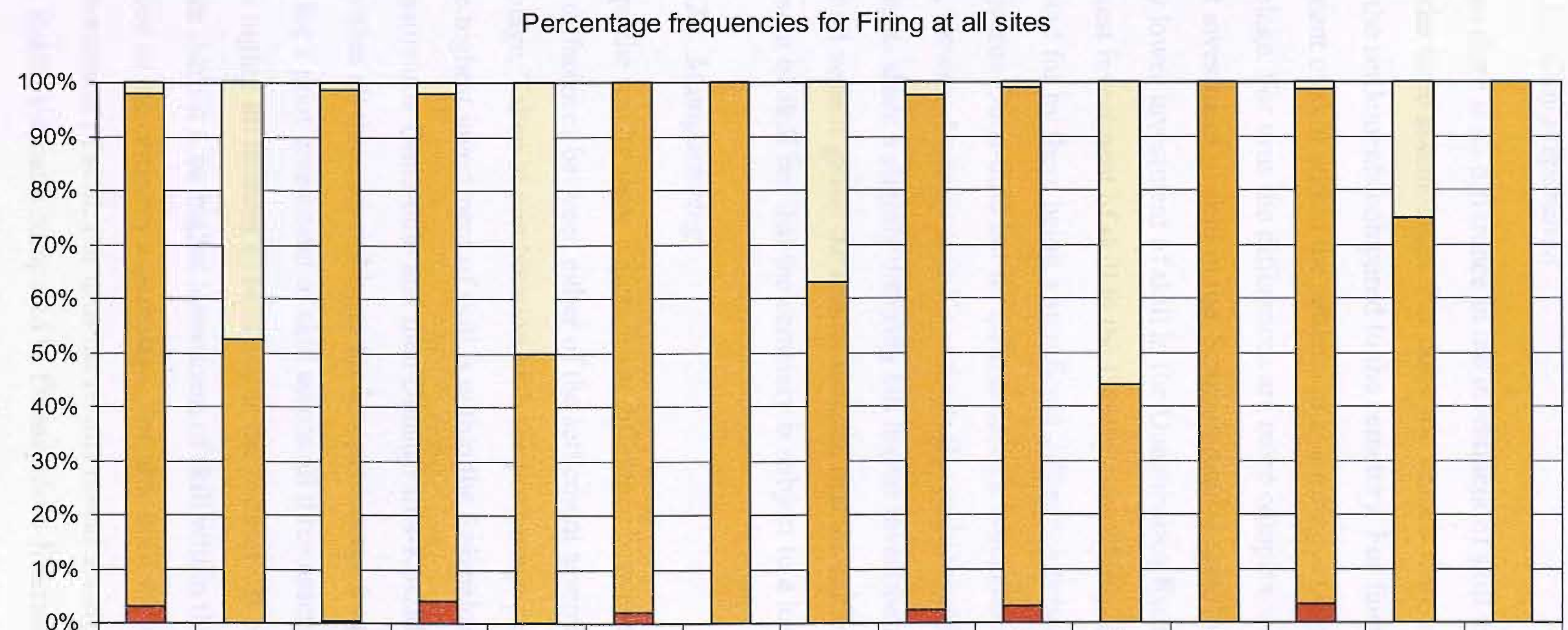
5.2.12.5 All vessels (Figure 5.12)

At Százhalombatta 2% all vessels fall in the 'soft' category, 95% in the 'normal' category and 3% in the 'high' category. At Dunaújváros-Kosziderpadlás 1.5% of all vessels are in the 'soft' category, 98% in the 'normal' category and 0.5% in the 'high' category. These differences are not significant ($\chi^2 = 1.377$; $p \leq 0.502$). At Dunaújváros-Duna-dűlő 47.5% of all vessels are in the 'soft'' category, 52.5% are in the 'normal' category and 0% are in the 'high' category. These results show a significant difference between Dunaújváros-Duna-dűlő and Százhalombatta ($\chi^2 = 200.089$; $p \leq 0.000$) and a significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás, ($\chi^2 = 102.343$; $p \leq 0.000$*). The results show that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for firing in the all vessels group.

5.2.12.6 Firing, Summary

The results show that for cups, domestic vessels, fineware, urns and the all vessels group there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher accuracy, investment of skill, within the settlement assemblages for the firing variable reflected by the very low frequency of either over-fired 'high' or under-fired 'soft' vessels in either of the settlement assemblages (Tables 5.2a, 5.2b, 5.2c, 5.2d).

Figure 5.12 Percentage and Numeric frequencies for Firing at all sites



	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz domestic	dn domestic	kp domestic	sz fineware	dn fineware	kp fineware	sz urns	dn urns	kp urns
Soft	2%	47.5%	1.5%	2%	50%	0%	0%	37%	2.3%	1%	56%	0%	1.5%	25%	0%
Normal	95%	52.5%	98%	94%	50%	98%	100%	63%	95.3%	96%	44%	100%	95%	75%	100%
High	3%	0%	0.5%	4%	0%	2%	0%	0%	2.3%	3%	0%	0%	3.5%	0%	0%

Numeric frequencies for Firing at all sites

	sz all	dn all	kp all	sz cups	dn cups	kp cups	sz dom.	dn dom.	kp dom.	sz fine.	dn fine.	kp fine.	sz urns	dn urns	kp urns
Soft	5	95	3	3	24	0	0	26	1	1	31	0	1	14	0
Normal	339	105	158	131	24	51	55	16	40	93	23	38	60	42	30
High	11	0	1	6	0	1	0	0	1	3	0	0	2	0	0

5.2.13 Summary of the differences between all three assemblages for all technological variables

5.2.13.1 Clay preparation

For cups there is no difference in the investment of skill for clay preparation between any of the three assemblages. For domestic vessels there is higher investment of skill within the settlements compared to the cemetery. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns the differences are more complex with the results indicating the highest investment of skill in the Százhalombatta assemblage, followed by a very slightly lower investment of skill in the Dunaújváros-Kosziderpadlás assemblage and the lowest investment of skill in the Dunaújváros-Duna-dűlő assemblage. This result is accounted for by there being a significant difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference, as a borderline result ($\chi^2 = 5.909$; p < or = 0.052), between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. The settlements share a slightly differing but higher investment of skill than the cemetery. For the all vessels group the results indicate that the settlement sites share a very similar investment of skill but that the cemetery is subject to a lower investment of skill

5.2.13.2 Manufacturing

For cups the results show a significant difference between the settlement assemblages but no differences between either of the settlement assemblages and the cemetery assemblage. Taken in combination with the percentage frequencies these results show that the highest investment of skill is within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás. The results show a trend within all three assemblages for low percentage frequencies in the 'good' category indicating a poor investment of skill across all three assemblages. For domestic vessels there is higher investment of skill within the settlements compared to the cemetery. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns both settlement assemblages' show a high investment of skill. For urns the results reveal a marginally higher investment of skill at Százhalombatta compared to Dunaújváros-Kosziderpadlás. Meanwhile the lowest investment of skill for the manufacturing variable for urns lies within the cemetery assemblage. For the all vessels group the results show that for the manufacturing variable there is a distinction to be drawn between the two settlement assemblages and the cemetery assemblage with a higher investment of skill observed in the settlement assemblages.

5.2.13.3 Wall thickness

For cups there is little or no difference in investment of skill, which is low, for wall thickness for all of the assemblages. For domestic vessels the results show that for wall thickness there is a difference between the two settlement assemblages representing a slightly higher investment of skill at Százhalombatta. This accounts for there being a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Kosziderpadlás and the Dunaújváros-Duna-dűlő. The highest investment of skill is at Százhalombatta, followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For urns the results show that there is no significant difference between any of the assemblages in relation to the wall thickness variable indicating a similarly high investment of skill across all three assemblages. For the all vessels group the results show the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Kosziderpadlás assemblage and a lower investment of skill within the cemetery assemblage compared to the settlement assemblages.

5.2.13.4 Additions

With regard to cups the results indicate that there is no difference in the investment of skill for additions between any of the assemblages. The investment of skill is low within all three assemblages. For domestic vessels the results show no difference between the settlement assemblages and no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő but a difference between Százhalombatta and Dunaújváros-Duna-dűlő indicating that the highest investment of skill is at Százhalombatta. For fineware the results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage. For urns there is no difference to be observed between any of the assemblages with a high investment of skill across all assemblages. For the all vessels group the results indicate a higher investment of skill within both settlement assemblages compared to the cemetery assemblage.

5.2.13.5 Interior surface treatment

With regard to cups there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszíderpadlás. The results show that for interior surface treatment for cups the highest investment of skill is in the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Koszíderpadlás. Percentage frequencies across all assemblages suggest a low investment of skill. For domestic vessels there is a higher investment of skill for interior surface treatments within the settlement assemblages compared to the cemetery assemblage. For fineware there is a far higher investment of skill for interior surface treatment within the settlement assemblages. For urns the results show no difference between any of the assemblages for interior surface treatment. The investment of skill is high for urns across all assemblages. For the all vessels group the results suggests that despite there being no observable difference between the settlement assemblages the investment of skill is closer between Dunaújváros-Duna-dűlő and Dunaújváros-Koszíderpadlás than it is between Dunaújváros-Duna-dűlő and Százhalombatta. This implies a slightly higher investment of skill within the Százhalombatta assemblage compared to Dunaújváros-Koszíderpadlás assemblage and a lower investment of skill within the cemetery assemblage compared to the settlement assemblages.

5.2.13.6 Exterior surface treatment

With regard to cups the results show that there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for exterior surface treatments for cups. There is no difference between Dunaújváros-Duna-dűlő and Dunaújváros-Koszíderpadlás. These results taken in combination with the percentage frequencies show the highest investment of skill for exterior surface treatment is in the Dunaújváros-Koszíderpadlás and the Dunaújváros-Duna-dűlő assemblages. There is a lower investment of skill in the Százhalombatta assemblage. This said the percentage frequencies indicate a low investment of skill across all assemblages. For domestic vessels there is a higher investment of skill within the settlement assemblages. For fineware there is a far higher investment of skill within the settlement assemblages compared to the cemetery. For urns there is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő but there is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill than Százhalombatta. Therefore, taken in combination with the percentage frequencies the results show the highest investment of skill for exterior surface treatment is at Százhalombatta, followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő. The results for the all vessels group show that there is a difference between all three sites for exterior surface treatments. The results, taken in combination with percentage frequencies, suggest the highest deployment of skill within the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta, and the lowest investment of skill in the Dunaújváros-Duna-dűlő assemblage.

5.2.13.7 Decoration

The results show that for decoration there is no difference between any of the sites for cups, domestic vessels, fineware or urns. The results for the all vessels group show a slightly higher investment of skill for decoration in the settlement assemblages compared to the cemetery assemblage.

5.2.13.8 Rim deviation on the horizontal plane

With regard to cups the results show that for rim deviation on the horizontal plane there is a difference between all three assemblages with a higher investment of skill at Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás compared to Százhalombatta. For domestic vessels there is no difference between the two settlement assemblages but there is a difference between the settlements and the cemetery, reflecting a higher investment of skill within the settlement assemblages. For fineware there is no difference between the two settlement assemblages for rim deviation on the horizontal plane but there is a difference between the settlements and the cemetery, reflecting a higher investment of skill for fineware within the settlement assemblages. For urns there is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the two settlement assemblages Százhalombatta is closer to

Dunaújváros-Duna-dűlő in terms of skill than Dunaújváros-Kosziderpadlás. These results taken in combination with the percentage frequencies show that the highest deployment of skill for rim deviation on the horizontal plane for urns is in the Dunaújváros-Kosziderpadlás assemblage, followed by Százhalombatta and then Dunaújváros-Duna-dűlő. For the all vessels groups the results show a higher investment of skill within the settlement assemblages compared to the cemetery.

5.2.13.9 Rim symmetry

With regard to cups the results show that for rim symmetry there is a difference between the two settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő but no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. Taken in combination with percentage frequencies these results show the highest deployment of skill within the Százhalombatta assemblage, followed by Dunaújváros-Duna-dűlő and then Dunaújváros-Kosziderpadlás.
For domestic vessels there is a higher investment of skill within the settlement assemblages compared to the cemetery assemblage. For fineware the results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill deployment than Százhalombatta. Taken in combination with the percentage frequencies the results show the highest investment of skill is in the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and then Dunaújváros-Duna-dűlő. For urns there is no difference between any of the sites for rim symmetry suggesting that they share a similarly high investment of skill. For the all vessel group there is a difference between the settlement assemblages and a difference between Százhalombatta and Dunaújváros-Duna-dűlő for rim symmetry. There is no difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results taken in combination with the percentage frequencies show the highest investment of skill is within the Százhalombatta assemblage followed by Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő which share a similar investment of skill.

5.2.13.10 Handle symmetry

With regard to cups there is no difference between any of the assemblages for handle symmetry for cups suggesting that they share a similarly modest investment of skill. The results suggest there is no difference between the settlement assemblages or between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő for handle symmetry for domestic vessels. There is a difference between Százhalombatta and Dunaújváros-Duna-dűlő. Despite there being no observable difference between the settlement assemblages the results show that Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta. Therefore, taken in combination with the percentage frequency the results suggest a higher investment of skill in the settlement assemblages. The results show that there is no difference between any of the assemblages for handle symmetry for urns or fineware. The results suggest a similarly high investment of skill across all three assemblages for these two vessel groups. For the all vessels group there is no difference between the settlement assemblages or between Százhalombatta and Dunaújváros-Duna-dűlő. There is a difference between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő. These results show that although there is no observable difference between the settlement assemblages Százhalombatta is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. Therefore, the results taken in combination with the percentage frequencies suggest the highest investment of skill is at Dunaújváros-Kosziderpadlás followed by Százhalombatta and then Dunaújváros-Duna-dűlő

5.2.13.11 Profile symmetry

With regard to cups the results show that although there is no observable significant difference between the two settlement assemblages Százhalombatta is slightly closer to Dunaújváros-Duna-dűlő in terms of skill investment than Dunaújváros-Kosziderpadlás. The results taken in combination with the percentage frequencies suggest a marginally higher investment of skill at Dunaújváros-Duna-dűlő compared to the settlement assemblages with a very modest investment of skill across all three assemblages.
For domestic vessels there are no differences between any of the assemblages for profile symmetry. The investment of skill for domestic vessels is low within all three assemblages. For fineware there is a higher investment of skill within both settlement assemblages compared to the cemetery assemblage for profile symmetry for fineware. For urns the results show that although there is no observable difference between the two settlement assemblages Dunaújváros-Kosziderpadlás is closer to Dunaújváros-Duna-dűlő in terms of skill investment than Százhalombatta. Taken in combination with the percentage frequencies the results show the greatest investment of skill is in the

Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő assemblages followed by Százhalombatta. The results for the all vessels group shows that there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher investment of skill within the settlement assemblages for profile symmetry.

5.2.13.12 Firing

The results show that for cups, domestic vessels, fineware, urns and the all vessels group there is no difference between the settlement assemblages but there is a difference between the settlements and the cemetery assemblage. There is a higher accuracy, investment of skill, within the settlement assemblages for the firing variable.

Table 5.2a Summary chart showing numbers of significant differences for each technological variable between each site for cups, domestic vessels, urns, fineware and the all vessels group

	clay peparation	manufacturing	wall thickness	additions	interior surface treatments	exterior surface treatments	decoration	rim deviation on the h. plane	rim symmetry	handle symmetry	profile symmetry	firing	**significant differences**
sz/kp cups	x	✓	x	x	✓	✓	x	✓	✓	x	x	x	**5**
sz/dn cups	x	x	✓	x	✓	✓	x	✓	✓	x	x	✓	**6**
kp/dn cups	x	x	x	x	x	x	x	✓	x	x	✓	✓	**3**
sz/kp domestic	x	x	✓	x	x	x	x	x	x	x	x	x	**1**
sz/dn domestic	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	x	✓	**10**
kp/dn domestic	✓	✓	x	x	✓	✓	x	✓	✓	x	x	✓	**7**
sz/kp urns	x	x	x	x	x	x	x	x	x	x	x	x	**0**
sz/dn urns	✓	✓	x	x	x	✓	x	x	x	x	✓	✓	**5**
kp/dn urns	x	x	x	x	x	x	x	✓	x	x	x	✓	**2**
sz/kp fineware	x	x	x	x	x	x	x	x	x	x	x	x	**0**
sz/dn fineware	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	✓	**10**
kp/dn fineware	✓	✓	✓	✓	✓	✓	x	✓	x	x	✓	✓	**9**
sz/kp all vessels	x	x	x	x	x	✓	x	x	✓	x	x	x	**2**
sz/dn all vessels	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	**11**
kp/dn vessels	✓	✓	x	✓	x	✓	✓	✓	x	✓	✓	✓	**9**

Table 5.2b Chi Square comparisons between Százhalombatta and Dunaújváros-Kosziderpadlás (note: * = pearson number, statistics in bold = significant differences)

Technological Variable/ Vessel group	Százhalombatta (N)			Dunaújvaros-Koszidcrpadlás (N)			X^2 =	df	p = 0.05
Cups	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	26	47	67	10	19	23	0.212	2	.899
Manufacturing	39	49	52	17	28	7	**11.615**	**2**	**.003**
Wall Thickness	43	34	58	13	22	16	5.511	2	.064
Additions	32	25	34	6	12	8	3.276	2	.194
Interior Surface Treatment	37	33	57	11	28	13	**12.711**	**2**	**.002**
Exterior Surface Treatment	34	48	55	2	21	29	**13.859**	**2**	**.001**
Decoration	9	1	14	3	2	5	2.206	2	.332*
Rim Deviation on H. Plane	27	49	14	15	7	4	**7.438**	**2**	**.024***
Rim symmetry	5	36	43	11	10	7	**19.821**	**2**	**.000***
Handle symmetry	13	30	46	3	8	16	0.511	2	.775*
Profile symmetry	27	43	45	17	15	14	2.976	2	.226
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	3	6	131	0	1	51	1.776	2	.411*
Domestic vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	5	14	36	10	11	21	4.307	2	.116
Manufacturing	1	20	34	2	14	26	0.730	2	.694*
Wall Thickness	10	19	26	19	13	10	**9.590**	**2**	**.008**
Additions	2	7	14	3	3	5	2.088	2	.352*
Interior Surface Treatment	4	21	30	5	15	22	0.611	2	.737*
Exterior Surface Treatment	5	23	27	7	15	20	1.331	2	.514
Decoration	7	14	13	5	6	14	2.285	2	.319
Rim Deviation on H. Plane	4	32	10	3	24	9	0.121	2	.941*
Rim symmetry	6	17	25	4	9	17	0.245	2	.885*
Handle symmetry	1	4	20	0	2	8	0.467	2	.792*
Profile symmetry	5	10	9	3	6	6	0.024	2	.988*
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	0	0	55	1	1	40	2.674	2	.236*
Urns	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	5	11	47	4	10	16	4.236	2	.120*
Manufacturing	2	14	47	0	10	20	2.102	2	.350*
Wall Thickness	9	14	40	4	4	22	1.138	2	.566*
Additions	1	8	14	0	3	13	2.122	2	.346*
Interior Surface Treatment	3	26	34	3	10	17	1.222	2	.543*
Exterior Surface Treatment	8	11	44	0	9	21	5.296	2	.071*
Decoration	1	10	20	1	3	15	1.702	2	.427*
Rim Deviation on H. Plane	2	18	14	0	10	10	1.418	2	.492*
Rim symmetry	3	12	25	0	7	9	1.910	2	.385*
Handle symmetry	1	3	18	0	1	15	1.359	2	.507*
Profile symmetry	4	5	17	0	1	8	2.159	2	.340*
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	2	60	0	0	29	1.428	1	.490*
Fineware	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	3	12	82	3	5	30	1.533	2	.465*
Manufacturing	3	28	66	2	7	29	1.762	2	.414*
Wall Thickness	7	25	63	2	4	32	4.498	2	.106*
Additions	5	14	42	0	3	17	2.632	2	.268*
Interior Surface Treatment	7	17	73	3	9	26	0.729	2	.695*
Exterior Surface Treatment	6	11	79	2	4	32	0.078	2	.962*
Decoration	4	15	44	2	4	18	0.570	2	.752*
Rim Deviation on H. Plane	7	28	35	1	6	20	4.685	2	.096*
Rim symmetry	5	16	59	2	7	15	1.149	2	.563*
Handle symmetry	4	7	47	0	3	14	1.482	2	.477*
Profile symmetry	4	9	45	1	0	11	2.137	2	.343*
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	3	93	0	1	37	0.418	2	.812*
All Vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	39	84	232	27	45	90	5.176	2	.075
Manufacturing	45	111	199	21	59	82	1.502	2	.472
Wall Thickness	69	92	187	38	43	80	1.081	2	.582
Additions	40	54	104	9	21	43	2.416	2	.299
Interior Surface Treatment	51	97	194	22	62	78	4.976	2	.083
Exterior Surface Treatment	53	93	205	11	49	102	**7.789**	**2**	**0.02**
Decoration	21	40	91	11	15	52	1.504	2	.471
Rim Deviation on H. Plane	40	127	73	19	47	43	3.293	2	.193
Rim symmetry	19	81	152	17	33	48	**7.657**	**2**	**.022**
Handle symmetry	19	44	131	3	14	53	2.805	2	.246
Profile symmetry	40	67	116	21	22	39	2.130	2	.345
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	5	11	339	1	3	157	1.377	2	.502

Table 5.2c Chi Square comparisons between Szazhalombatta and Dunaújváros-Duna-dűlő (note: * = pearson number, statistics in bold = significant differences)

Technological Variable/ Vessel group	Százhalombatta (N)			Dunaújváros-Duna-dűlő (N)			X² =	df	p = 0.05
Cups	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	26	47	67	10	24	14	5.648	2	.059
Manufacturing	39	49	52	10	25	13	4.306	2	.116
Wall Thickness	43	34	58	8	20	20	**32.000**	**2**	**0.43**
Additions	32	25	34	11	15	12	1.766	2	.413
Interior Surface Treatment	37	33	57	7	25	16	**10.984**	**2**	**.004**
Exterior Surface Treatment	34	48	55	3	27	18	**11.438**	**2**	**.003**
Decoration	9	1	14	4	0	3	1.027	2	.598*
Rim Deviation on H. Plane	27	49	14	3	25	12	**10.429**	**2**	**.005**
Rim symmetry	5	36	43	9	14	20	**6.680**	**2**	**.035***
Handle symmetry	13	30	46	6	16	17	0.775	2	.679
Profile symmetry	27	43	45	6	24	17	3.585	2	.167
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	3	6	131	24	0	24	**67.291**	**2**	**.000***
Domestic vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	5	14	36	17	18	7	**27.074**	**2**	**.000**
Manufacturing	1	20	34	9	23	10	**19.000**	**2**	**.000***
Wall Thickness	10	19	26	22	7	13	**13.036**	**2**	**.001**
Additions	2	17	14	8	11	5	**9.169**	**2**	**.010***
Interior Surface Treatment	4	21	30	11	24	7	**17.249**	**2**	**.000**
Exterior Surface Treatment	5	23	27	16	16	10	**13.687**	**2**	**.001**
Decoration	7	14	13	10	11	8	1.698	2	.428
Rim Deviation on H. Plane	4	32	10	9	22	1	**8.913**	**2**	**.012***
Rim symmetry	6	17	25	13	13	9	**8.966**	**2**	**.011**
Handle symmetry	1	4	20	2	12	10	**7.649**	**2**	**.022***
Profile symmetry	5	10	9	12	15	5	3.989	2	.136
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	0	0	55	26	0	16	**56.952**	**1**	**.000**
Urns	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	5	11	47	11	30	15	**28.386**	**2**	**.000**
Manufacturing	2	14	47	6	22	28	**8.208**	**2**	**.017***
Wall Thickness	9	14	40	12	14	28	1.866	2	.393
Additions	1	8	14	3	9	21	0.695	2	.706*
Interior Surface Treatment	3	26	34	1	22	33	0.940	2	.625*
Exterior Surface Treatment	8	11	44	1	22	33	**10.306**	**2**	**.006***
Decoration	1	10	20	6	13	23	2.573	2	.276*
Rim Deviation on H. Plane	2	18	14	4	24	7	3.843	2	.146*
Rim symmetry	3	12	25	4	14	23	0.368	2	.832*
Handle symmetry	1	3	18	4	8	24	1.646	2	.439*
Profile symmetry	4	5	17	2	24	25	**7.290**	**2**	**.026***
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	2	60	14	0	42	**16.087**	**2**	**.000***
Fineware	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	3	12	82	11	31	12	**59.648**	**2**	**.000**
Manufacturing	3	28	66	18	24	12	**39.353**	**2**	**.000**
Wall Thickness	7	25	63	21	16	15	**28.363**	**2**	**.000**
Additions	5	14	42	9	11	9	**13.139**	**2**	**.001***
Interior Surface Treatment	7	17	73	12	21	21	**19.786**	**2**	**.000**
Exterior Surface Treatment	6	11	79	9	23	22	**27.153**	**2**	**.000**
Decoration	4	15	44	6	13	18	5.026	2	.081*
Rim Deviation on H. Plane	7	28	35	13	29	5	**22.605**	**2**	**.000**
Rim symmetry	5	16	59	13	16	19	**17.120**	**2**	**.000**
Handle symmetry	4	7	47	2	6	21	1.145	2	.564*
Profile symmetry	4	9	45	11	18	18	**17.255**	**2**	**.000**
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	3	93	31	0	23	**66.515**	**2**	**.000**
All vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	39	84	232	49	103	48	**90.805**	**2**	**.000**
Manufacturing	45	111	199	43	94	63	**31.754**	**2**	**.000**
Wall Thickness	69	92	187	63	57	76	**13.879**	**2**	**.001**
Additions	40	54	104	31	46	47	**6.685**	**2**	**.035**
Interior Surface Treatment	51	97	194	31	92	77	**19.632**	**2**	**.000**
Exterior Surface Treatment	53	93	205	29	88	83	**18.700**	**2**	**.000**
Decoration	21	40	91	26	37	52	**6.278**	**2**	**.043**
Rim Deviation on H. Plane	40	127	73	29	100	25	**10.611**	**2**	**.005**
Rim symmetry	19	81	152	39	57	71	**23.977**	**2**	**.000**
Handle symmetry	19	44	131	14	42	72	4.580	2	.101
Profile symmetry	40	67	116	31	81	65	**11.735**	**2**	**.003**
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	5	11	339	95	0	105	**200.089**	**2**	**.000**

Table 5.2d Chi Square comparisons between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő (note: * = pearson number, statistics in bold = significant differences)

Technological Variable/ Vessel group	Dunaújvaros-Koszidcrpadlás (N)			Dunaújváros-Duna-dűlő (N)			X^2 =	df	p = 0.05
Cups	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	10	19	23	10	24	14	2.634	2	.268
Manufacturing	17	28	7	10	25	13	3.674	2	.159
Wall Thickness	13	22	16	8	20	20	2.574	2	.462*
Additions	6	12	8	11	15	12	0.369	2	.832
Interior Surface Treatment	11	28	13	7	25	16	1.217	2	.544
Exterior Surface Treatment	2	21	29	3	27	18	3.370	2	.185*
Decoration	3	2	5	4	0	3	2.181	2	.336*
Rim Deviation on H. Plane	15	7	4	3	25	12	**20.668**	**2**	**.000**
Rim symmetry	11	10	7	9	14	20	4.204	2	.122
Handle symmetry	3	8	16	6	16	17	1.567	2	.457*
Profile symmetry	17	15	14	6	24	17	**7.858**	**2**	**.020**
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	0	1	51	24	0	24	**34.615**	**2**	**.000***
Domestic vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	10	11	21	17	18	7	**10.868**	**2**	**.004**
Manufacturing	2	14	26	9	23	10	**14.395**	**2**	**.001**
Wall Thickness	19	13	10	22	7	13	2.440	2	.295
Additions	3	3	5	8	11	5	2.338	2	.311*
Interior Surface Treatment	5	15	22	11	24	7	**12.550**	**2**	**.002**
Exterior Surface Treatment	7	15	20	16	16	10	**7.048**	**2**	**.029**
Decoration	5	6	14	10	11	8	4.552	2	.103
Rim Deviation on H. Plane	3	24	9	9	22	1	**9.284**	**2**	**.010***
Rim symmetry	4	9	17	13	13	9	**7.865**	**2**	**.020**
Handle symmetry	0	2	8	2	12	10	4.335	2	.114*
Profile symmetry	3	6	6	12	15	5	3.681	2	.159*
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	1	40	26	0	16	**34.434**	**2**	**.000***
Urns	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	4	10	16	11	30	15	5.909	2	.052
Manufacturing	0	10	20	6	22	28	4.373	2	.112*
Wall Thickness	4	4	22	12	14	28	3.838	2	.147
Additions	0	3	13	3	9	21	2.256	2	.324*
Interior Surface Treatment	3	10	17	1	22	33	3.037	2	.219*
Exterior Surface Treatment	0	9	21	1	22	33	1.384	2	.500*
Decoration	1	3	15	6	13	23	3.303	2	.192*
Rim Deviation on H. Plane	0	10	10	4	24	7	**6.702**	**2**	**.035***
Rim symmetry	0	7	9	4	14	23	1.849	2	.397*
Handle symmetry	0	1	15	4	8	24	4.494	2	.106*
Profile symmetry	0	1	8	2	24	25	4.936	2	.085*
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	0	0	29	14	0	42	**8.680**	**1**	**.002***
Fineware	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	3	5	30	11	31	12	**30.928**	**2**	**.000**
Manufacturing	2	7	29	18	24	12	**29.049**	**2**	**.000**
Wall Thickness	2	4	32	21	16	15	**30.108**	**2**	**.000**
Additions	0	3	17	9	11	9	**14.882**	**2**	**.001***
Interior Surface Treatment	3	9	26	12	21	21	**8.455**	**2**	**.015**
Exterior Surface Treatment	2	4	32	9	23	22	**17.421**	**2**	**.000***
Decoration	2	4	18	6	13	18	4.184	2	.123*
Rim Deviation on H. Plane	1	6	20	13	29	5	**32.817**	**2**	**.000**
Rim symmetry	2	7	15	13	16	19	4.948	2	.102
Handle symmetry	0	3	14	2	6	21	1.362	2	.506*
Profile symmetry	1	0	11	11	18	18	**11.203**	**2**	**.004***
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	0	1	37	31	0	23	**33.497**	**2**	**.000***
All vessels	**Poor**	**Moderate**	**Good**	**Poor**	**Moderate**	**Good**			
Clay Preparation	27	45	90	49	103	48	**38.802**	**2**	**.000**
Manufacturing	21	59	82	43	94	63	**14.297**	**2**	**.001**
Wall Thickness	38	43	80	63	57	76	4.885	2	.087
Additions	9	21	43	31	46	47	**9.180**	**2**	**.010**
Interior Surface Treatment	22	62	78	31	92	77	3.428	2	.180
Exterior Surface Treatment	11	49	102	29	88	83	**17.614**	**2**	**.000**
Decoration	11	15	52	26	37	52	**8.730**	**2**	**.013**
Rim Deviation on H. Plane	19	47	43	29	100	25	**18.729**	**2**	**.000**
Rim symmetry	17	33	48	39	57	71	1.657	2	.437
Handle symmetry	3	14	53	14	42	72	**8.032**	**2**	**.018**
Profile symmetry	21	22	39	31	81	65	**8.773**	**2**	**.012**
	Soft	**High**	**Normal**	**Soft**	**High**	**Normal**			
Firing	1	3	157	95	0	105	**102.343**	**2**	**.000***

5.3 The vessel groups: differences within each assemblage

The data in this section is presented slightly differently to the preceding section. In order to establish differences between vessel groups within each assemblage it is necessary to compare all technological variables for each vessel combination. This results in too much information to be presented within the text. To solve this problem each site is discussed in turn and the Pearson Chi-squared results are presented in table format after the text for each vessel combination. Charts presenting percentage and numeric frequencies for each vessel group are located at the end of the discussion of each assemblage. For the purpose of this analysis the firing variable is presented within separate charts owing to the necessarily different criteria of 'soft', 'normal' and 'high' noted previously.

5.3.1 Százhalombatta

5.3.1.1 Cups and domestic vessels

The results show seven significant differences between cups and domestic vessels at Százhalombatta (Table 5.3). Of these seven variables six, when taken in combination with the percentage frequencies (Figure 5.13, 5.14 & 5.17) show a greater investment of skill in domestic vessels. The variable of decoration shows a greater investment of skill for cups. These results, taken in combination with the percentage frequencies for cups (Figure 5.13) and domestic vessels (Figure 5.14), show that cups are subject to a lower investment of skill than domestic vessels within this assemblage.

Table 5.3 Pearson Chi-Squared tests showing differences between cups and domestic vessels at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Cups (N)			Százhalombatta Domestic (N)			$X^2 =$	df	p < or = 0.05
Cups/Domestic	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	26	47	67	5	14	36	5.580	2	.061
Manufacturing	39	49	52	1	20	34	**24.146**	**2**	**.000**
Wall Thickness	43	34	58	10	19	26	4.188	2	.123
Additions	32	25	34	2	7	14	**7.862**	**2**	**.020**
Interior Surface Treatment	37	33	57	4	21	30	**12.554**	**2**	**.002**
Exterior Surface Treatment	34	48	55	5	23	27	**6.773**	**2**	**.034**
Decoration	9	1	14	7	14	13	**12.001**	**2**	**.002**
Rim Deviation on H. Plane	27	49	14	4	32	10	**8.903**	**2**	**.012**
Rim symmetry	5	36	43	6	17	25	1.997	2	.368*
Handle symmetry	13	30	46	1	4	20	**6.543**	**2**	**.038***
Profile symmetry	27	43	45	5	10	9	0.169	2	.919
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	3	6	131	0	0	55	3.707	2	.157*

5.3.1.2 Cups and urns

The results show ten significant differences between cups and urns at Százhalombatta (Table 5.4). When taken in combination with the percentage frequencies for cups (Figure 5.13 & 5.17) and urns (Figure 5.15 & 5.17) the results show that for these ten variables cups receive a lower investment of skill than urns within this assemblage.

Table 5.4 Pearson Chi-Squared tests showing differences between cups and urns at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Cups (N)			Százhalombatta Urns (N)			X^2 =	df	p < or = 0.05
Cups/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	26	47	67	5	11	47	**13.221**	**2**	**.001**
Manufacturing	39	49	52	2	14	47	**31.751**	**2**	**.000**
Wall Thickness	43	34	58	9	14	40	**9.297**	**2**	**.010**
Additions	32	25	34	1	8	14	**11.178**	**2**	**.004**
Interior Surface Treatment	37	33	57	3	26	34	**18.865**	**2**	**.000**
Exterior Surface Treatment	34	48	55	8	11	44	**15.538**	**2**	**.000**
Decoration	9	1	14	1	10	20	**14.161**	**2**	**.001***
Rim Deviation on H. Plane	27	49	14	2	18	14	**14.323**	**2**	**.001**
Rim symmetry	5	36	43	3	12	25	1.890	2	.389*
Handle symmetry	13	30	46	1	3	18	**6.584**	**2**	**.037***
Profile symmetry	27	43	45	4	5	17	**6.040**	**2**	**.049**
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	3	6	131	1	2	60	0.217	2	.897*

5.3.1.3 Cups and fineware

The results show eleven significant differences between cups and fineware at Százhalombatta (Table 5.5). When taken in combination with the percentage frequencies for cups (Figure 5.13 & 5.17) and fineware (Figure 5.16 & 5.17) at Százhalombatta the results show that for these eleven variables cups receive a lower investment of skill than fineware within this assemblage.

Table 5.5 Pearson Chi-Squared tests showing differences between cups and fineware at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Cups (N)			Százhalombatta Fineware (N)			X^2 =	df	p < or = 0.05
Cups/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	26	47	67	3	12	82	**36.773**	**2**	**.000**
Manufacturing	39	49	52	3	28	66	**36.230**	**2**	**.000**
Wall Thickness	43	34	58	7	25	63	**23.411**	**2**	**.000**
Additions	32	25	34	5	14	42	**20.015**	**2**	**.000**
Interior Surface Treatment	37	33	57	7	17	73	**25.594**	**2**	**.000**
Exterior Surface Treatment	34	48	55	6	11	79	**43.735**	**2**	**.000**
Decoration	9	1	14	4	15	44	**15.278**	**2**	**.000***
Rim Deviation on H. Plane	27	49	14	7	28	35	**25.151**	**2**	**.000**
Rim symmetry	5	36	43	5	16	59	**10.111**	**2**	**.006***
Handle symmetry	13	30	46	4	7	47	**13.840**	**2**	**.001**
Profile symmetry	27	43	45	4	9	45	**24.169**	**2**	**.000**
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	3	6	131	1	3	93	0.667	2	.717*

5.3.1.4 Domestic vessels and urns

The results show only two significant differences between domestic vessels and urns at Százhalombatta (Table 5.6). When taken in combination with the percentage frequencies for domestic vessels (Figure 5.14 & 5.17) and urns (Figure 5.15 & 5.17) at Százhalombatta the results show that for these two variables domestic vessels receive a lower investment of skill than urns within this assemblage.

Table 5.6 Pearson Chi-Squared tests showing differences between domestic vessels and urns at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Domestic (N)			Százhalombatta Urns (N)			X² =	df	p < or = 0.05
Domestic/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	5	14	36	5	11	47	1.281	2	.527*
Manufacturing	1	20	34	2	14	47	2.950	2	.229*
Wall Thickness	10	19	26	9	14	40	3.263	2	.196
Additions	2	7	14	1	8	14	0.400	2	.819*
Interior Surface Treatment	4	21	30	3	26	34	0.384	2	.825*
Exterior Surface Treatment	5	23	27	8	11	44	**8.495**	**2**	**.014**
Decoration	7	14	13	1	10	20	**6.527**	**2**	**.038***
Rim Deviation on H. Plane	4	32	10	2	18	14	3.533	2	.171*
Rim symmetry	6	17	25	3	12	25	1.144	2	.564*
Handle symmetry	1	4	20	1	3	18	0.057	2	.972*
Profile symmetry	5	10	9	4	5	17	4.166	2	.125*
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	0	55	1	2	60	2.687	2	.261

5.3.1.5 Domestic vessels and fineware

The results show eight significant differences between domestic vessels and fineware at Százhalombatta (Table 5.7). Taken in combination with the percentage frequencies for domestic vessels (Figure 5.14 & 5.17) and fineware (Figure 5.16 & 5.17) the results show that domestic vessels receive a lower investment of skill than fineware.

Table 5.7 Pearson Chi-Squared tests showing differences between domestic vessels and fineware at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Domestic (N)			Százhalombatta Fineware (N)			X² =	df	p < or = 0.05
Domestic/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	5	14	36	3	12	82	**7.558**	**2**	**.023***
Manufacturing	1	20	34	3	28	66	1.048	2	.592*
Wall Thickness	10	19	26	7	25	63	**6.415**	**2**	**.040**
Additions	2	7	14	5	14	42	0.539	2	.764*
Interior Surface Treatment	4	21	30	7	17	73	**8.212**	**2**	**.016***
Exterior Surface Treatment	5	23	27	6	11	79	**20.192**	**2**	**.000***
Decoration	7	14	13	4	15	44	**9.930**	**2**	**.007***
Rim Deviation on H. Plane	4	32	10	7	28	35	**10.456**	**2**	**.005***
Rim symmetry	6	17	25	5	16	59	**6.275**	**2**	**.043***
Handle symmetry	1	4	20	4	7	47	0.449	2	.799*
Profile symmetry	5	10	9	4	9	45	**12.156**	**2**	**.002***
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	0	55	1	3	93	2.329	2	.312*

5.3.1.6 Fineware and urns

The results show only one significant difference between fineware and urns at Százhalombatta (Table 5.8). When taken in combination with the percentage frequencies for fineware the results show that for this variable, interior surface treatment, fineware receives a greater investment of skill. The results for the remaining variables, when taken in combination with the percentage frequencies, for fineware (Figure 5.16 & 5.17) and urns (Figure 5.15 7 5.17) at Százhalombatta show that these two vessel groups share an almost identical investment of skill within this assemblage.

Table 5.8 Pearson Chi-Squared tests showing differences between fineware and urns at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Fineware (N)			Százhalombatta Urns (N)			$X^2 =$	df	p < or = 0.05
Fineware/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	3	12	82	5	11	47	2.948	2	.229*
Manufacturing	3	28	66	2	14	47	0.876	2	.645*
Wall Thickness	7	25	63	9	14	40	2.049	2	.359
Additions	5	14	42	1	8	14	1.399	2	.497*
Interior Surface Treatment	7	17	73	3	26	34	**10.969**	**2**	**.004***
Exterior Surface Treatment	6	11	79	8	11	44	3.486	2	.175
Decoration	4	15	44	1	10	20	1.025	2	.599*
Rim Deviation on H. Plane	7	28	35	2	18	14	1.693	2	.429*
Rim symmetry	5	16	59	3	12	25	1.688	2	.430*
Handle symmetry	4	7	47	1	3	18	0.174	2	.917*
Profile symmetry	4	9	45	4	5	17	1.869	2	.393*
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	1	3	93	1	2	60	0.097	2	.953*

5.3.1.7 All vessel groups

The results show eleven significant differences when all vessels are compared against each other. The only technological variable that shows no difference is firing (Table 5.9). These results taken in combination with the percentage frequencies for cups (Figure 5.13), domestic vessels (Figure 5.14), urns (Figure 5.15), fineware (Figure 5.16), and the firing variable (Figure 5.17) at Százhalombatta show that the investment of skill between vessel groups is heterogeneous.

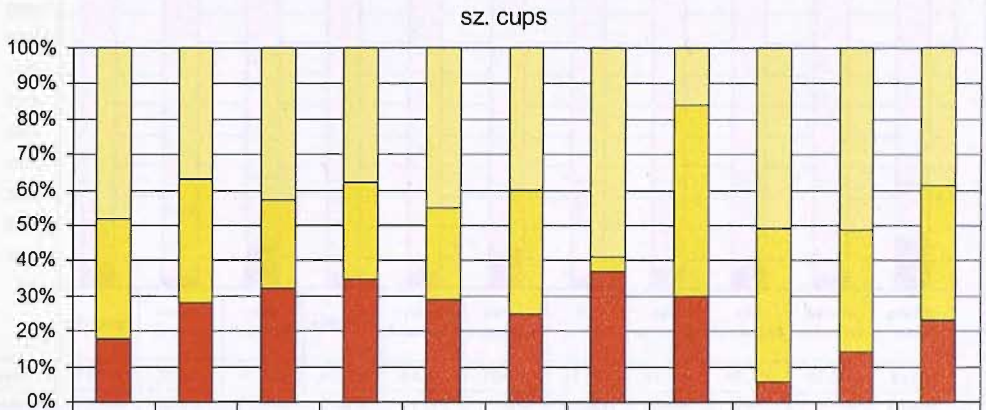
Table 5.9 Pearson Chi-Squared tests showing differences between the all vessels group at Százhalombatta. (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Százhalombatta Cups (N)			Százhalombatta Domestic (N)			Százhalombatta Urns (N)			Százhalombatta Fineware (N)			X² =	df	p < or = 0.05
All vessel groups	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**			
Clay Preparation	26	47	67	5	14	36	5	11	47	3	12	82	**40.245**	**6**	**.000**
Manufacturing	39	49	52	1	20	34	2	14	47	3	28	66	**62.875**	**6**	**.000**
Wall Thickness	43	34	58	10	19	26	9	14	40	7	25	63	**28.284**	**6**	**.000**
Additions	32	25	34	2	7	14	1	8	14	5	14	42	**27.474**	**6**	**.000***
Interior Surface Treatment	37	33	57	4	21	30	3	26	34	7	17	73	**45.484**	**6**	**.000**
Exterior Surface Treatment	34	48	55	5	23	27	8	11	44	6	11	79	**54.850**	**6**	**.000**
Decoration	9	1	14	7	14	13	1	10	20	4	15	44	**27.651**	**6**	**.000**
Rim Deviation on H. Plane	27	49	14	4	32	10	2	18	14	7	28	35	**37.640**	**6**	**.000**
Rim symmetry	5	36	43	6	17	25	3	12	25	5	16	59	**13.035**	**6**	**.042***
Handle symmetry	13	30	46	1	4	20	1	3	18	4	7	47	**19.599**	**6**	**.004***
Profile symmetry	27	43	45	5	10	9	4	5	17	4	9	45	**27.174**	**6**	**.000***
	soft	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**			
Firing	3	6	131	0	0	55	1	2	60	1	3	93	3.938	6	.685*

5.3.1.8 Százhalombatta summary

The results show that within the Százhalombatta assemblage cups receive the least investment of skill. Domestic vessels receive a greater investment of skill than cups but a lower investment of skill than fineware or urns. Urns and fineware both receive a high investment of skill but fineware receives a marginally higher investment of skill than urns.

Percentage and numeric frequency charts for Százhalombatta

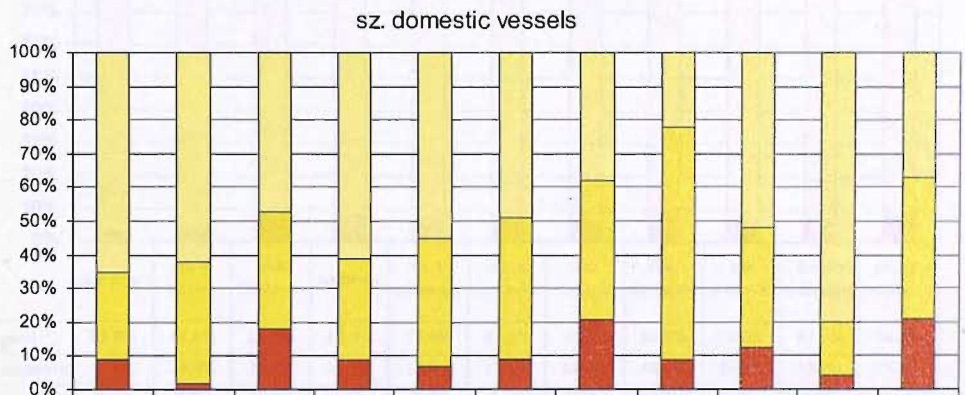


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	48.0%	37.0%	43.0%	38.0%	45.0%	40.0%	59.0%	16.0%	51.0%	51.5%	39.0%
moderate	34.0%	35.0%	25.0%	27.0%	26.0%	35.0%	4.0%	54.0%	43.0%	34.0%	38.0%
poor	18.0%	28.0%	32.0%	35.0%	29.0%	25.0%	37.0%	30.0%	6.0%	14.5%	23.0%

Numeric frequencies for cups at Százhalombatta

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	67	52	58	34	57	55	14	14	43	46	45
moderate	47	49	34	25	33	48	1	49	36	30	43
poor	26	39	43	32	37	34	9	27	5	13	27
N/A	0	0	5	49	13	3	116	50	56	51	25

Figure 5.13 Percentage and numeric frequencies for eleven technological variables for cups at Százhalombatta (note: firing variable is presented separately)

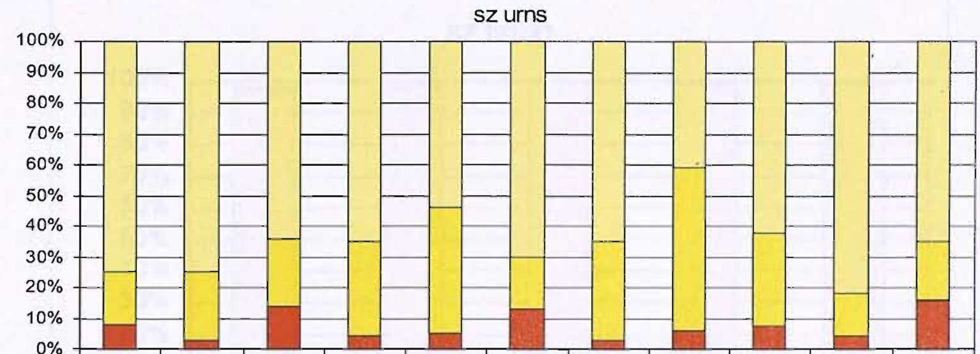


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	65.5%	62.0%	47.0%	61.0%	55.0%	49.0%	38.0%	22.0%	52.0%	80.0%	37.0%
moderate	25.5%	36.0%	35.0%	30.0%	38.0%	42.0%	41.0%	69.0%	35.5%	16.0%	42.0%
poor	9.0%	2.0%	18.0%	9.0%	7.0%	9.0%	21.0%	9.0%	12.5%	4.0%	21.0%

Numeric frequencies for domestic vessels at Százhalombatta

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	36	34	26	14	30	27	13	10	25	20	9
moderate	14	20	19	7	21	23	14	32	17	4	10
poor	5	1	10	2	4	5	7	4	6	1	5
N/A	0	0	0	32	0	0	21	9	7	30	31

Figure 5.14 Percentage and numeric frequencies for eleven technological variables for domestic vessels at Százhalombatta (note: firing variable is presented separately)

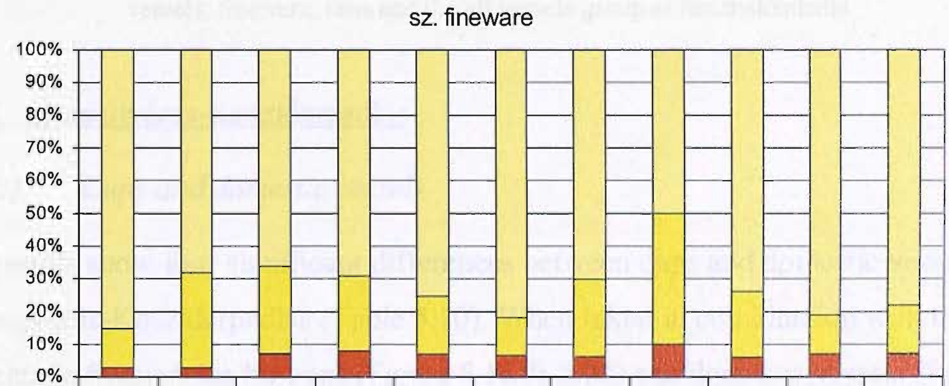


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	75.0%	75.0%	64.0%	65.0%	54.0%	70.0%	65.0%	41.0%	62.5%	82.0%	65.0%
moderate	17.0%	22.0%	22.0%	31.0%	41.0%	17.0%	32.0%	53.0%	30.0%	14.0%	19.0%
poor	8.0%	3.0%	14.0%	4.0%	5.0%	13.0%	3.0%	6.0%	7.5%	4.0%	16.0%

Numeric frequencies for urns at Százhalombatta

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	47	47	40	15	34	44	20	14	25	18	17
moderate	11	14	14	7	26	11	10	18	12	3	5
poor	5	2	9	1	3	8	1	2	3	1	4
N/A	0	0	0	40	0	0	32	29	23	41	37

Figure 5.15 Percentage and numeric frequencies for eleven technological variables for urns at Százhalombatta (note: firing variable is presented separately)



	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	85.0%	68.0%	66.3%	69.0%	75.0%	82.0%	70.0%	50.0%	74.0%	81.0%	78.0%
moderate	12.0%	29.0%	26.3%	23.0%	18.0%	11.5%	24.0%	40.0%	20.0%	12.0%	15.0%
poor	3.0%	3.0%	7.3%	8.0%	7.0%	6.5%	6.0%	10.0%	6.0%	7.0%	7.0%

Numeric frequencies for fineware at Százhalombatta

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	82	66	63	42	73	79	44	35	59	47	45
moderate	12	28	25	14	17	11	15	28	16	7	9
poor	3	3	7	5	7	6	4	7	5	4	4
N/A	0	0	2	36	0	1	34	27	17	39	39

Figure 5.16 Percentage and numeric frequencies for eleven technological variables for fineware at Százhalombatta (note: firing variable is presented separately)

	all vessels	cups	domestic	fineware	urns
soft	2%	2%	0%	1%	1.5%
normal	95%	94%	100%	96%	95%
high	3%	4%	0%	3%	3.5%

Numeric frequencies for firing for all vessel groups at Százhalombatta

	all vessels	cups	domestic	fineware	urns
soft	5	3	0	1	1
normal	339	131	55	93	60
high	11	6	0	3	2

Figure 5.17 Percentage and numeric frequencies for firing for cups, domestic vessels, fineware, urns and the all vessels group at Százhalombatta

5.3.2 Dunaújváros-Kosziderpadlás

5.3.2.1 Cups and domestic vessels

The results show four significant differences between cups and domestic vessels at Dunaújváros-Kosziderpadlás (Table 5.10). When taken in combination with the percentage frequencies for cups (Figure 5.18 & 5.22) and domestic vessels (Figure 5.19 & Figure 5.22) the results show there is greater investment of skill for domestic vessels.

Table 5.10 Pearson Chi-Squared tests showing differences between cups and domestic vessels at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Kosziderpadlás Cups (N)			Dunaújváros-Koszíderpadlás Domestic (N)			X^2 =	df	p < or = 0.05
Cups/Domestic	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	19	23	10	11	21	1.184	2	.553
Manufacturing	17	28	7	2	14	26	**28.886**	**2**	**.000**
Wall Thickness	13	22	16	19	13	10	3.997	2	.136
Additions	6	12	8	3	3	5	1.210	2	.546*
Interior Surface Treatment	11	28	13	5	15	22	**7.573**	**2**	**.023**
Exterior Surface Treatment	2	21	29	7	15	20	4.417	2	.110*
Decoration	3	2	5	5	6	14	0.410	2	.815*
Rim Deviation on H. Plane	15	7	4	3	24	9	**18.944**	**2**	**.000**
Rim symmetry	11	10	7	4	9	17	**7.677**	**2**	**.022**
Handle symmetry	3	8	16	0	2	8	1.845	2	.397*
Profile symmetry	17	15	14	3	6	6	1.487	2	.475*
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	1	51	1	2	91	1.280	2	.527*

5.3.2.2 Cups and urns

The results show eight significant differences between cups and urns at Dunaújváros-Kosziderpadlás (Table 5.11).When taken in combination with the percentage frequencies for cups (Figure 5.18 & 5.22) and urns (Figure 5.20 & 5.22) the results show that for these eight variables there is a higher investment of skill for urns than for cups.

Table 5.11 Pearson Chi-Squared tests showing differences between cups and urns at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Kosziderpadlás Cups (N)			Dunaújváros-Kosziderpadlás Urns (N)			X^2 =	df	p < or = 0.05
Cups/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	19	23	4	10	16	0.784	2	.676
Manufacturing	17	28	7	0	10	20	**32.996**	**2**	**.000**
Wall Thickness	13	22	16	4	4	22	**14.180**	**2**	**.001**
Additions	6	12	8	0	3	13	**10.823**	**2**	**.004***
Interior Surface Treatment	11	28	13	3	10	17	**8.297**	**2**	**0.16**
Exterior Surface Treatment	2	21	29	0	9	21	2.346	2	.309*
Decoration	3	2	5	1	3	15	3.770	2	.152*
Rim Deviation on H. Plane	15	7	4	0	10	10	**23.198**	**2**	**.000**
Rim symmetry	11	10	7	0	7	9	**9.190**	**2**	**.010***
Handle symmetry	3	8	16	0	1	15	**6.059**	**2**	**.048***
Profile symmetry	17	15	14	0	1	18	**10.952**	**2**	**.004***
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	1	51	0	0	29	0.565	1	.452*

5.3.2.3 Cups and fineware

The results show ten significant differences between cups and fineware at Dunaújváros-Kosziderpadlás (Table 5.12). When taken in combination with the percentage frequencies for cups (Figure 5.18 & 5.22) and fineware (Figure 5. 21 & 5.22) show that for these ten variables there is a higher investment of skill for fineware than for cups.

Table 5.12 Pearson Chi-Squared tests showing differences between cups and fineware at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Kosziderpadlás Cups (N)			Dunaújváros-Kosziderpadlás Fineware (N)			X^2 =	df	p < or = 0.05
Cups/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	19	23	3	5	30	**11.425**	**2**	**.003**
Manufacturing	17	28	7	2	7	29	**39.297**	**2**	**.000**
Wall Thickness	13	22	16	2	4	32	**26.264**	**2**	**.000**
Additions	6	12	8	0	3	17	**14.097**	**2**	**.001***
Interior Surface Treatment	11	28	13	3	9	26	**17.329**	**2**	**.000**
Exterior Surface Treatment	2	21	29	2	4	32	**9.766**	**2**	**.008***
Decoration	3	2	5	2	4	18	2.950	2	.229*
Rim Deviation on H. Plane	15	7	4	1	6	20	**26.402**	**2**	**.000**
Rim symmetry	11	10	7	2	7	15	**10.060**	**2**	**.009***
Handle symmetry	3	8	16	0	3	14	**3.304**	**2**	**.192***
Profile symmetry	17	15	14	1	0	11	**14.704**	**2**	**.001***
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	1	51	0	1	37	0.051	1	.822*

5.3.2.4 Domestic vessels and urns

The results, taken in combination with the percentage frequencies, show that for the majority of technological variables there is a similar investment of skill for domestic vessels (Figure 5. 19 & 5.22) and urns (Figure 5. 20 & 5.22). For two variables there is a higher investment of skill for urns (Table 5.13).

Table 5.13 Pearson Chi-Squared tests showing differences between domestic vessels and urns at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Kosziderpadlás Domestic (N)			Dunaújváros-Kosziderpadlás Urns (N)			$X^2 =$	df	p < or = 0.05
Domestic/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	11	21	4	10	16	1.373	2	.503
Manufacturing	2	14	26	0	10	20	1.491	2	.475*
Wall Thickness	19	13	10	4	4	22	**18.250**	**2**	**.000**
Additions	3	3	5	0	3	13	5.830	2	.054*
Interior Surface Treatment	5	15	22	3	10	17	0.145	2	.930*
Exterior Surface Treatment	7	15	20	0	9	21	**6.711**	**2**	**.035***
Decoration	5	6	14	1	3	15	2.938	2	.230*
Rim Deviation on H. Plane	3	24	9	0	10	10	4.623	2	.099*
Rim symmetry	4	9	17	0	7	9	2.701	2	.259*
Handle symmetry	0	2	8	0	1	15	1.140	1	.286*
Profile symmetry	3	6	6	0	1	18	5.714	2	.057
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	1	2	91	0	0	29	1.421	2	.491*

5.3.2.5 Domestic vessels and fineware

There are six significant differences between domestic vessels and fineware at Dunaújváros-Kosziderpadlás (Table 5.14). When taken in combination with the percentage frequencies for domestic vessels (Figure 5.19 & 5.22) and fineware (Figure 5. 21 & 5.22) the results show a higher investment of skill for fineware.

Table 5.14 Pearson Chi-Squared tests showing differences between domestic vessels and fineware at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Kosziderpadlás Domestic (N)			Dunaújváros-Kosziderpadlás Fineware (N)			$X^2 =$	df	p < or = 0.05
Domestic/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	11	21	3	5	30	**7.679**	**2**	**.022**
Manufacturing	2	14	26	2	7	29	2.303	2	.316*
Wall Thickness	19	13	10	2	4	32	**32.839**	**2**	**.000**
Additions	3	3	5	0	3	17	**7.571**	**2**	**.023***
Interior Surface Treatment	5	15	22	3	9	26	2.139	2	.343
Exterior Surface Treatment	7	15	20	2	4	32	**11.745**	**2**	**.003***
Decoration	5	6	14	2	4	18	2.166	2	.339
Rim Deviation on H. Plane	3	24	9	1	6	20	**14.993**	**2**	**.001***
Rim symmetry	4	9	17	2	7	15	0.380	2	.827*
Handle symmetry	0	2	8	0	3	14	0.023	1	.879*
Profile symmetry	3	6	6	1	0	11	**8.239**	**2**	**.016***
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	1	2	91	0	1	37	0.919	2	.632*

5.3.2.6 Fineware and urns

The results show no significant differences between fineware and urns at Dunaújváros-Kosziderpadlás (Table 5.15). The results, for fineware (Figure 5.21 & 5.22) and urns (Figure 5.20 & 5.22), when taken in combination with the percentage frequencies, at Dunaújváros-Kosziderpadlás show that both vessel groups receive a similarly high investment of skill.

Table 5.15 Pearson Chi-Squared tests showing differences between fineware and urns at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Koszderpadlás Fineware (N)			Dunaújváros-Koszderpadlás Urns (N)			X^2 =	df	p < or = 0.05
Fineware/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	3	5	30	4	10	16	5.201	2	.074*
Manufacturing	2	7	29	0	10	20	3.287	2	.193*
Wall Thickness	2	4	32	4	4	22	1.599	2	.449*
Additions	0	3	17	0	3	13	0.090	1	.764*
Interior Surface Treatment	3	9	26	3	10	17	1.009	2	.604*
Exterior Surface Treatment	2	4	32	0	9	21	5.339	2	.069
Decoration	2	4	18	1	3	15	0.170	2	.919*
Rim Deviation on H. Plane	1	6	20	0	10	10	4.388	2	.111*
Rim symmetry	2	7	15	0	7	9	1.979	2	.372*
Handle symmetry	0	3	14	0	1	15	1.005	1	.316*
Profile symmetry	1	0	11	0	1	18	2.088	2	.352*
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	1	37	0	0	29	0.775	1	.379*

5.3.2.7 All vessel groups

The results show nine significant differences when all vessels are compared against each other (Table 5.16). These results, taken in combination with the percentage frequencies for cups (Figure 5.18), domestic vessels (Figure 5.19), urns (Figure 5. 20), fineware (Figure 5.20) and the firing variable (5.22), at Dunaújváros-Kosziderpadlás show that for the majority of technological variables the investment of skill between vessel groups is heterogeneous.

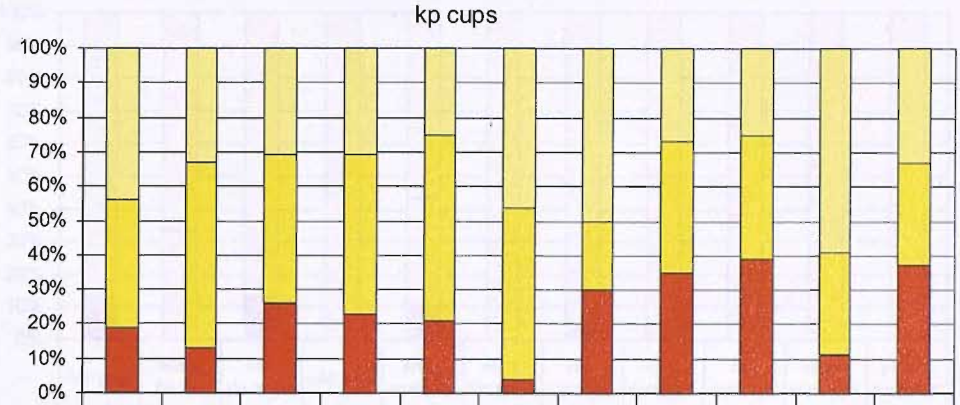
Table 5.16 Pearson Chi-Squared tests showing differences between all vessel groups at Dunaújváros-Kosziderpadlás (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-K-padlás Cups (N)			Dunaújváros-K-padlás Domestic (N)			Dunaújváros-K-padlás Urns (N)			Dunaújváros-K-padlás Fineware (N)			X² =	df	p < or = 0.05
All vessel groups	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**			
Clay Preparation	10	19	23	10	11	21	4	10	16	3	5	30	**13.890**	**6**	**.031**
Manufacturing	17	28	7	2	14	26	0	10	20	2	7	29	**53.049**	**6**	**.000***
Wall Thickness	13	22	16	19	13	10	4	4	22	2	4	32	**49.532**	**6**	**.000**
Additions	6	12	8	3	3	5	0	3	13	0	3	17	**20.984**	**6**	**.002***
Interior Surface Treatment	11	28	13	5	15	22	3	10	17	3	9	26	**18.781**	**6**	**.005***
Exterior Surface Treatment	2	21	29	7	15	20	0	9	21	2	4	32	**20.892**	**6**	**.002***
Decoration	3	2	5	5	6	14	1	3	15	2	4	18	6.049	6	.418*
Rim Deviation on H. Plane	15	7	4	3	24	9	0	10	10	1	6	20	**55.949**	**6**	**.000***
Rim symmetry	11	10	7	4	9	17	0	7	9	2	7	15	**17.447**	**6**	**.008***
Handle symmetry	3	8	16	0	2	8	0	1	15	0	3	14	9.365	6	.154*
Profile symmetry	17	15	14	3	6	6	0	1	8	1	0	11	**22.948**	**6**	**.001***
	soft	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**			
Firing	0	1	51	1	1	40	0	0	29	0	1	37	3.598	6	.731*

5.3.2.8 *Dunaújváros-Kosziderpadlás, summary*

The results show that within the Dunaújváros-Kosziderpadlás assemblage cups receive the least investment of skill. Domestic vessels receive a greater investment of skill than cups but a lower investment of skill than urns and a much lower investment of skill than fineware. Urns and fineware both receive a high investment of skill but with fineware receiving a marginally higher investment of skill than urns.

Percentage and numeric frequency charts for Dunaújváros-Kosziderpadlás

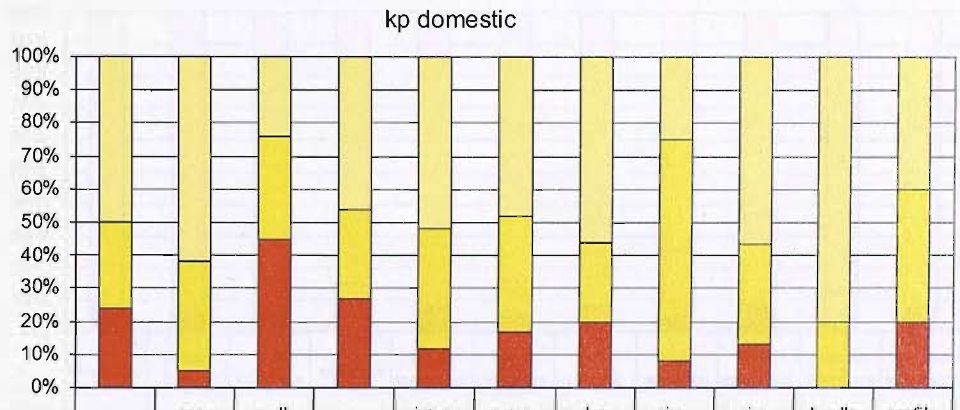


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	44%	33%	31%	31%	25%	46%	50%	27%	25%	59%	33%
moderate	37%	54%	43%	46%	54%	50%	20%	38%	36%	30%	30%
poor	19%	13%	26%	23%	21%	4%	30%	35%	39%	11%	37%

Numeric frequencies for cups at Dunaújváros-Kosziderpadlás

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	23	7	16	8	13	29	5	7	7	16	15
moderate	19	28	22	12	28	21	2	10	10	8	14
poor	10	17	13	6	11	2	3	9	11	3	17
N/A	0	0	1	26	0	0	42	26	24	25	6

Figure 5.18 Percentage and numeric frequencies for eleven technological variables for cups at Dunaújváros-Kosziderpadlás (note: firing variable is presented separately)

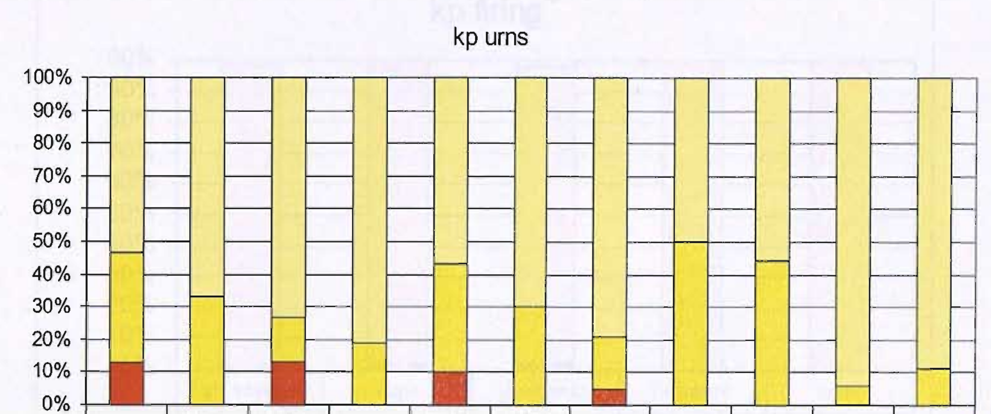


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	50%	62%	24%	46%	52%	48%	56%	25%	57%	80%	40%
moderate	26%	33%	31%	27%	36%	35%	24%	67%	30%	20%	40%
poor	24%	5%	45%	27%	12%	17%	20%	8%	13%	0%	20%

Numeric frequencies for domestic vessels at Dunaújváros-Kosziderpadlás

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	21	26	10	5	22	20	14	9	17	8	6
moderate	11	14	13	3	15	15	6	24	9	2	6
poor	10	2	19	3	5	7	5	3	4	0	3
N/A	0	0	0	31	0	0	17	6	12	32	27

Figure 5.19 Percentage and numeric frequencies for eleven technological variables for domestic vessels at Dunaújváros-Kosziderpadlás (note: firing variable is presented separately)

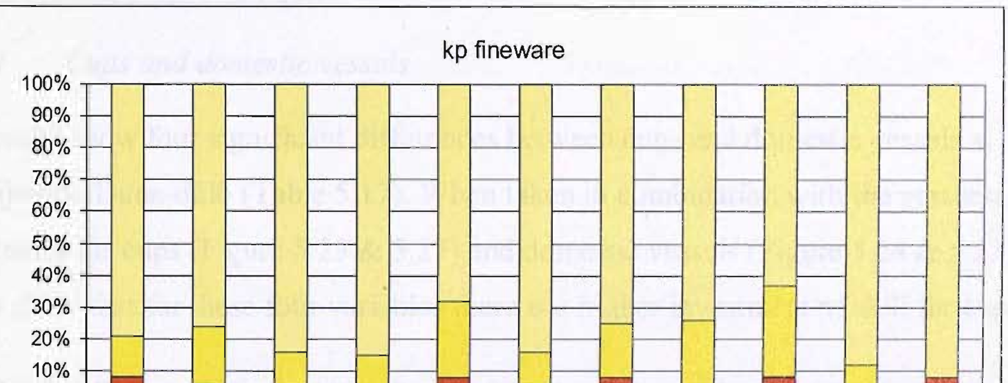


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	53.3%	67%	73.3%	81%	57%	70%	79%	50%	56%	94%	89%
moderate	33.3%	33%	13.3%	19%	33%	30%	16%	50%	44%	6%	11%
poor	13.3%	0%	13.3%	0%	10%	0%	5%	0%	0%	0%	0%

Numeric frequencies for urns at Dunaújváros-Kosziderpadlás

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	16	20	22	13	17	21	15	10	9	15	8
moderate	10	10	4	3	10	9	3	10	7	1	1
poor	4	0	4	0	3	0	1	0	0	0	0
N/A	0	0	0	14	0	0	11	10	14	14	1

Figure 5.20 Percentage and numeric frequencies for eleven technological variables for urns at Dunaújváros-Kosziderpadlás (note: firing variable is presented separately)

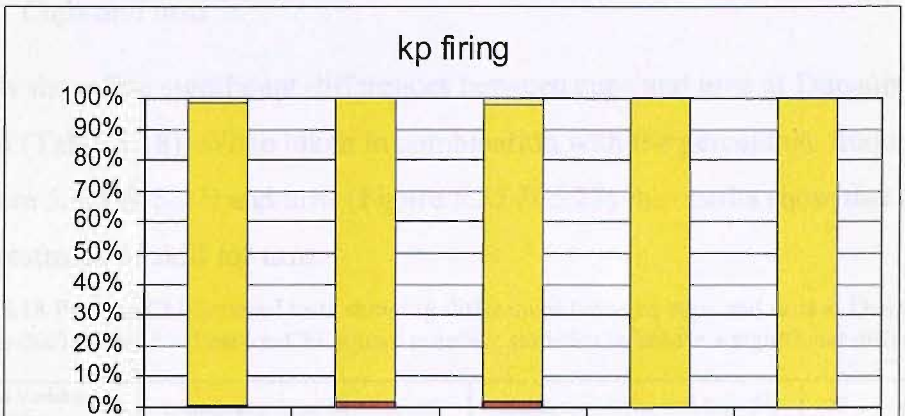


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	79%	76%	84%	85%	68%	84%	75%	74%	63%	88%	92%
moderate	13%	19%	11%	15%	24%	11%	17%	22%	29%	12%	0%
poor	8%	5%	5%	0%	8%	5%	8%	4%	8%	0%	8%

Numeric frequencies for fineware at Dunaújváros-Koszidernadlás

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	30	29	32	17	26	32	18	20	15	15	11
moderate	5	7	4	3	9	4	4	6	7	2	0
poor	3	2	2	0	3	2	2	1	2	0	1
N/A	0	0	0	18	0	0	14	11	14	21	26

Figure 5.21 Percentage and numeric frequencies for eleven technological variables for fineware at Dunaújváros-Koszidernadlás (note: firing variable is presented separately)



	all vessels	cups	domestic	fineware	urns
soft	1.5%	0%	2.3%	0%	0%
normal	98%	98%	95.3%	100%	100%
high	0.5%	2%	2.3%	0%	0%

Numeric frequencies for firing for all vessel groups at Dunaújváros-Koszíderpadlás

kp firing	all vessels	cups	domestic	fineware	urns
soft	3	0	1	0	0
normal	158	51	40	38	30
high	1	1	1	0	0

Figure 5.22 Percentage and numeric frequencies for firing for cups, domestic vessels, fineware, urns and the all vessels group at Dunaújváros-Koszíderpadlás

5.3.3 Dunaújváros-Duna-dűlő

5.3.3.1 Cups and domestic vessels

The results show four significant differences between cups and domestic vessels at Dunaújváros-Duna-dűlő (Table 5.17). When taken in combination with the percentage frequencies for cups (Figure 5.23 & 5.27) and domestic vessels (Figure 5.24 & 5.27) the results show that for these four variables there is a higher investment of skill for cups.

Table 5.17 Pearson Chi-Squared tests showing differences between cups and domestic vessels at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Cups (N)			Dunaújváros-Duna-dűlő Domestic (N)			X^2 =	df	p < or = 0.05
Cups/Domestic	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	24	14	17	18	7	4.674	2	.097
Manufacturing	10	25	13	9	23	10	0.128	2	.938
Wall Thickness	8	20	20	22	7	13	**14.417**	**2**	**.001**
Additions	11	15	12	8	11	5	0.875	2	.646
Interior Surface Treatment	7	25	16	11	24	7	4.134	2	.127
Exterior Surface Treatment	3	27	18	16	16	10	**14.528**	**2**	**.001**
Decoration	4	0	3	10	11	8	3.830	2	.147*
Rim Deviation on H. Plane	3	25	12	9	22	1	**13.411**	**2**	**.001**
Rim symmetry	9	14	20	13	13	9	4.225	2	.121
Handle symmetry	6	16	17	2	12	10	0.864	2	.649*
Profile symmetry	6	24	17	12	15	5	**8.185**	**2**	**.017**
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	24	0	24	26	0	16	1.291	1	.256

5.3.3.2 Cups and urns

The results show five significant differences between cups and urns at Dunaújváros-Duna-dűlő (Table 5.18). When taken in combination with the percentage frequencies for cups (Figure 5. 23 & 5.27) and urns (Figure 5.25 & 5.27) the results show that there is a higher investment of skill for urns.

Table 5.18 Pearson Chi-Squared tests showing differences between cups and urns at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Cups (N)			Dunaújváros-Duna-dűlő Urns (N)			X^2 =	df	p < or = 0.05
Cups/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	24	14	11	30	15	0.134	2	.935
Manufacturing	10	25	13	6	22	28	**6.204**	**2**	**.045**
Wall Thickness	8	20	20	12	14	28	2.856	2	.241
Additions	11	15	12	3	9	21	**8.509**	**2**	**.014**
Interior Surface Treatment	7	25	16	1	22	33	**10.033**	**2**	**.007***
Exterior Surface Treatment	3	27	18	1	22	33	5.338	2	.069*
Decoration	4	0	3	6	13	23	**7.727**	**2**	**.021***
Rim Deviation on H. Plane	3	25	12	4	24	7	1.151	2	.562*
Rim symmetry	9	14	20	4	14	23	2.135	2	.344
Handle symmetry	6	16	17	4	8	24	4.148	2	.126*
Profile symmetry	6	24	17	2	24	25	3.366	2	.186*
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	24	0	24	14	0	42	**7.019**	**1**	**.008**

5.3.3.3 Cups and fineware

There are three significant differences between cups and fineware at Dunaújváros-Duna-dűlő (Table 5.20). Wall thickness and rim deviation show a higher investment of skill for cups while decoration shows a higher investment of skill for fineware. Taken in combination with the percentage frequencies for cups (Figure 5.23 & 5.27) and fineware (Figure 5.26 & 5.27) the results show a low investment of skill for both groups.

Table 5.19 Pearson Chi-Squared tests showing differences between cups and fineware at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Cups (N)			Dunaújváros-Duna-dűlő Fineware (N)			X^2 =	df	p < or = 0.05
Cups/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	10	24	14	11	31	12	0.742	2	.690
Manufacturing	10	25	13	18	24	12	2.025	2	.363
Wall Thickness	8	20	20	21	16	15	**7.042**	**2**	**.030**
Additions	11	15	12	9	11	9	0.036	2	.982
Interior Surface Treatment	7	25	16	12	21	21	2.004	2	.367
Exterior Surface Treatment	3	27	18	9	23	22	3.507	2	.173
Decoration	4	0	3	6	13	18	**6.839**	**2**	**.033***
Rim Deviation on H. Plane	3	25	12	13	29	5	**9.441**	**2**	**.009**
Rim symmetry	9	14	20	13	16	19	0.616	2	.735
Handle symmetry	6	16	17	2	6	21	5.617	2	.060*
Profile symmetry	6	24	17	11	18	18	2.381	2	.304
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	24	0	24	31	0	23	0.561	1	.454

5.3.3.4 Domestic vessels and urns

The results show ten significant differences between domestic vessels and urns at Dunaújváros-Duna-dűlő (Table 5.20). When taken in combination with the percentage frequencies for domestic vessels (Figure 5. 26 & 5.27) and urns (Figure 5.25 & 5.27) the results show that for these ten variables there is a higher investment of skill for urns.

Table 5.20 Pearson Chi-Squared tests showing differences between domestic vessels and urns at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Domestic (N)			Dunaújváros-Duna-dűlő Urns (N)			X^2 =	df	p < or = 0.05
Domestic/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	17	18	7	11	30	15	5.298	2	.071
Manufacturing	9	23	10	6	22	28	**7.497**	**2**	**.024**
Wall Thickness	22	7	13	12	14	28	**9.477**	**2**	**.009**
Additions	8	11	5	3	9	21	**11.176**	**2**	**.004***
Interior Surface Treatment	11	24	7	1	22	33	**26.185**	**2**	**.000**
Exterior Surface Treatment	16	16	10	1	22	33	**27.874**	**2**	**.000**
Decoration	10	11	8	6	13	23	**6.356**	**2**	**.042**
Rim Deviation on H. Plane	9	22	1	4	24	7	**6.389**	**2**	**.041***
Rim symmetry	13	13	9	4	14	23	**10.917**	**2**	**.004**
Handle symmetry	2	12	10	4	8	24	5.033	2	.081*
Profile symmetry	12	15	5	2	24	25	**20.188**	**2**	**.000**
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	26	0	16	14	0	42	**13.730**	**1**	**.000**

5.3.3.5 Domestic vessels and fineware

There are two significant differences between domestic vessels and fineware at Dunaújváros-Duna-dűlő (Table 5.21). When taken in combination with the percentage frequencies for domestic vessels (Figure 5. 5.24 & 5.27) and fineware (Figure 5.26 & 5.27) the results show a marginally higher investment of skill for fineware. The results show a low investment of skill for both vessel groups.

Table 5.21 Pearson Chi-Squared tests showing differences between domestic vessels and fineware at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Domestic (N)			Dunaújváros-Duna-dűlő Fineware (N)			X^2 =	df	p < or = 0.05
Domestic/Fineware	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	17	18	7	11	31	12	4.614	2	.100
Manufacturing	9	23	10	18	24	12	1.758	2	.415
Wall Thickness	22	7	13	21	16	15	2.718	2	.257
Additions	8	11	5	9	11	9	0.745	2	.689
Interior Surface Treatment	11	24	7	12	21	21	**6.065**	**2**	**.048**
Exterior Surface Treatment	16	16	10	9	23	22	**6.358**	**2**	**.042**
Decoration	10	11	8	6	13	18	4.153	2	.125
Rim Deviation on H. Plane	9	22	1	13	29	5	1.563	2	.458*
Rim symmetry	13	13	9	13	16	19	1.918	2	.383
Handle symmetry	2	12	10	2	6	21	5.480	2	.065*
Profile symmetry	12	15	5	11	18	18	5.251	2	.072
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	26	0	16	31	0	23	0.198	1	.656

5.3.3.6 Fineware and urns

The results show seven significant differences between fineware and urns at Dunaújváros-Duna-dűlő (Table 5.22). When taken in combination with the percentage frequencies for fineware (Figure 5.26 & 5.27) and urns (Figure 5.25 & 5.27) the results show that for these seven variables urns receive a higher investment of skill.

Table 5.22 Pearson Chi-Squared tests showing differences between fineware and urns at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Fineware (N)			Dunaújváros-Duna-dűlő Urns (N)			X^2 =	df	p < or = 0.05
Fineware/Urns	**poor**	**moderate**	**good**	**poor**	**moderate**	**good**			
Clay Preparation	11	31	12	11	30	15	0.314	2	.855
Manufacturing	18	24	12	6	22	28	**12.912**	**2**	**.002**
Wall Thickness	21	16	15	12	14	28	**6.574**	**2**	**.037**
Additions	9	11	9	3	9	21	**8.019**	**2**	**.018**
Interior Surface Treatment	12	21	21	1	22	33	**13.647**	**2**	**.001**
Exterior Surface Treatment	9	23	22	1	22	33	**8.589**	**2**	**.014***
Decoration	6	13	18	6	13	23	0.295	2	.863
Rim Deviation on H. Plane	13	29	5	4	24	7	4.062	2	.131
Rim symmetry	13	16	19	4	14	23	4.981	2	.083
Handle symmetry	2	6	21	4	8	24	0.403	2	.817*
Profile symmetry	11	18	18	2	24	25	**8.701**	**2**	**.013**
	soft	**high**	**normal**	**soft**	**high**	**normal**			
Firing	31	0	23	14	0	42	**12.184**	**1**	**.000**

5.3.3.7 All vessels group

The results show ten significant differences when all vessels are compared against each other (Table 5.23). These results, taken in combination with the percentage frequencies for cups (Figure 5.23), domestic vessels (Figure 5.24), urns (Figure 5.25), fineware (Figure 5.26) and the firing variable (Figure 5.27), at Dunaújváros-Duna-dűlő show that for the majority of technological variables the investment of skill between vessel groups is heterogeneous.

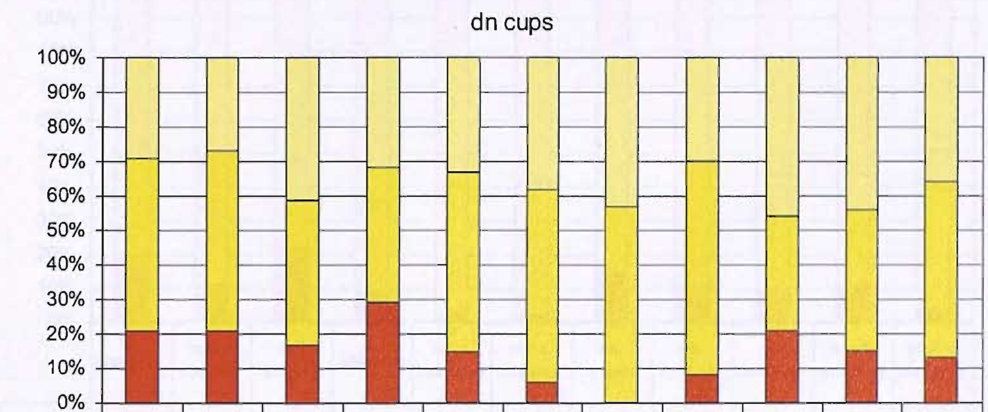
Table 5.23 Pearson Chi-Squared tests showing differences between all vessels at Dunaújváros-Duna-dűlő (Note: * = Pearson Chi-square number; statistics in bold = a significant difference)

Technological Variable / Vessel group	Dunaújváros-Duna-dűlő Cups (N)			Dunaújváros-Duna-dűlő Domestic (N)			Dunaújváros-Duna-dűlő Urns (N)			Dunaújváros-Duna-dűlő Fineware (N)			X² =	df	p < or = 0.05
All vessel groups	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**	**poor**	**mod.**	**good**			
Clay Preparation	10	24	14	17	18	7	11	30	15	11	31	12	7.773	6	.225
Manufacturing	10	25	13	9	23	10	6	22	28	18	24	12	**16.307**	**6**	**.012**
Wall Thickness	8	20	20	22	7	13	12	14	28	21	16	15	**21.304**	**6**	**.002**
Additions	11	15	12	8	11	5	3	9	21	9	11	9	**14.915**	**6**	**.021**
Interior Surface Treatment	7	25	16	11	24	7	1	22	33	12	21	21	**29.821**	**6**	**.000**
Exterior Surface Treatment	3	27	18	16	16	10	1	22	33	9	23	22	**33.917**	**6**	**.000**
Decoration	4	0	3	10	11	8	6	13	23	6	13	18	**13.073**	**6**	**.042***
Rim Deviation on H. Plane	3	25	12	9	22	1	4	24	7	13	29	5	**18.090**	**6**	**.006**
Rim symmetry	9	14	20	13	13	9	4	14	23	13	16	19	11.675	6	.070
Handle symmetry	6	16	17	2	12	10	4	8	24	2	6	21	10.840	6	.093*
Profile symmetry	6	24	17	12	15	5	2	24	25	11	18	18	**22.672**	**6**	**.001**
	soft	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**	**soft**	**high**	**normal**			
Firing	24	0	24	26	0	16	14	0	42	31	0	23	**17.744**	**3**	**.000**

5.3.3.8 Dunaújváros-Duna-dűlő, summary

The results show that within the Dunaújváros-Duna-dűlő assemblage fineware receives the least investment of skill, followed very closely by domestic vessels. Cups receive a higher investment of skill compared to domestic vessels and a marginally higher investment of skill compared to fineware. Meanwhile, urns receive the greatest investment of skill.

Percentage and numeric frequency charts for Dunaújváros-Duna-dűlő

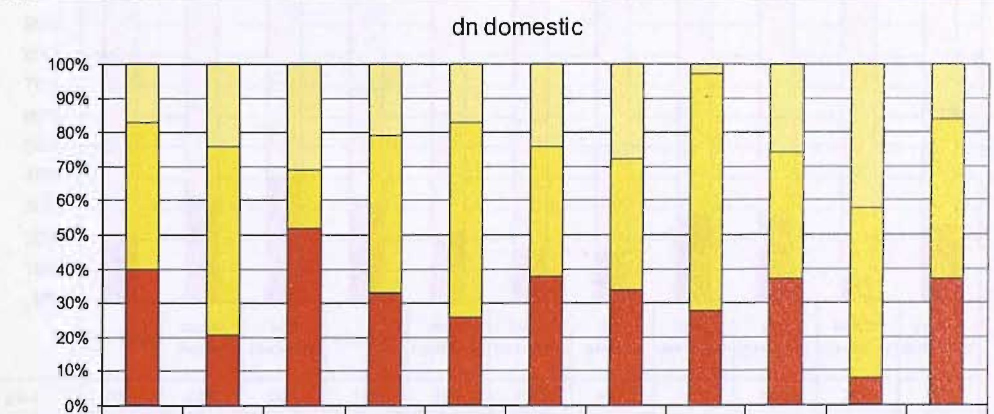


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	29%	27%	41.5%	32%	33%	38%	43%	30%	46%	44%	36%
moderate	50%	52%	41.5%	39%	52%	56%	57%	62%	33%	41%	51%
poor	21%	21%	17%	29%	15%	6%	0%	8%	21%	15%	13%

Numeric frequencies for cups at Dunaújváros-Duna-dűlő

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	14	13	20	12	16	18	3	12	20	17	17
moderate	24	25	20	15	25	27	4	25	14	16	24
poor	10	10	8	11	7	3	0	3	9	6	6
N/A	0	0	0	10	0	0	41	8	5	9	1

Figure 5.23 Percentage and numeric frequencies for eleven technological variables for cups at Dunaújváros-Duna-dűlő (note: firing variable is presented separately)



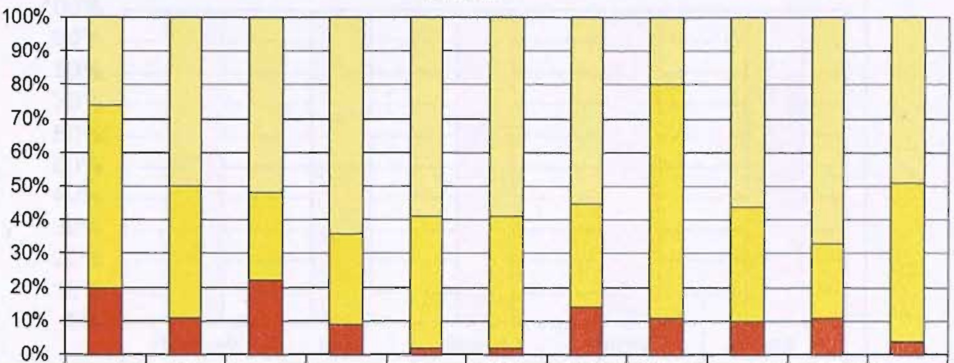
	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	17%	24%	31%	21%	17%	24%	28%	3%	26%	42%	16%
moderate	43%	55%	17%	46%	57%	38%	38%	69%	37%	50%	47%
poor	40%	21%	52%	33%	26%	38%	34%	28%	37%	8%	37%

Numeric frequencies for domestic vessels at Dunaújváros-Duna-dűlő

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	7	10	13	5	7	10	8	1	9	10	5
moderate	18	23	7	11	24	16	11	22	13	12	15
poor	17	9	22	8	11	16	10	9	13	2	12
N/A	0	0	0	18	0	0	13	10	7	18	10

Figure 5.24 Percentage and numeric frequencies for eleven technological variables for domestic vessels at Dunaújváros-Duna-dűlő (note: firing variable is presented separately)

dn urns



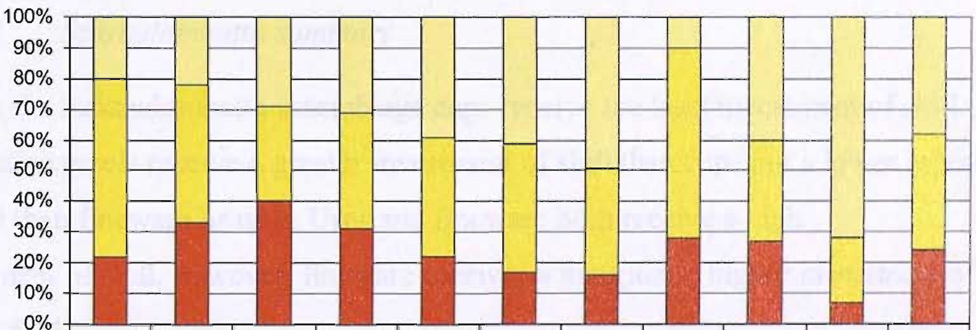
	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	26%	50%	52%	64%	59%	59%	55%	20%	56%	67%	49%
moderate	54%	39%	26%	27%	39%	39%	31%	69%	34%	22%	47%
poor	20%	11%	22%	9%	2%	2%	14%	11%	10%	11%	4%

Numeric frequencies for urns at Dunaújváros-Duna-dűlő

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	15	28	28	21	33	33	23	7	23	24	25
moderate	30	22	14	9	22	22	13	24	14	8	24
poor	11	6	12	3	1	1	6	4	4	4	2
N/A			2	23	0	0	14	21	15	20	5

Figure 5.25 Percentage and numeric frequencies for eleven technological variables for urns at Dunaújváros-Duna-dűlő (note: firing variable is presented separately)

dn fineware

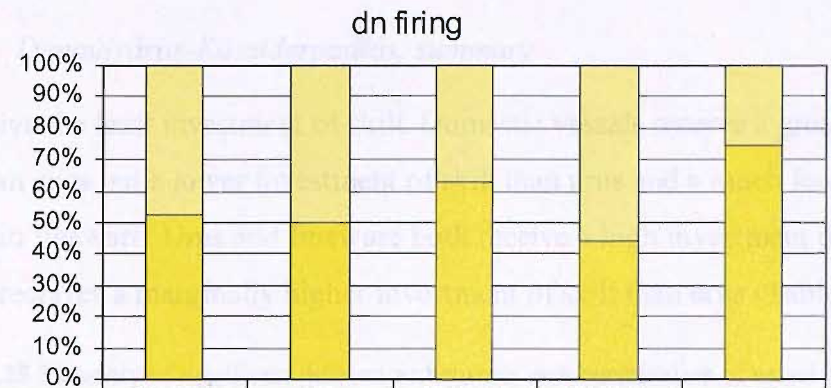


	clay prep.	manu-facture	wall thickness	additions	int. s. treatment	ext. s. treatment	dec-oration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	20%	22%	29%	31%	39%	41%	49%	10%	40%	72%	38%
moderate	58%	45%	31%	38%	39%	42%	35%	62%	33%	21%	38%
poor	22%	33%	40%	31%	22%	17%	16%	28%	27%	7%	24%

Numeric frequencies for fineware at Dunaújváros-Duna-dűlő

	clay.prep	manu-facture	wall thickness	additions	int. surface treatment	ext. surface treatment	decoration	rim. deviation	rim symmetry	handle symmetry	profile symmetry
good	11	12	15	9	21	22	18	5	19	21	18
moderate	31	24	16	11	21	23	13	29	16	6	18
poor	12	18	21	9	12	9	6	13	13	2	11
N/A	0	0	2	25	0	0	17	7	6	25	7

Figure 5.26 Percentage and numeric frequencies for eleven technological variables for fineware at Dunaújváros-Duna-dűlő (note: firing variable is presented separately)



	all vessels	cups	domestic	fineware	urns
soft	47.5%	50%	37%	56%	25%
normal	52.5%	50%	63%	44%	75%
high	0%	0%	0%	0%	0%

Numeric frequencies for firing for all vessel groups at Dunaújváros-Duna-dűlő

	all vessels	cups	domestic	fineware	urns
soft	95	24	26	31	14
normal	105	24	16	23	42
high	0	0	0	0	0

Figure 5.27 Percentage and numeric frequencies for firing for cups, domestic vessels, fineware, urns and the all vessels group at Dunaújváros-Duna-dűlő

5.3.4 Summary: differences between vessel groups within each site

5.3.4.1 Százhalombatta summary

Within the Százhalombatta assemblage cups receive the least investment of skill. Domestic vessels receive a greater investment of skill than cups but a lower investment of skill than fineware or urns. Urns and fineware both receive a high investment of skill, however, fineware receives a marginally higher investment of skill (Table 5.24)

Table 5.24 Summary of significant differences between each combination of vessel groups for Százhalombatta

Százhalombatta	clay peparation	manufacturing	wall thickness	additions	interior surface treatments	exterior surface treatments	decoration	rim deviation on the h. plane	rim symmetry	handle symmetry	profile symmetry	firing	Significant
cups/domestic vessels	x	✓	x	✓	✓	✓	✓	✓	x	✓	x	x	7
cups/urns	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	x	10
cups/fineware	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	11
domestic vessels/urns	x	x	x	x	x	✓	✓	x	x	x	x	x	2
domestic vessels/fineware	✓	x	✓	x	✓	✓	✓	✓	✓	x	✓	x	8
fineware/urns	x	x	x	x	✓	x	x	x	x	x	x	x	1
all vessels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	11

5.3.4.2 Dunaújváros-Kosziderpadlás, summary

Cups receive the least investment of skill. Domestic vessels receive a greater investment of skill than cups but a lower investment of skill than urns and a much lower investment of skill than fineware. Urns and fineware both receive a high investment of skill. Fineware receives a marginally higher investment of skill than urns (Table 5.25).

Table 5.25 Summary of significant differences between each combination of vessel groups for Dunaújváros-Kosziderpadlás

Dunaújváros-Kosziderpadlás	clay peparation	manufacturing	wall thickness	additions	interior surface treatments	exterior surface treatments	decoration	rim deviation on the h. plane	rim symmetry	handle symmetry	profile symmetry	firing	**Significant**
cups/domestic vessels	x	✓	x	x	✓	x	x	✓	✓	x	x	x	**4**
cups/urns	x	✓	✓	✓	✓	x	x	✓	✓	✓	✓	x	**8**
cups/fineware	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	x	**9**
domestic vessels/urns	x	x	✓	✓	x	✓	x	x	x	x	✓	x	**4**
domestic vessels/fineware	✓	x	✓	✓	x	✓	x	✓	x	x	✓	x	**6**
fineware/urns	x	x	x	x	x	x	x	x	x	x	x	x	**0**
all vessels	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	x	**9**

5.3.4.3 Dunaújváros-Duna-dűlő, summary

Cups receive a higher investment of skill than domestic vessels and a marginally higher investment of skill than fineware. Cups, fineware and domestic vessels all receive a similarly poor investment of skill. Urns receive a greater investment of skill (Table 5.26).

Table 5.26 Summary of differences between each combination of vessel groups for Dunaújváros-Duna-dűlő

Dunaújváros-Duna-dűlő	clay peparation	manufacturing	wall thickness	additions	interior surface treatments	exterior surface treatments	decoration	rim deviation on the h. plane	rim symmetry	handle symmetry	profile symmetry	firing	**Significant**
cups/domestic vessels	x	x	✓	x	x	✓	x	✓	x	x	✓	x	**4**
cups/urns	x	✓	x	✓	✓	x	✓	x	x	x	x	✓	**5**
cups/fineware	x	x	✓	x	x	x	✓	✓	x	x	x	x	**3**
domestic vessels/urns	x	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	**10**
domestic vessels/fineware	x	x	x	x	x	✓	x	x	x	x	x	x	**1**
fineware/urns	x	✓	✓	✓	✓	✓	x	x	x	x	✓	✓	**7**
all vessels	x	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	**10**

5.3.4.4 Overall summary

The results show that within the Százhalombatta and Dunaújváros-Kosziderpadlás settlement assemblages' cups receive the least investment of skill. This is followed by domestic vessels and then urns and finally fineware. The difference between urns and fineware is marginal with both vessel groups receiving a high investment of skill. In contrast to these results within the Dunaújváros-Duna-dűlő cemetery, assemblage fineware receives a low investment of skill alongside cups and domestic vessels. Meanwhile, urns receive the greatest investment of skill.

5.4 Fabric series: characterisation of fabrics and relationship of fabrics, and fabric groups, to each site and to vessel groups

5.4.1 The fabric series

All sherds were examined macroscopically and using x10 and x20 microscopic magnification. The methodologies followed were those of the Prehistoric Ceramic Research Group (1997), and Orton *et al* (1997).

Twenty-six distinct fabrics have been identified. It is usual within pottery studies to groups fabrics based on inclusion type as an aid to provenance studies. This is not one of the purposes of this study. The grouping of fabrics through association to the dominant inclusion type is used here for descriptive purposes and as a potential tool for investigating any relationship that exists between the preparation of particular fabric types, the investment of skill employed in their preparation, and any relationship to particular vessel groups. There are two key aspects of fabric preparation that are of importance with regard to this study. The first relates to the appropriateness of inclusions, or tempering material, selected in relation to vessel function. It is well understood that different inclusion types offer different technological characteristics that can aid, or hinder, the performance characteristics of specific vessel types. This is discussed in detail within the methodology (chapter 4). The second is to the overall textural characteristics of each fabric. Textural characteristics are constituted by the selection of natural and/or deliberate inclusions, how these are added to or taken from the clay, how they are mixed (wedged) through the clay, how tight or loose a fabric is, and the nature of the clay matrix. In summary, the textural types refer to inclusion density, size ranges, and sorting. They also refer to the clay matrix in terms of how well the clay has been cleaned of detritus. Finally, the tightness or looseness of fabrics is noted as this affects performance, for example, a fine, tight fabric may be appropriate for a fineware vessel but may be considered as undesirable for a cooking vessel (Rye 1976, 1981; Schiffer *et al* 1994). The textural type and its appropriate use is another indicator of the investment of skill that has taken place. The elements comprising each textural type are shown in Table 5.27; the rationale for their use within this study is discussed in greater depth within the methodology (chapter 4). The symbols ●, ▲ and ■ are used as labels for the textural types in preference to numeric or alphabetic labels so as to not cause confusion in the presentation of tables and charts. Each fabric is also assigned a colour code for easy reference in the charts that follow.

Table 5.27 Descriptions of textural types

●	Tight, fabrics with predominately very well and well sorted inclusions/temper with a modest size range and a well sorted, clean, clay matrix. These combined elements suggest probable drying of the raw clay, sieving to remove any detritus and to grade inclusion or temper size and a thorough wedging process.
▲	Looser fabrics than above, with predominately moderately sorted inclusions/temper with a moderate size range of grains and a moderately clean clay matrix. These combined elements suggest probable drying of the clay with moderate grading of inclusion size range. Less time has been spent on the wedging process resulting in moderately sorted inclusions and a moderately open fabric.
■	Coarse, open fabrics with predominately poorly sorted inclusions, a broad size range of inclusion grains and a ragged clay matrix. These combined elements suggest the unlikelihood of much cleaning or sorting of the clay or inclusions/temper and little time spent wedging the clay.

5.4.2 Characterisation of fabrics

Twenty-six fabrics were identified. The main inclusions are grog, limestone, and quartz. These inclusions appear in a number of combinations. Grog appears as a primary inclusion with varying amounts of quartz both as a natural inclusion and as deliberately added temper. A number of fabrics have grog combined with various amounts of limestone. There are also Limestone fabrics with no addition of grog and varying amounts of quartz which appears to be naturally present. Limestone may be a naturally occurring inclusion and is in keeping with the geology of the region (Rónai *et al.* 1972; Szentes *et al.* 1968) however, in two of the fabrics (L1 and L5) it appears as well sorted with a fine inclusion size suggesting that its incorporation does not have to be assumed as random. Finally, there are quartz fabrics with no grog or limestone. One quartz fabric has a sparse amount of limestone as a naturally occurring inclusion. Full descriptions are given below and a précis of fabric descriptions is given in Table 5.28.

5.4.2.1 Grog fabrics (G)

G1 is a tight fabric with inclusions of grog and quartz. The well-sorted nature and modest size range of both the grog and quartz inclusions suggest sieving or sorting of inclusions and thorough mixing (wedging) of the clay. G1 = (●)

G2 is a refined, tight, fabric, with a moderate to common amount of well-sorted grog in a clean clay matrix. The sorting and modest size range suggests sieving of inclusions and thorough mixing (wedging) of the clay. G2 = (●)

G3 is very different in character to the other grog fabrics with a high presence of orange coloured grog and quartz present both as crushed grains and as granules. The well-sorted nature and modest size range of the grog in this fabric suggests careful handling of this deliberately added inclusion. The quartz inclusions, however, display an extremely broad and gradated size range and are less well-sorted throughout the clay body; this suggests that the quartz is natural to the clay matrix, which has not been subjected to a thorough process of refining before the addition of the grog temper. G3 = (▲)

G4 has a sparse amount of both poorly sorted grog and quartz and a coarse clay matrix, than either G1 or G2. G4 = (■)

G5, is moderately to poorly sorted grog and a very loose texture from poor wedging. There is also a coarser clay matrix with red and black iron throughout. G5 = (■)

G6 also represents a well prepared fabric but with a lower amount of, and finer grained, grog than that of G2 but with a slightly coarser sandy clay matrix. The tight, compacted, texture of G6 also suggests careful attention to clay preparation. G6 = (●)

G7 has a somewhat different nature to the other grog fabrics with the presence of both quartz and quartzite and very well rounded, hard, red iron pellets. The presence of the quartz, quartzite and red iron pellets suggests a more random approach to clay preparation. G7 = (▲)

G8 is a coarser fabric with moderately-sorted grog and poorly-sorted quartz pebbles that range from 0.5–2.5mm suggesting a continuous size range, and the unlikelihood of the quartz being a deliberately added temper. As with fabric G3 the nature of the quartz inclusions suggests that the raw clay has not been subjected to a particularly thorough process of refining before the addition of the grog temper. G8 = (■)

5.4.2.2 Grog and limestone fabrics (GL)

GL1 is a coarse fabric with moderately to poorly sorted grog and limestone, both with a broad size range, and a fairly coarse clay matrix with a high percentage of coarse sand and random quartz pebbles measuring up to 3mm. GL1 = (■).

GL2 is similar to GL1 but appears as a coarser fabric both macroscopically and microscopically — with a greater size range of limestone present and with additional, random, limestone inclusions that exceed the normal size range. The clay matrix is similar to GL1. The nature of this fabric, as with GL1, suggests the possibility of a low investment of preparation. GL2 = (■).

GL3 has a less sandy matrix than for GL1 or GL2 and, despite the black iron that is present, is a more organised fabric with modest size ranges for grains of grog and limestone which are both moderately-sorted rather than moderately to poorly-sorted. GL3 = (▲).

GL4 appears to be a very well prepared fabric. Unusually there are three distinct inclusions; grog, limestone and quartz all of which are present in relatively modest amounts. The first two inclusions are characterised by modest size ranges, and in the case of the quartz there is no deviation from the 0.5mm grain size. The clay matrix is clean with a 20% presence of well-sorted fine sand. All three inclusion types are well-sorted, and evenly mixed amongst each other, suggesting a well wedged clay body. GL4 = (●).

GL5 is similar to GL4, but has a higher percentage of finely crushed grog that is well-sorted, but the limestone content is less well-sorted than GL4 and occasional, random, quartz granules suggest less thorough preparation. GL5 = (▲)

GL6 sees another increase in the grog content and a wider size range of grains, this time only moderately-sorted. Meanwhile, the limestone inclusions also have a broad size range and are poorly-sorted. GL6 = (■)

GL7 has the highest grog content of all the grog, and grog and limestone fabrics. As with GL4 there are three distinct inclusions in this fabric, however, in this instance the grog has a generally broad size range with the additional, occasional presence of very large grog inclusions, up to 7mm, and is only moderately-sorted. The limestone and quartz content also have a broad size range, up to 4mm, and are moderately-sorted; meanwhile, the clay matrix is of coarse sand. GL7 = (■)

5.4.2.3 Limestone fabrics (L)

L1 is a fine, well prepared fabric with a moderate amount of limestone with a modest size range and well-sorted grains. The clay matrix is very clean with clear grains of coarse, rounded, grains of sand. L1 = (●)

L2 is similar to L1 but the limestone content has a far broader size range and is moderately to poorly-sorted. The limestone may be a naturally occurring inclusion that has not been refined out of the clay during the cleaning and preparation process. The fact that it is also only moderately to poorly-sorted suggests a less careful approach to this fabrics preparation. The clay matrix is more complex with medium to coarse sand grains that are both sub-angular and sub-rounded. L2 = (▲).

L3 is a crude fabric with a sparse amount of limestone with an extremely broad size range from 0.5mm up to 10mm all of which is poorly-sorted. It has an uneven consistency and is exceptionally friable and loose. L3 = (■).

L4 is another coarse fabric. The limestone content has a far more modest size range than L2 and L3 but it is poorly-sorted and accompanied by a messy, uneven clay matrix, further suggesting little attention to the wedging process, with common amounts of black iron. L4 = (■).

L5 is a clean, sandy fabric with a sparse amount of limestone, with a very modest size range, that is well sorted. There is also the occasional presence of black iron. It is very similar in character to L1 and is a fine and well prepared fabric. L5 = (●).

5.4.2.4 *Quartz fabrics* (Q)

Q1 is a very, tight, fine and entirely clean fabric with common to abundant presence of fine sand, which is very well-sorted throughout the clay. It is a tight, dense fabric suggesting careful wedging and cleaning. Q1 = (●).

Q2, as with Q1, it is a clean fabric with very well-sorted sand. In this instance this takes the form of coarse, angular grains that may be clear or white. Again, it is tight and dense suggesting good attention to wedging. Q2 = (●).

Q3 is similar in terms of its overall character to Q1 and may represent a local variant of this type of fabric. It also an extremely fine fabric with an abundant presence of very well sorted quartz grains with a modest size range. The moderate black iron content, also with a modest size range, is also very well sorted suggesting careful wedging and clay preparation. Q3 = (●).

Q4 has unusual characteristics in that it is clearly laminated and has a sparse presence of very well sorted quartz pebbles with a fairly broad size range. These may be naturally occurring but the fact that they are very well sorted, as is the coarse sand in the clay matrix and the generally clean nature of this fabric suggests careful cleaning and wedging has occurred. Q4 = (●).

Q5 is a well prepared fabric with the moderate quartz and quartzite being well sorted, as are the iron oxide pellets that are present and the abundant fine sand. Q5 is, again, only present at Százhalombatta. Q5 = (●).

Q6 is the only quartz fabric that can be described as having a messy appearance. It is made up of a very common amount of moderately sorted, coarse-grained white and clear quartz with red and black iron oxide throughout and with the occasional presence of limestone. It gives the appearance of being far less well prepared than the other quartz fabrics. Q6 = (▲).

Table 5.28 Summarised descriptions of each fabric and allocated textural types

Fabric code and textural type	FABRIC DESCRIPTION
G1●	grog, 10/15%, 0.5/2mm, w/m sorted; quartz, 5/7%, 0.5/1mm, w sorted; q 20/30% as m/f sand; fine grained tight fabric with clean clay matrix
G2●	grog, 15/25%, 0.25/1mm, w sorted; w sorted quartz 20% as f sand; clean clay matrix
G3▲	grog, 20%, 0.25/1mm, w/m sorted / orange; quartz as discrete granules and as messy crushed and angular fragments 10%, 0.5/7mm, m sorted; quartz 20% as f sand through the clay matrix
G4■	grog, 3/10%, 0.5/1mm, p sorted; quartz 5/10%, 0.5/1.5mm m/p sorted; quartz 20/30% as m sand; coarse clay matrix
G5■	grog, 3/10%, 0.5/2mm, m/p sorted; quartz, 20/40%, as m/c sand; red and black iron unevenly mixed through the clay matrix; loose, soft fabric with messy clay matrix
G6●	grog, 5/10%, 0.25/0.5mm, w sorted; quartz as m sand; tight, fine grained fabric with clean clay matrix
G7▲	grog, 7/10%, 0.5/2mm, m sorted; quartz and quartzite,10%, 0.5mm, m sorted; quartz as f sand; hard, round red iron pellets occassionally present
G8■	grog, 10/20%, 0.25/1.5mm, m sorted; quartz, 3/7%, 0.5/2.5mm as coarse sand through to granules, p sorted; quartz 10% as f/m sand
GL1■	grog, 10/30%, 0.5/2mm, m/p sorted; limestone, 5/15%, 0.25/2mm, m/p sorted; quartz, 20/40% as m/c sand; (random sub-rounded quartz granules 3mm), coarse clay matrix
GL2■	grog, 7/15%, 0.25/1.5 mm, m/p sorted; limestone, 5/15%, 0.5/4mmm, p sorted; occassional larger limestone vp sorted; quartz, 20/40% as m/c sand, coarse clay matrix
GL3▲	grog, 5/10%, 0.5/1mm, m sorted; limestone 5/10%, 0.25/1mm, m sorted; quartz 20% as m/c sand, black iron m/p sorted through the clay matrix
GL4●	grog, 7/10%, 0.5/1mm, w sorted; limestone 3/7%, 0.25/1mm, w sorted; q 3/10%, 0.5mm, w sorted; quartz 20% as f sand; highly organised fabric, clean clay matrix
GL5▲	grog, 15/25%, 0.25/0.5mm, m sorted; limestone, 10%, 0.25/1mm, m sorted; occassional sub-rounded quartz granules 2/4mm; quartz 20% as f sand
GL6■	grog, 20/30%,0.25/3mm, m sorted; limestone,10%, 0.5/3mm, p sorted; quartz 20% as m sand
GL7■	grog, 30/40% , 0.5/2mm (occ. larger - up to 7mm), m/p sorted; limestone, 15%, 0.25/4mm, m/p sorted; quartz, 7%, 1/ 4mm, m/p sorted; quartz 20-30% as c sand; crude messy looking fabric
L1●	limestone, 10/15%, 0.25/1mm, w sorted; clear grains of rounded quartz 20% as c sand; clean clay matrix
L2▲	limestone, 7/15%, 0.25/ 4mm, m/p sorted; q 20/30% as m/c sand; complex clay matrix
L3■	limestone, 7/10%, 0.5 /10mm, p sorted; soft friable fabric, very loose and uneven consistency
L4■	limestone, 3/7%, 0.25/1mm, p sorted, 20% messy black iron; quartz as f sand; messy, uneven clay matrix
L5●	limestone,3/7%, 0.25/0.5mm, w sorted; quartz, 25/30%, as c sand, w. sorted, (occ. black iron); very fine grained sandy fabric
Q1●	q 20/40% as very well sorted fine sand; tight fabric with clean clay matrix
Q2●	quartz, 20/30% as very well sorted coarse sand, angular white and clear; clean clay matrix
Q3●	quartz, 40%, 0.5/0.75mm, vw sorted; quartz as f sand; black iron, 10%, 0.5/0.75 vw sorted; a clean, tight fabric / excellent preparation
Q4●	quartz, 7%, 1/4mm as very coarse sand through to sub-rounded granules, w sorted; quartz, 20-30% as c sand
Q5●	quartz and quartzite, 10%, 0.5/2mm, w sorted; quartz, 30%, as f sand; w sorted iron as round pellets
Q6▲	messy looking quartz, rounded to angular, 30%, 0.5/1mm, m sorted; red iron and black iron, m sorted; occassional limestone up to 3%; messy looking fabric

5.4.3 Frequency of individual fabrics (and corresponding textural type) within each assemblage

5.4.3.1 Százhalombatta

At Százhalombatta 20 of the 26 identified fabrics are represented. G2● is the most frequent fabric with a 17.2% presence. This is followed by GL1■ (10.7%), Q1● (8.2%), G4■ (6.8%), G5■ (5.3%), Q6▲ (5.3%), G1● (5.1%), G6● (3.9%), GL3 ▲ (3.4%) and L4■ (3.2%). Of the twenty fabrics present at Százhalombatta exactly half of them have less than a 2% frequency; these are fabrics L1● (1.1%), L2▲ (1.1%), Q3● (1.1%), Q5● (1.7%), L5● (0.8%), GL4● (0.8%), G7 ▲ (0.6%), G3▲ (0.3%), Q2● (0.3%) and Q4● (0.3%), (Table 5.31, Figure 5.28). The G fabrics have the highest frequency (39.2%), the Q fabrics have a frequency of 16.9%, the GL fabrics have a frequency of 14.9% and the L fabrics have a lower frequency of 6.2% (Tables 5.29, 5.30).

5.4.3.2 Dunaújváros-Kosziderpadlás

At Dunaújváros-Kosziderpadlás 13 of the 26 identified fabrics are represented. The most frequent fabric at Dunaújváros-Kosziderpadlás is G2● (22.8%). This is followed by G6● (10.5%) GL5▲ (9.3%) and Q3● (7.4%) The next most frequent fabrics at Dunaújváros-Kosziderpadlás are GL3▲ (6.8%), GL2■ (6.2%), GL1■ (5.6%) and G8■ (4.3%). G5■ and GL6■ both have a modest frequency of 3.1%. Only three fabrics have less than a 2% presence; these are G1● (1.9%), GL7■ (1.2%), and GL4● (0.6%), (Table 5.31, Figure 5.28). At Dunaújváros-Kosziderpadlás there is a strong frequency of both G fabrics (42.6%) and GL fabrics (32.8%). There is a modest frequency of Q fabrics (7.4%) and L fabrics are not present (Tables 5.29, 5.30).

5.4.3.3 Dunáujváros-Duna-dűlő

At Dunáujváros-Duna-dűlő 16 of the 26 identified fabrics are present. The most frequent fabric is L2▲ (13.5%). This is followed by GL1■ (10%), G6● (8.5%), GL4● (6.5%), GL5▲ (6.0%), G2● (5.5%) and GL3▲ (5.0%). Fabrics G5■ (3.5%), GL2■ (3.5%), Q1● (3.5%), G8■ (2.5%) and L3■ (2.0%) are all infrequent. There are four fabrics with less than a 2% frequency, GL7■ (1.5%), L5 ● (1.0%), GL6■ (0.5%) and Q3● (0.5%) (Table 5.31, Figure 5.28). At Dunáujváros-Duna-dűlő the GL fabrics have the greatest frequency (33.0%), G fabrics have a frequency of 20.0% and L fabrics a frequency of 16.5%. Q fabrics are infrequent (4%), (Tables 5.29, 5.30).

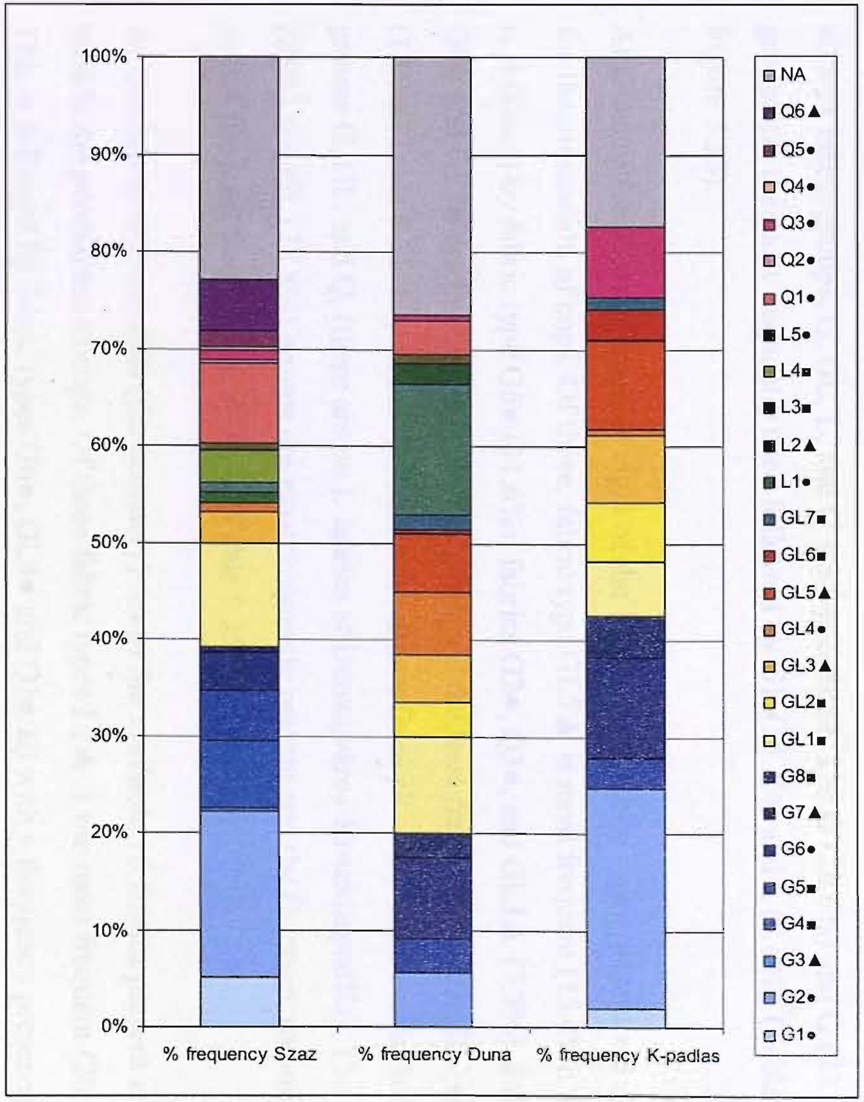


Figure 5.28 Percentage frequencies of fabrics and textural types in relation to all vessel groups at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas), and Dunáujváros-Duna-dűlő (Duna)

Table 5.29 Percentage and numeric frequencies of fabrics and textural types in relation to all vessels at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas), and Dunáujváros-Duna-dűlő (Duna)

FABRIC TYPE	% frequency Szaz	% frequency Duna	% frequency K-padlas	No. at Szaz	No. at Duna	No. at K-padlas
G1●	5.1%	0.0%	1.9%	18	0	3
G2●	17.2%	5.5%	22.8%	61	11	37
G3▲	0.3%	0.0%	0.0%	1	0	0
G4■	6.8%	0.0%	0.0%	24	0	0
G5■	5.3%	3.5%	3.1%	19	7	5
G6●	3.9%	8.5%	10.5%	14	17	17
G7▲	0.6%	0.0%	0.0%	2	0	0
G8■	0.0%	2.5%	4.3%	0	5	7
GL1■	10.7%	10.0%	5.6%	38	20	9
GL2■	0.0%	3.5%	6.2%	0	7	10
GL3▲	3.4%	5.0%	6.8%	12	10	11
GL4●	0.8%	6.5%	0.6%	3	13	1
GL5▲	0.0%	6.0%	9.3%	0	12	15
GL6■	0.0%	0.5%	3.1%	0	1	5
GL7■	0.0%	1.5%	1.2%	0	3	2
L1●	1.1%	0.0%	0.0%	4	0	0
L2▲	1.1%	13.5%	0.0%	4	27	0
L3■	0.0%	2.0%	0.0%	0	4	0
L4■	3.2%	0.0%	0.0%	11	0	0
L5●	0.8%	1.0%	0.0%	3	2	0
Q1●	8.2%	3.5%	0.0%	29	7	0
Q2●	0.3%	0	0.0%	1	0	0
Q3●	1.1%	0.5%	7.4%	4	1	12
Q4●	0.3%	0.0%	0.0%	1	0	0
Q5●	1.7%	0.0%	0.0%	6	0	0
Q6▲	5.3%	0.0%	0.0%	19	0	0
NA	22.8%	26.5%	17.3%	81	53	28
	100.0%	100.0%	100.0%	355	200	162

Table 5.30 Fabric groups: percentage and numeric frequency at each site

Fabric Groups	Százhalombatta		Dunáujváros-Duna-dűlő		Dunaújváros-Kosziderpadlás	
Grog	39.2%	139	20.0%	40	42.6%	69
Grog and Limestone	14.9%	53	33.0%	66	32.8%	53
Limestone	6.2%	22	16.5%	33	0.0%	0
Quartz	16.9%	60	4.0%	8	7.4%	12
NA	22.8%	81	26.5%	53	17.3%	28
Total	100.0%	355	100.0%	200	100.0%	162

5.4.4 Frequency of individual fabrics (and corresponding textural type) in relation to vessel groups at Százhalombatta, Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő

5.4.4.1 Cups

At Százhalombatta just seven of the available 20 fabrics present are used for the production of cups. Fabric G2● shows the greatest frequency (15.7%). Fabric GL1■ has a frequency presence of 14.3%; G4■ and Q6▲ both have a frequency of 12.9%; Q1● has a 10% frequency; L4■ a 7.9% frequency (Table 5.31, Figure 5.29). Fabric L1● shows the least frequency with a (0.7%) presence. Despite the limited range of fabrics all four fabric groups, G, GL, L, and Q are represented. The G (28.6%) and Q (22.9%) groups are the most frequently used followed by GL (14.3%) and L (8.6%), (Table 5.35, Figure 5.33).

At Dunaújváros-Kosziderpadlás eight of the 13 available fabric types present are used for the production of cups. Of these, fabric type GL5▲ is most frequent (15.4%). This is followed by fabric type G6● (11.6%); fabrics G2●, Q3●, and GL3▲ (7.7%). Fabrics G8■ and GL2■ are less frequent (both 3.8%), and the least frequent fabric is GL1■ (1.9%) (Table 5.31, Figure 5.29). Fabrics are drawn from all of the three available fabric groups G, GL, and Q, (there are no L fabrics at Dunaújváros-Kosziderpadlás). The G (25%) and GL (28.8%) groups are most frequently present and the Q group, meanwhile, shows the least frequent use (9.6%), (Table 5.35, Figure 5.33).

At Dunáujváros-Duna-dűlő (the cemetery) ten of the available 16 fabrics present are used in the production of cups. Of these fabric types L2▲ is the most frequent (20.8%). This is followed by fabric types G6●, GL4● and Q1● all with a frequency presence of 10.4%. There are then six fabric types G2●, L5●, GL3▲, GL5▲, G8■ and GL2■ that all have a low frequency presence of 2.1%, (Table 5.31, Figure 5.29). Fabrics are drawn from all four fabric groups G, GL, L, and Q with a higher frequency of fabrics from the L (22.9%), GL (16.7%) and G (14.6%) groups than the Q group 10.4% (Table 5.35, Figure 5.33).

5.4.4.2 Domestic vessels

At Százhalombatta 13 of the available 20 fabric types are used in the production of domestic vessels. Fabric G2● shows the greatest frequency (18.2%). GL1■ has a frequency presence of 14.5%; G1● has a frequency of 12.7%; G6● a frequency of 7.3% and both GL3▲ and L2▲ have a frequency of 5.5%. G5■ has a low frequency presence (3.6%). This is followed by a number of fabrics all have an infrequent presence of 1.8%. These fabrics are; G3▲, G4■, Q1●, Q3●, Q5● and Q6▲ (Table 5.32, Figure 5.30). All four fabric groups, G, GL, L, and Q are represented. The G group is most frequent (45.5%), the GL group follows (20.0%), and Q group (7.2%) and the L group (5.5%) are less frequently used (Table 5.35, Figure 5.34).

At Dunaújváros-Kosziderpadlás 12 of the available 13 fabrics identified are used in the production of domestic vessels. Of these, fabric type GL3▲ is most frequent (16.7%), followed by fabric type GL1■ (14.3%). Fabrics GL2■ and G2● both have a frequency of 11.9% while fabrics G5■, GL5▲ and GL6■ all have the same frequency of 7.1%. Fabrics G6● and G8■ share a frequency of 4.8%. Fabrics G1● and GL7■ are both infrequently present (2.4%), (Table 5.32, Figure 5.30). Fabrics are only drawn from the G and GL fabric groups. The L group never appears at Dunaújváros-Kosziderpadlás and in this instance there is no use of the Q fabrics. The GL group makes up 61.9% of the total frequency of fabrics used for producing domestic vessels at Dunaújváros-Kosziderpadlás and the G group accounts for 31.0%, (Table 5.35, Figure 5.34).

At Dunáujváros-Duna-dűlő (the cemetery) 13 of the available 16 fabrics identified are used in the production of domestic vessels. Of these GL1■ and L2▲ are both most frequent (14.3%). This is followed by fabric GL5▲ (11.9%) and then a number of fabrics; G5■, GL2■, GL3▲, GL4▲ and GL7■ all share the same frequency of 7.1%. Fabrics G2● and G6● share a frequency of 4.8%. Fabrics G8■, L3■ and Q3● share a low frequency of 2.4% (Table 5.32, Figure 5.30). Fabrics are predominately drawn from all four fabric groups. The GL fabric group shows the greatest frequency (54.6%), followed by the G group (19.1%) and the L group (16.7%). Although the Q fabric group appears it has a very infrequent overall presence (2.4%), (Table 5.35, Figure 5.34).

5.4.4.3 Urns

At Százhalombatta 15 of the available 20 fabric types are used in the production of urns. Fabric G2● shows the greatest frequency (17.5%) followed by fabric G5■ (11.1%). Fabric GL1■ has a frequency presence of 9.5% and fabrics G1● and G4■ both have a frequency presence of 7.9%. Fabric GL2 has a frequency of 6.3% and is followed by fabrics G6■, L5●, Q1●, and Q5● all with the same frequency of 4.8%. The least frequent fabrics are GL3▲ (3.2%) and fabrics G7▲, L2▲, Q3● and Q4● which share the same frequency of (1.6%), (Table 5.33, Figure 5.31). Fabrics are predominately drawn from the G fabric group (50.8%). The GL group has a frequency of 19.0% and the Q group a frequency of 12.8%. The least frequent group is L (6.4%), (Table 5.35, Figure 5.35).

At Dunaújváros-Kosziderpadlás 11 of the available 13 fabrics identified are used in the production of urns. Of these, fabric G2● has a particularly high frequency (40.0%). This is followed by G6■ (13.4%) and G8■ (10.0%). Fabric GL1■ has a frequency of 6.7% and then fabrics G1●, G5■, GL2■, GL5▲, GL6■, GL■7, and Q3● all share the same frequency of 3.3% (Table 5.33, Figure 5.31). Fabrics are drawn from the three available groups G, GL and Q. The G group represents a very high frequency of 70%, the GL group has a frequency of 19.9% and the Q group is infrequently represented (3.6%), (Table 5.35, Figure 5.35).

At Dunáujváros-Duna-dűlő (the cemetery) 11 of the available 16 fabrics identified are used in the production of urns. Fabric G8■ shows the highest frequency (12.5%) followed by GL1■ (10.7%). Fabrics GL5▲ and L2▲ share the same frequency of 8.9% and fabrics G2● and GL3▲ share the same frequency of 7.1%. Four fabrics, G5■, G8■, GL2■ and Q1● all have a frequency of 3.6%. The least frequent fabric is GL4● (1.8%), (Table 5.33, Figure 5.31). Fabrics are drawn from all four fabric groups. The GL group shows the highest frequency (32.1%), the G group has a frequency of 32.1%, the L group a frequency of 8.9%. The Q group has a low frequency of 3.6%, (Table 5.35, Figure 5.35).

5.4.4.4 Fineware

At Százhalombatta 13 of the available 20 fabric types are used in the production of fineware. Fabric G2● shows the greatest frequency (18.6%) followed by fabric Q1● (11.3%), fabric G5■ (10.3%), fabric G6● (7.2%), fabric G1● (6.2%), fabrics GL3▲ (5.2%), fabric G8■ (4.1%) and fabric L1● (3.1%). Fabrics Q3 and Q5 both have a frequency of 2.1%, and fabrics GL4● and Q2● have the lowest frequency of 1.0%, (Table 5.34, Figure 5.32). Fabrics are drawn from all four fabric groups for the production of fineware at Százhalombatta. The G group has the highest frequency of 47.4%, followed by the Q group (16.5%). Both the GL (6.2%) and L group (3.1%) are less common (Table 5.35, Figure 5.36).

At Dunaújváros-Kosziderpadlás eight of the available 13 fabrics identified are used in the production of fineware. Of these, fabric G2● has a particularly high frequency (49.5%). This is followed by fabric Q3● (15.8%) and fabric G6 ● (13.2%). Fabric GL5▲ has a frequency of 7.9% and fabric GL2■ a frequency of 5.3%. Three fabrics; G1●, G5■ and GL6■ share the same frequency of 2.6% (Table 5.34, Figure 5.32). Fabrics are drawn from the three available groups G, GL and Q. The G group represents a high frequency of 57.9%, the GL group and Q group share the same frequency of 15.8% (Table 5.35, Figure 5.36).

At Dunáujváros-Duna-dűlő (the cemetery) 13 of the available 16 fabrics identified are used in the production of fineware. Fabric GL1■ shows the highest frequency (14.8%) followed by fabric L2▲ (11.0%). Fabrics G1● and GL4● both share the same frequency of 7.4%. Fabrics G6● and L3■ both share the same frequency of 5.6%, and fabrics G5■ and GL3▲ share the same frequency of 3.7%. Fabrics G8■, GL5▲, GL6■ and L5● all share the same percentage frequency (1.9%). Fabric GL2■ has a frequency of 1.8% (Table 5.34, Figure 5.32). Fabrics are drawn from all three of the available four fabric groups. The GL group shows the highest frequency (31.5%), the G group has a frequency of 18.6%, the L group a frequency of 18.5%. The Q group is not represented (Table 5.35, Figure 5.36).

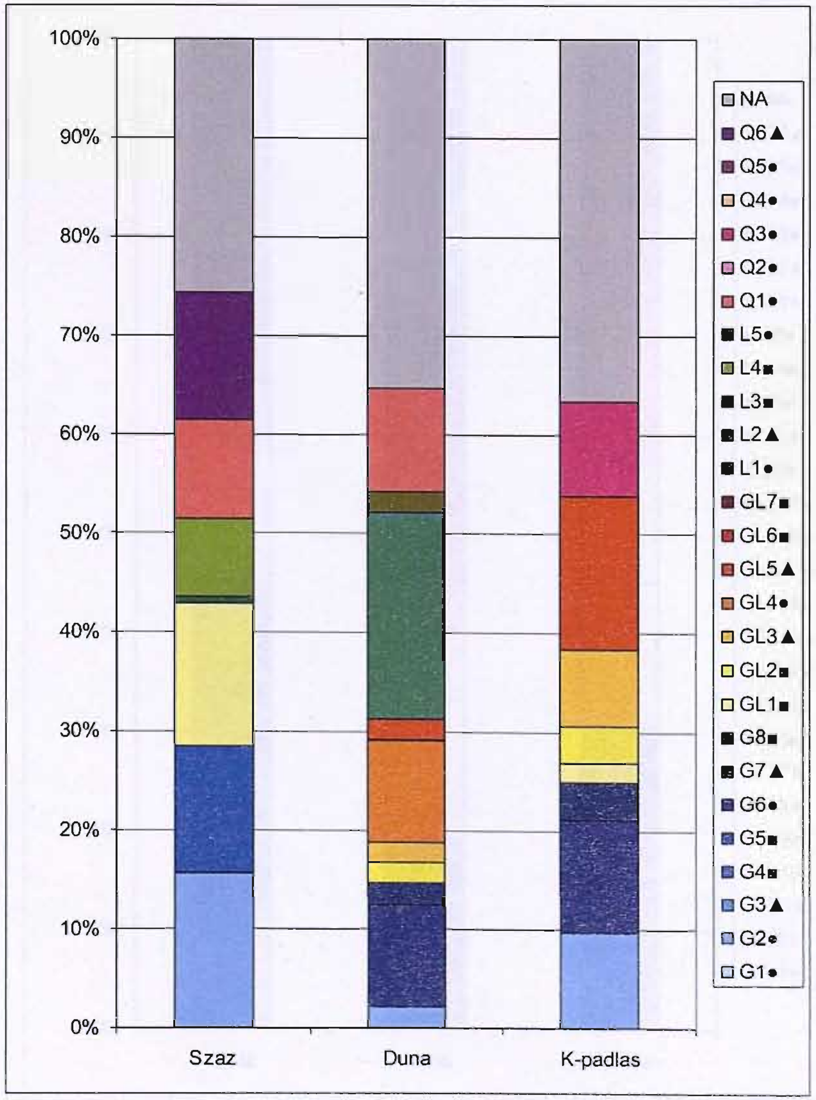


Figure 5.29 Percentage frequencies of fabrics and textural types in relation to cups at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

Table 5.31 Percentage and numeric frequencies of fabrics and textural types in relation to cups at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

FABRIC CODE	Szaz	Duna	K-padlas	Szaz	Duna	K-padlas
G1•	0.0%	0.0%	0.0%	0	0	0
G2•	15.7%	2.1%	9.6%	22	1	5
G3▲	0.0%	0.0%	0.0%	0	0	0
G4■	12.9%	0.0%	0.0%	18	0	0
G5■	0.0%	0.0%	0.0%	0	0	0
G6•	0.0%	10.4%	11.6%	0	5	6
G7▲	0.0%	0.0%	0.0%	0	0	0
G8■	0.0%	2.1%	3.8%	0	1	2
GL1■	14.3%	0.0%	1.9%	20	0	1
GL2■	0.0%	2.1%	3.8%	0	1	2
GL3▲	0.0%	2.1%	7.7%	0	1	4
GL4•	0.0%	10.4%	0.0%	0	5	0
GL5▲	0.0%	2.1%	15.4%	0	1	8
GL6■	0.0%	0.0%	0.0%	0	0	0
GL7■	0.0%	0.0%	0.0%	0	0	0
L1•	0.7%	0.0%	0.0%	1	0	0
L2▲	0.0%	20.8%	0.0%	0	10	0
L3■	0.0%	0.0%	0.0%	0	0	0
L4■	7.9%	0.0%	0.0%	11	0	0
L5•	0.0%	2.1%	0.0%	0	1	0
Q1•	10.0%	10.4%	0.0%	14	5	0
Q2•	0.0%	0.0%	0.0%	0	0	0
Q3•	0.0%	0.0%	9.6%	0	0	5
Q4•	0.0%	0.0%	0.0%	0	0	0
Q5•	0.0%	0.0%	0.0%	0	0	0
Q6▲	12.9%	0.0%	0.0%	18	0	0
NA	25.7%	35.4%	36.6%	36	17	19
total	100.0%	100.0%	100.0%	140	48	52

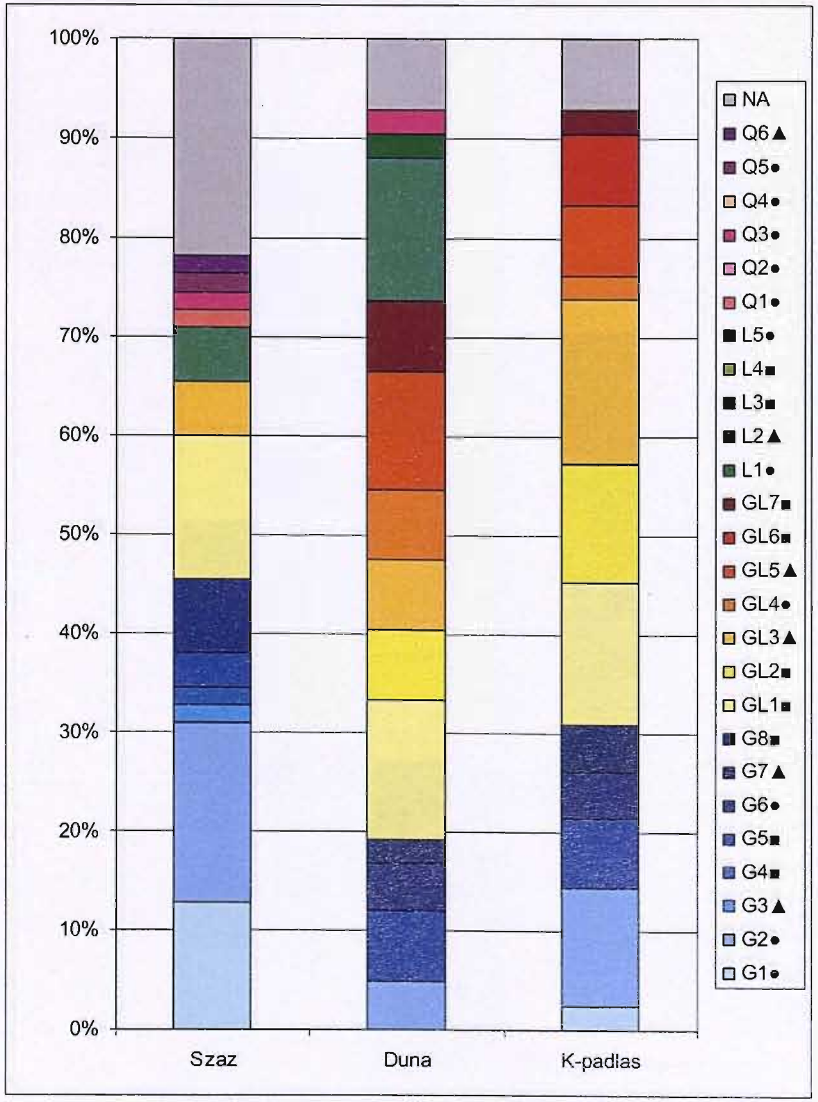


Figure 5.30 Percentage frequencies of fabrics and textural types in relation to domestic vessels at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunaújváros-Duna-dűlő (Duna)

Table 5.32 Percentage and numeric frequencies of fabrics and textural types in relation to domestic vessels at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunaújváros-Duna-dűlő (Duna)

FABRIC CODE	Szaz	Duna	K-padlas	Szaz	Duna	K-padlas
G1•	12.7%	0.0%	2.4%	7	0	1
G2•	18.2%	4.8%	11.9%	10	2	5
G3▲	1.8%	0.0%	0.0%	1	0	0
G4■	1.8%	0.0%	0.0%	1	0	0
G5■	3.6%	7.1%	7.1%	2	3	3
G6•	7.3%	4.8%	4.8%	4	2	2
G7▲	0.0%	0.0%	0.0%	0	0	0
G8■	0.0%	2.4%	4.8%	0	1	2
GL1■	14.5%	14.3%	14.3%	8	6	6
GL2■	0.0%	7.1%	11.9%	0	3	5
GL3▲	5.5%	7.1%	16.7%	3	3	7
GL4•	0.0%	7.1%	2.4%	0	3	1
GL5▲	0.0%	11.9%	7.1%	0	5	3
GL6■	0.0%	0.0%	7.1%	0	0	3
GL7■	0.0%	7.1%	2.4%	0	3	1
L1•	0.0%	0.0%	0.0%	0	0	0
L2▲	5.5%	14.3%	0.0%	3	6	0
L3■	0.0%	2.4%	0.0%	0	1	0
L4■	0.0%	0.0%	0.0%	0	0	0
L5•	0.0%	0.0%	0.0%	0	0	0
Q1•	1.8%	0.0%	0.0%	1	0	0
Q2•	0.0%	0.0%	0.0%	0	0	0
Q3•	1.8%	2.4%	0.0%	1	1	0
Q4•	0.0%	0.0%	0.0%	0	0	0
Q5•	1.8%	0.0%	0.0%	1	0	0
Q6▲	1.8%	0.0%	0.0%	1	0	0
NA	21.8%	7.1%	7.1%	12	3	3
total	100.0%	100.0%	100.0%	55	42	42

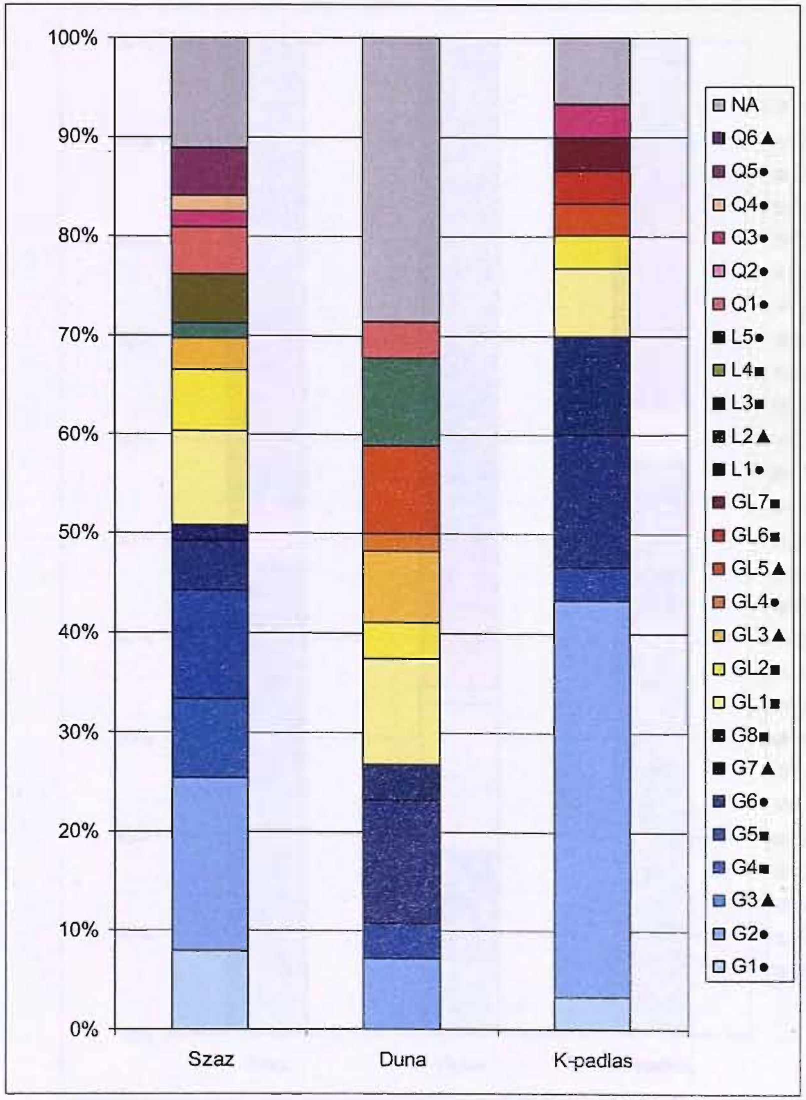


Figure 5.31 Percentage frequencies of fabrics and textural types in relation to urns at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

Table 5.33 Percentage and numeric frequencies of fabrics and textural types in relation to urns at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

FABRIC CODE	Szaz	Duna	K-padlas	Szaz	Duna	K-padlas
G1•	7.9%	0.0%	3.3%	5	0	1
G2•	17.5%	7.1%	40.0%	11	4	12
G3▲	0.0%	0.0%	0.0%	0	0	0
G4■	7.9%	0.0%	0.0%	5	0	0
G5■	11.1%	3.6%	3.3%	7	2	1
G6•	4.8%	12.5%	13.4%	3	7	4
G7▲	1.6%	0.0%	0.0%	1	0	0
G8■	0.0%	3.6%	10.0%	0	2	3
GL1■	9.5%	10.7%	6.7%	6	6	2
GL2■	6.3%	3.6%	3.3%	4	2	1
GL3▲	3.2%	7.1%	0.0%	2	4	0
GL4•	0.0%	1.8%	0.0%	0	1	0
GL5▲	0.0%	8.9%	3.3%	0	5	1
GL6■	0.0%	0.0%	3.3%	0	0	1
GL7■	0.0%	0.0%	3.3%	0	0	1
L1•	0.0%	0.0%	0.0%	0	0	0
L2▲	1.6%	8.9%	0.0%	1	5	0
L3■	0.0%	0.0%	0.0%	0	0	0
L4■	0.0%	0.0%	0.0%	0	0	0
L5•	4.8%	0.0%	0.0%	3	0	0
Q1•	4.8%	3.6%	0.0%	3	2	0
Q2•	0.0%	0.0%	0.0%	0	0	0
Q3•	1.6%	0.0%	3.3%	1	0	1
Q4•	1.6%	0.0%	0.0%	1	0	0
Q5•	4.8%	0.0%	0.0%	3	0	0
Q6▲	0.0%	0.0%	0.0%	0	0	0
NA	11.1%	28.6%	6.7%	7	16	2
total	100.0%	100.0%	100.0%	63	56	30

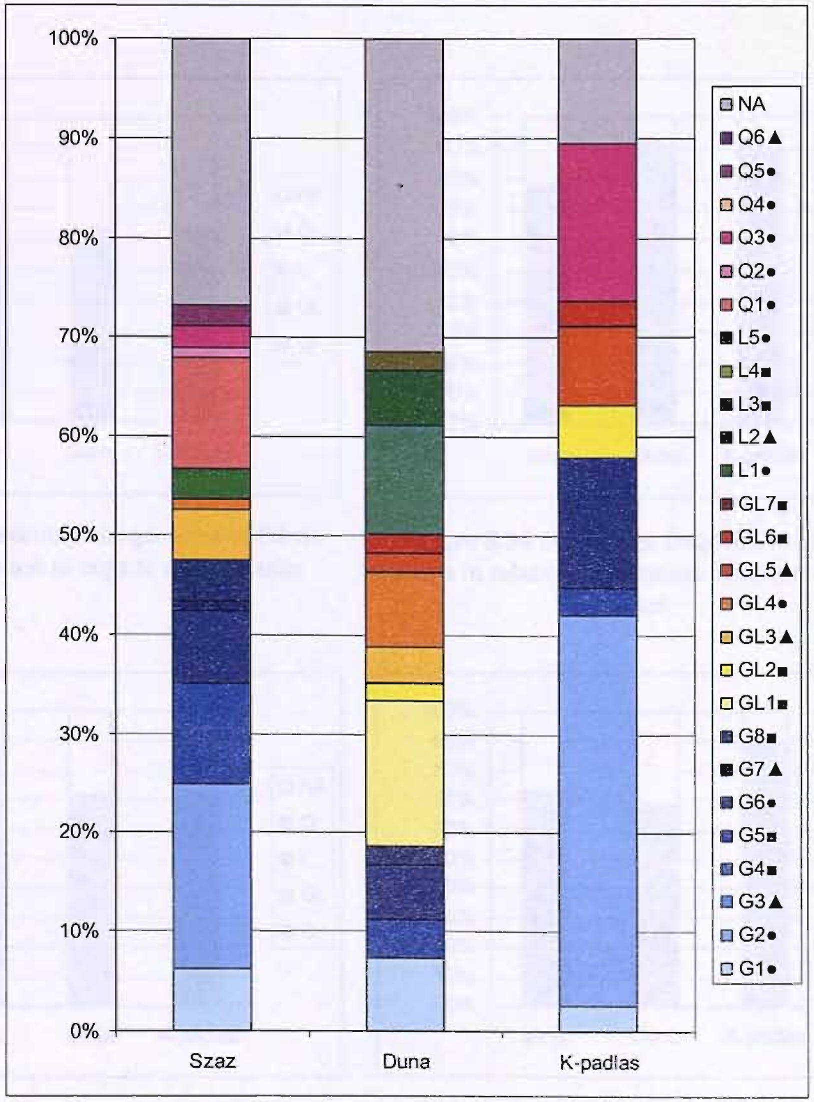


Figure 5.32 Percentage frequencies of fabrics and textural types in relation to fineware at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunaújváros-Duna-dűlő (Duna)

Table 5.34 Percentage and numeric frequencies of fabrics and textural types in relation to fineware at Százhalombatta (Szaz), Dunaújváros-Koszidérpadlás (K-padlas) and Dunaújváros-Duna-dűlő

FABRIC CODE	Szaz	Duna	K-padlas	Szaz	Duna	K-padlas
G1•	6.2%	7.4%	2.6%	6	4	1
G2•	18.6%	0.0%	39.5%	18	0	15
G3▲	0.0%	0.0%	0.0%	0	0	0
G4■	0.0%	0.0%	0.0%	0	0	0
G5■	10.3%	3.7%	2.6%	10	2	1
G6•	7.2%	5.6%	13.2%	7	3	5
G7▲	1.0%	0.0%	0.0%	1	0	0
G8■	4.1%	1.9%	0.0%	4	1	0
GL1■	0.0%	14.8%	0.0%	0	8	0
GL2■	0.0%	1.8%	5.3%	0	1	2
GL3▲	5.2%	3.7%	0.0%	5	2	0
GL4•	1.0%	7.4%	0.0%	1	4	0
GL5▲	0.0%	1.9%	7.9%	0	1	3
GL6■	0.0%	1.9%	2.6%	0	1	1
GL7■	0.0%	0.0%	0.0%	0	0	0
L1•	3.1%	0.0%	0.0%	3	0	0
L2▲	0.0%	11.0%	0.0%	0	6	0
L3■	0.0%	5.6%	0.0%	0	3	0
L4■	0.0%	0.0%	0.0%	0	0	0
L5•	0.0%	1.9%	0.0%	0	1	0
Q1•	11.3%	0.0%	0.0%	11	0	0
Q2•	1.0%	0.0%	0.0%	1	0	0
Q3•	2.1%	0.0%	15.8%	2	0	6
Q4•	0.0%	0.0%	0.0%	0	0	0
Q5•	2.1%	0.0%	0.0%	2	0	0
Q6▲	0.0%	0.0%	0.0%	0	0	0
NA	26.8%	31.4%	10.5%	26	17	4
total	100.0%	100.0%	100.0%	97	54	38

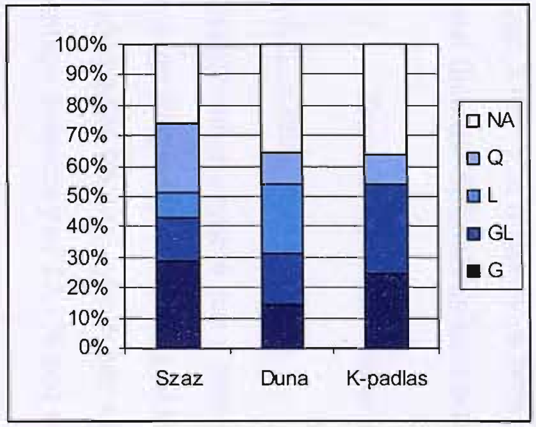


Figure 5.33 Percentage frequencies of fabric groups in relation to cups at all three sites

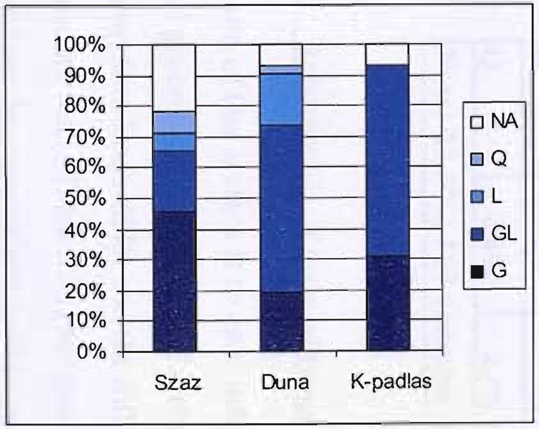


Figure 5.34 Percentage frequencies of fabric groups in relation to domestic vessels at all three sites

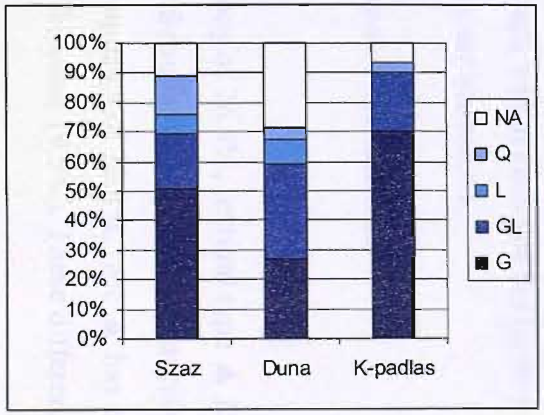


Figure 5.35 Percentage frequencies of fabric groups in relation to urns at all three sites

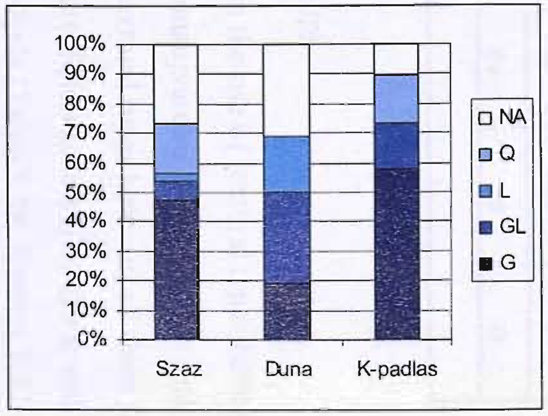


Figure 5.36 Percentage frequencies of fabric groups in relation to fineware at all three sites

Table 5.35 Percentage and numeric frequency of fabric groups in relation to vessel groups at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

Cups	**Szaz**		**Duna**		**K-padlas**	
G	28.6%	40	14.6%	7	25.0%	13
GL	14.3%	20	16.7%	8	28.8%	15
L	8.6%	12	22.9%	11	0.0%	0
Q	22.9%	32	10.4%	5	9.6%	5
NA	25.7%	36	35.4%	17	36.6%	19
	100.0%	**140**	**100.0%**	**48**	**100.0%**	**52**
Dom.	**Szaz**		**Duna**		**K-padlas**	
G	45.4%	25	19.1%	8	31.0%	13
GL	20.0%	11	54.6%	23	61.9%	26
L	5.5%	3	16.7%	7	0.0%	0
Q	7.2%	4	2.4%	1	0.0%	0
NA	21.8%	12	7.1%	3	7.1%	3
	100.0%	**55**	**100.0%**	**42**	**100.0%**	**42**
Urns	**Szaz**		**Duna**		**K-padlas**	
G	50.8%	32	26.8%	15	70.0%	21
GL	19.0%	12	32.1%	18	19.9%	6
L	6.4%	4	8.9%	5	0.0%	0
Q	12.8%	8	3.6%	2	3.3%	1
NA	11.1%	7	28.6%	16	6.7%	2
	100.0%	**63**	**100.0%**	**56**	**100.0%**	**30**
F/ware	**Szaz**		**Duna**		**K-padlas**	
G	47.4%	42	18.6%	10	57.9%	22
GL	6.2%	10	31.5%	17	15.8%	6
L	3.1%	3	18.5%	10	0.0%	0
Q	16.5%	16	0.0%	0	15.8%	6
NA	26.8%	26	31.4%	17	10.5%	4
	100.0%	**97**	**100.0%**	**54**	**100.0%**	**38**

5.4.5 Relationship of fabric groups to textural types

The G fabric group show textural type ● to have the highest frequency (24.8%), followed by ■ (9.3%) while type ▲ is least frequent (0.4%). The GL group shows type ■ to have the highest frequency (13.2%), followed by type▲ (8.4%) while type ● is least frequent (2.4%). The L group shows type ▲ to have the highest frequency (8.4%) followed by type ■ (2.1%) while type ● is least frequent (1.3%). Finally, the Q group show type ● to have the highest frequency (8.4%) followed by type ▲ (2.7%) while type ■ is not present at all (Table 5.36).

Table 5.36 Relationship between fabric groups and textural types across all three assemblages

Textural Type	% ●	% ▲	% ■	No. ●	No.▲	No. ■
G	24.8%	0.4%	9.3%	178	3	67
GL	2.4%	8.4%	13.2%	17	60	95
L	1.3%	4.3%	2.1%	9	31	15
Q	8.4%	2.7%	0.0%	61	19	0
Note: 23.3%; 162 samples = NA						

5.4.6 Relationship of textural types to vessel groups

The aim of this section is to establish differences in the use of textural types between vessel groups within each site, Százhalombatta, Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő, and the different use of textural types between all three sites. Chi square tests (Table 5.37) are used to substantiate differences and numeric and percentage frequencies are used to support this analysis (Table 5.38, Figures 5.37, 5.38, 5.39 and 5.40). The differences between vessel groups within each site are presented first and then the differences between the three sites are examined.

5.4.6.1 Textural types and vessel groups: differences between sites

5.4.6.1.1 Cups

At Százhalombatta type ● has a percentage frequency of 26.4%, textural type ▲ has a percentage frequency of 12.9% and type ■ is most frequent (35.1%). At Dunaújváros-Kosziderpadlás textural type ● has a percentage frequency of 30.8%, type ▲ has a percentage frequency of 23.1% and type ■ is least frequent (9.5%). These differences are significant ($\chi^2 = 14.766$; $p \leq 0.002$). At Dunáujváros-Duna-dűlő type ● has a percentage frequency of 35.4%, type ▲ has a percentage frequency of 25.0% and type ■ is least frequent (4.2%). These results show a significant difference between Százhalombatta and Dunáujváros-Duna-dűlő ($\chi^2 23.410$; $p \leq 0.000$) but no significant difference between Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő ($\chi^2 1.287$; $p \leq 732$*) (Table 5.37a). The results taken in combination with the percentage frequencies (Table 5.38, Figure 5.37) reflect the more frequent use of type ■ for the production of cups at Százhalombatta than at either Dunaújváros-Kosziderpadlás or Dunáujváros-Duna-dűlő. At Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő types ● and ▲ are used more frequently for the production of cups.

5.4.6.1.2 Domestic vessels

At Százhalombatta type ● has the greatest frequency (43.6%), type ▲ has a percentage frequency of 14.6% and type ■ has a percentage frequency of 19.9%. At Dunaújváros-Kosziderpadlás type ● has a percentage frequency of 21.5%, type ▲ has a percentage frequency of 23.8% and type ■ is most frequent (47.6%). These differences are significant ($\chi^2 = 13.983$; $p \leq 0.004$). At Dunáujváros-Duna-dűlő type ● has a percentage frequency of 19.1%, type ▲ has a percentage frequency of 33.3% and type ■ has the greatest frequency (40.4%). The results reflect a significant difference between Százhalombatta and Dunáujváros-Duna-dűlő ($\chi^2 15.360$; $p \leq 0.002$) but no significant difference between Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő ($\chi^2 = 0.969$; $p \leq 0.809$*) (Table 5.37a). The results taken in combination with the percentage frequencies (Table 5.38, Figure 5.38) reflect the more frequent use of type ● for the production of domestic vessels at Százhalombatta than at either Dunaújváros-Kosziderpadlás or Dunáujváros-Duna-dűlő. At Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő types ▲ and ■ are used more frequently for the production of domestic vessels.

5.4.6.1.3 Urns

At Százhalombatta type ● has the greatest frequency (47.8%), type ▲ has the lowest percentage frequency (6.4%) and type ■ has a percentage frequency of 34.8%. At Dunaújváros-Kosziderpadlás type ● has the greatest percentage frequency (60.0%), type ▲ has a percentage frequency of 3.3% and type ■ has a percentage frequency of 29.9%.

These differences are not significant ($\chi^2 = 1.784$; $p \leq 0.618$*). At Dunáujváros-Duna-dűlő type ● has a percentage frequency of 25.0%, type ▲ has a percentage frequency of 24.9% and type ■ has a percentage frequency of 21.5%. The results reflect a significant difference between Százhalombatta and Dunáujváros-Duna-dűlő ($\chi^2$14.940; $p \leq 0.002$) and a significant difference between Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő ($\chi^2 = 16.813$; $p \leq 0.002$*) (Table 5.37a). The results taken in combination with the percentage frequencies (Table 5.38, Figure 5.39) reflect the more frequent use of type ● for the production of urns at both Százhalombatta and Dunaújváros-Kosziderpadlás than at Dunáujváros-Duna-dűlő. There appears to be a very similar use of textural types for urns at both settlement sites compared with the cemetery (Dunáujváros-Duna-dűlő), where there is a very even frequency distribution of all three textural types used for the production of urns.

5.4.6.1.4 Fineware

At Százhalombatta type ● has the greatest frequency (52.6%), type ▲ has the lowest percentage frequency (6.2%) and type ■ has a percentage frequency of 14.4%. At Dunaújváros-Kosziderpadlás type ● has the greatest percentage frequency (71.1%), type ▲ has a percentage frequency of 7.9% and type ■ has a percentage frequency of 10.5%. These differences are not significant ($\chi^2 = 5.301$; $p \leq 0.151$*). At Dunáujváros-Duna-dűlő type ● has a percentage frequency of 22.3%, type ▲ has a percentage frequency of 16.6% and type ■ has a percentage frequency of 29.7%. The results reflect a significant difference between Százhalombatta and Dunáujváros-Duna-dűlő ($\chi^2$16.205; $p \leq 0.001$) and a significant difference between Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő ($\chi^2 = 22.420$; $p \leq 0.000$*) (Table 5.37a). The results taken in combination with the percentage frequencies (Table 5.38, Figure 5.40) reflect the more frequent use of type ● for the production of fineware at both Százhalombatta and Dunaújváros-Kosziderpadlás than at Dunáujváros-Duna-dűlő. At Dunáujváros-Duna-dűlő type ■ is more frequent.

5.4.6.1.5 Summary

Cups: The results taken in combination with the percentage frequencies (Table 5.38, Figure 5.37) reflect the more frequent use of textural type ■ for the production of cups at Százhalombatta than at either Dunaújváros-Kosziderpadlás or Dunáujváros-Duna-dűlő. At Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő types ● and ▲ are used more frequently for the production of cups.

Domestic vessels: Textural type ● is used more frequently for the production of domestic vessels at Százhalombatta than at either Dunaújváros-Kosziderpadlás or Dunáujváros-Duna-dűlő. At Dunaújváros-Koszіderpadlás and Dunáujváros-Duna-dűlő types ▲ and ■ are used more frequently for the production of domestic vessels (Table 5.38, Figure 5.38).

Urns: Textural type ● is used more frequently for the production of urns at both Százhalombatta and Dunaújváros-Koszіderpadlás than at Dunáujváros-Duna-dűlő. There appears to be a very similar use of textural types for urns at both settlement sites compared with the cemetery (Dunáujváros-Duna-dűlő), where there is a very even frequency distribution of all three textural types used for the production of urns (Table 5.38, Figure 5.39)

Fineware: Textural type ● is used more frequently for the production of fineware at both Százhalombatta and Dunaújváros-Koszіderpadlás than at Dunáujváros-Duna-dűlő. At Dunáujváros-Duna-dűlő type ■ is more frequent (Table 5.38, Figure 5.40)

Table 5.37a Differences for textural types between all three sites

Vessel group / Textural Types	Százhalombatta			Dunaújváros-Koszіderpadlás			X^2 =	df	p = 0.05
	●	▲	■	●	▲	■			
Cups	37	18	49	16	12	5	**14.766**	**3**	**0.002**
Domestic Vessels	24	8	11	9	10	20	**13.983**	**3**	**0.003**
Urns	32	6	18	18	1	9	1.784	3	0.618*
Fineware	51	6	14	27	3	4	5.301	3	0.151*
Vessel group / Textural Types	Százhalombatta			Dunáujváros-Duna-dűlő			X^2 =	df	p = 0.05
	●	▲	■	●	▲	■			
Cups	37	18	49	14	12	2	**23.410**	**3**	**0.000**
Domestic Vessels	24	8	11	8	14	17	**15.360**	**3**	**0.002**
Urns	32	6	18	14	14	12	**14.940**	**3**	**0.002**
Fineware	51	6	14	12	9	16	**16.205**	**3**	**0.001**
Vessel group / Textural Types	Dunaújváros-Koszіderpadlás			Dunáujváros-Duna-dűlő			X^2 =	df	p = 0.05
	●	▲	■	●	▲	■			
Cups	16	12	5	14	12	2	1.287	3	0.732*
Domestic Vessels	9	10	20	8	14	17	0.972	3	0.808*
Urns	18	1	9	14	14	12	**16.813**	**3**	**0.002***
Fineware	27	3	4	12	9	16	**22.420**	**3**	**0.000***

5.4.6.2 Textural types and vessel groups: differences within each site

5.4.6.2.1 Százhalombatta

Cups and domestic vessels:

For cups textural type ● has a frequency of 26.4%, type ▲ has a frequency of 12.9 and type ■ a frequency of 35.1%. For domestic vessels type ● has a frequency of 43.6%, type ▲ a frequency of 14.6% and type ■ a frequency of 19.9% (Table 5.38, Figures 5.37 & 5.38) These differences are not significant ($\chi^2 = 6.981$; $p \leq 0.073$) (Table 5.37b).

Cups and urns:

For cups textural type ● has a frequency of 26.4%, type ▲ has a frequency of and type ■ a frequency of 35.1%. For urns type ● has a frequency of 47.8%, type ▲ a frequency of 6.4% and type ■ a frequency of 34.8% (Table 5.37, Figure 5.37 & 5.39). These differences are significant ($\chi^2 = 12.999$; $p \leq 0.005$) (Table 5.37b).

Cups and fineware:

For cups textural type ● has a frequency of 26.4%, type ▲ has a frequency of and type ■ a frequency of 35.1%. For fineware type ● has a frequency of 52.6%, type ▲ a frequency of 6.2% and type ■ a frequency of 14.4% (Table 5.38, Figure 5.37 & 5.40). These differences are significant ($\chi^2 = 22.884$; $p \leq 0.000$) (Table 5.37b).

Domestic vessels and urns:

For domestic vessels type ● has a frequency of 43.6%, type ▲ a frequency of 14.6% and type ■ a frequency of 19.9%. For urns type ● has a frequency of 47.8%, type ▲ a frequency of 6.4% and type ■ a frequency of 34.8% (Table 5.37, Figure 5.38 & 5.39). These differences are not significant ($\chi^2 = 3.929$; $p \leq 0.271$) (Table 5.37b).

Domestic vessels and fineware:

For domestic vessels type ● has a frequency of 43.6%, type ▲ a frequency of 14.6% and type ■ a frequency of 19.9%. For fineware type ● has a frequency of 52.6%, type ▲ a frequency of 6.2% and type ■ a frequency of 14.4% (Table 5.38, Figure 5.38 & 5.40). These differences are not significant ($\chi^2 = 4.113$; $p \leq 0.250$) (Table 5.37b).

Urns and fineware:

For urns type ● has a frequency of 47.8%, type ▲ a frequency of 6.4% and type ■ a frequency of 34.8%. For fineware type ● has a frequency of 52.6%, type ▲ a frequency of 6.2% and type ■ a frequency of 14.4% (Table 5.38, Figure 5.39 & 5.40). These differences are significant ($\chi^2 = 8.969$; $p \leq 0.030$*) (Table 5.37b).

Százhalombatta Summary:

There are significant differences between: cups and urns; cups and fineware; and urns and fineware (Table 5.37b). Taken in combination with percentage frequencies (Table 5.38, Figures 5.37–5.40) these differences show that there is a higher frequency of textural type ● used in the production of both urns and fineware than in the production of cups. Type ■ is most frequently used in the production of cups. In the case of urns and fineware while type ● is the most frequently used for both vessel types, a greater frequency of type ■ is present as the next most frequent textural type in relation to urns than fineware. Meanwhile, no significant differences occur between; cups and domestic vessels, domestic vessels and urns, or domestic vessels and fineware. This suggests that while there is a distinction to be made with regard to the selection of textural types it is not so clearly defined as to extend to across all vessel groups equally.

5.4.6.2.2 Dunaújváros-Kosziderpadlás

Cups and domestic vessels:

For cups textural type ● has a frequency of 30.8%, type ▲ has a frequency of 23.1% and type ■ a frequency of 9.5%. For domestic vessels type ● has a frequency of 21.5%, type ▲ a frequency of 23.8% and type ■ a frequency of 47.6% (Table 5.38, Figures 5.37 & 5.38). These differences are significant ($\chi^2 = 23.713$; $p \leq 0.000$) (Table 5.37b).

Cups and urns:

For cups textural type ● has a frequency of 60.0%, type ▲ has a frequency of 3.3% and type ■ a frequency of 9.5%. For urns type ● has a frequency of 60.0%, type ▲ a frequency of 3.3% and type ■ a frequency of 29.9% (Table 5.38, Figure 5.37 & 5.39). These differences are significant ($\chi^2 = 19.857$; $p \leq 0.000$*) (Table 5.37b).

Cups and fineware:

For cups textural type ● has a frequency of 26.4%, type ▲ has a frequency of and type ■ a frequency of 35.1%. For fineware type ● has a frequency of 71.1%, type ▲ a frequency of 7.9% and type ■ a frequency of 10.5% (Table 5.38, Figure 5.37 & 5.40). These differences are significant ($\chi^2 = 16.325$; $p \leq 0.001$*) (Table 5.37b).

Domestic vessels and urns:

For domestic vessels type ● has a frequency of 21.5%, type ▲ a frequency of 23.8% and type ■ a frequency of 47.6%. For urns type ● has a frequency of 60.0%, type ▲ a frequency of 3.3% and type ■ a frequency of 29.9% (Table 5.38, Figure 5.38 & 5.39). These differences are significant ($\chi^2 = 14.076$; $p \leq 0.004$*) (Table 5.37b).

Domestic vessels and fineware:

For domestic vessels type ● has a frequency of 21.5%, type ▲ a frequency of 23.8% and type ■ a frequency of 47.6%. For fineware type ● has a frequency of 71.1%, type ▲ a frequency of 7.9% and type ■ a frequency of 10.5% (Table 5.38, Figure 5.38 & 5.40). These differences are significant ($\chi^2 = 23.437$; $p \leq 0.000$*) (Table 5.37b).

Urns and fineware:

For urns type ● has a frequency of 60.0%, type ▲ a frequency of 3.3% and type ■ a frequency of 29.9%. For fineware type ● has a frequency of 71.1%, type ▲ a frequency of 7.9% and type ■ a frequency of 10.5% (Table 5.38, Figure 5.39 & 5.40). These differences are not significant ($\chi^2 = 4.5111$; $p \leq 0.211$*) (Table 5.37b).

Dunaújváros-Kosziderpadlás Summary:

There are significant differences between: cups and domestic vessels; cups and urns; cups and fineware; domestic vessels and urns; and domestic vessels and fineware (Table 5.37). Taking these results in combination with percentage frequencies (Table 5.38, Figures 5.37–5.40) they show that while type ● is the most frequent textural type for cups it is closely followed by type ▲. This is in contrast to urns and fineware where textural type ● is unequivocally highly frequent. Meanwhile, domestic vessels show a different trend to the other vessel groups with textural type ■ being most frequent while the frequencies for types ▲ and ■ are almost equally divided. There is no significant difference between urns and fineware, which both show the very frequent use of type ● (Table 5.37b).

5.4.6.2.3 Dunáujváros-Duna-dűlő

Cups and domestic vessels:

For cups textural type ● has a frequency of 35.4%, type ▲ has a frequency of 25.0% and type ■ a frequency of 4.2%. For domestic vessels type ● has a frequency of 19.1%, type ▲ a frequency of 33.3% and type ■ a frequency of 40.4% (Table 5.38, Figures 5.37 & 5.38). These differences are significant ($\chi^2 = 29.037$; $p \leq 0.000$) (Table 5.37b).

Cups and urns:

For cups textural type ● has a frequency of 35.4%, type ▲ has a frequency of 25.0% and type ■ a frequency of 4.2%. For urns type ● has a frequency of 25.0%, type ▲ a frequency of 24.9% and type ■ a frequency of 21.5% (Table 5.38, Figure 5.37 & 5.39). These differences are not significant ($\chi^2 = 7.908$; $p \leq 0.067$) (Table 5.37b).

Cups and fineware:

For cups textural type ● has a frequency of 35.4%, type ▲ has a frequency of 25.0% and type ■ a frequency of 4.2%. For fineware type ● has a frequency of 22.3%, type ▲ a frequency of 16.6% and type ■ a frequency of 29.7% (Table 5.38, Figure 5.37 & 5.40). These differences are significant ($\chi^2 = 12.870$; $p \leq 0.010$) (Table 5.37b).

Domestic vessels and urns:

For domestic vessels type ● has a frequency of 19.1%, type ▲ a frequency of 33.3% and type ■ a frequency of 40.4%. For urns type ● has a frequency of 25.0%, type ▲ a frequency of 24.9% and type ■ a frequency of 21.5% (Table 5.38, Figure 5.38 & 5.39). These differences are significant ($\chi^2 = 10.282$; $p \leq 0.022$) (Table 5.37b).

Domestic vessels and fineware

For domestic vessels type ● has a frequency of 19.1%, type ▲ a frequency of 33.3% and type ■ a frequency of 40.4%. For fineware type ● has a frequency of 22.3%, type ▲ a frequency of 16.6% and type ■ a frequency of 29.7% (Table 5.38, Figure 5.38 & 5.40). These differences are significant ($\chi^2 = 11.245$; $p \leq 0.016$) (Table 5.37b).

Urns and fineware:

For urns type ● has a frequency of 25.0%, type ▲ a frequency of 24.9% and type ■ a frequency of 21.5%. For fineware type ● has a frequency of 22.3%, type ▲ a frequency of 16.6% and type ■ a frequency of 29.7% (Table 5.38, Figure 5.39 & 5.40). These differences are not significant ($\chi^2 = 1.807$; $p \leq 0.613$) (Table 5.37b).

Dunáujváros-Duna-dűlő Summary:

There are significant differences between: cups and domestic vessels; cups and fineware; domestic vessels and urns; and domestic vessels and fineware (Table 5.37b).

Taken in combination with the percentage frequencies (Table 5.38, Figures 5.37-5.40) the results show that while type ● is the most frequent textural type for cups this is not the case for domestic vessels or fineware. For these, type ■ is the most frequent textural type. In the case of domestic vessels this is followed by strong frequency presence of type ▲. For fineware type ■ is followed by a fairly close frequency presence of type ● and ▲ respectively. Meanwhile, for the urn vessel group the frequencies are fairly evenly distributed between all three textural types. There are no significant differences between: cups and urns; or urns and fineware suggesting a very similar distribution of textural type frequencies between these vessel groups (Table 5.37b).

Table 5.37b Significant differences for textural types within each site

Textural Types	●	▲	■	●	▲	■	X^2 =	df	p < or = 0.05
Százhalombatta		Cups			Domestic				
Cups/Domestic	37	18	49	24	8	11	6.981	3	0.073
		Cups			Urns				
Cups/Urns	37	18	49	32	6	18	**12.999**	**3**	**0.005**
		Cups			Fineware				
Cups/Fineware	37	18	49	51	6	14	**22.884**	**3**	**0.000**
		Domestic			Urns				
Domestic/Urns	24	8	11	32	6	18	3.929	3	0.269
		Domestic			Fineware				
Domestic/Fineware	24	8	11	51	6	14	4.113	3	0.236
		Fineware			Urns				
Fineware/Urns	51	6	14	32	6	18	**8.969**	**3**	**0.030***
Dunaújváros-K-padlás		Cups			Domestic				
Cups/Domestic	16	12	5	9	10	20	**23.713**	**3**	**0.000**
		Cups			Urns				
Cups/Urns	16	12	5	18	1	9	**19.857**	**3**	**0.000***
		Cups			Fineware				
Cups/Fineware	16	12	5	27	3	4	**16.325**	**3**	**0.001***
		Domestic			Urns				
Domestic/Urns	9	10	20	18	1	9	**13.100**	**3**	**0.004***
		Domestic			Fineware				
Domestic/Fineware	9	10	20	27	3	4	**23.437**	**3**	**0.000***
		Fineware			Urns				
Fineware/Urns	27	3	4	18	1	9	4.511	3	0.211*
Dunaújváros-Duna-dűlő		Cups			Domestic				
Cups/Domestic	14	12	2	8	14	17	**29.037**	**3**	**0.000**
		Cups			Urns				
Cups/Urns	14	12	2	14	14	12	**7.908**	**3**	**0.048**
		Cups			Fineware				
Cups/Fineware	14	12	2	12	9	16	**12.870**	**3**	**0.005**
		Domestic			Urns				
Domestic/Urns	8	14	17	14	14	12	**10.282**	**3**	**0.016**
		Domestic			Fineware				
Domestic/Fineware	8	14	17	12	9	16	**11.245**	**3**	**0.010**
		Fineware			Urns				
Fineware/Urns	12	9	16	14	14	12	1.817	3	0.611

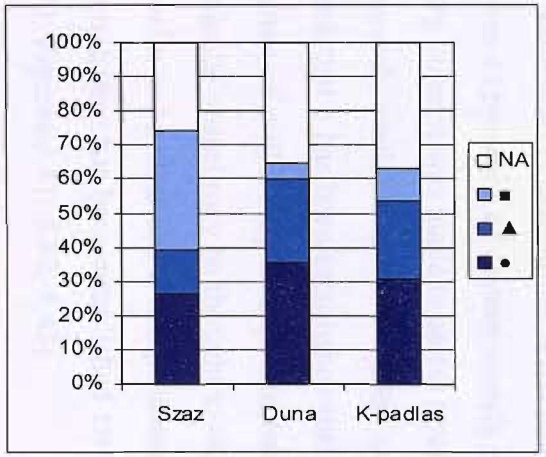


Figure 5.37 Percentage frequencies of textural types in relation to cups at all sites

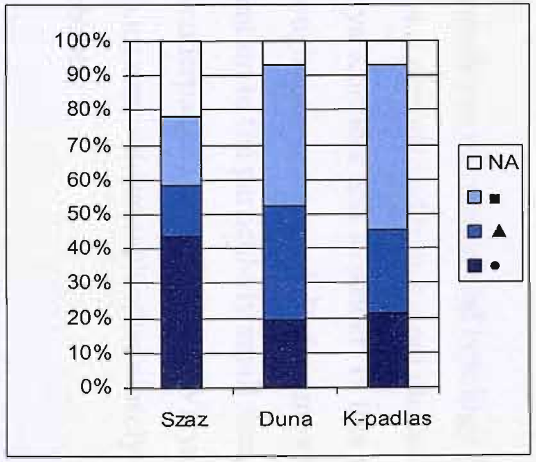


Figure 5.38 Percentage frequencies of textural types in relation to domestic vessels at all sites

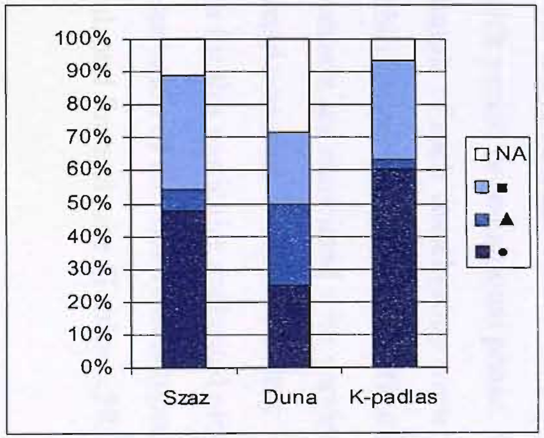


Figure 5.39 Percentage frequencies of textural types in relation to urns at all sites

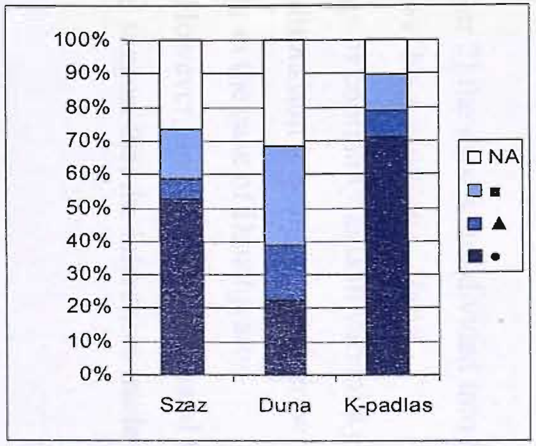


Figure 5.40 Percentage frequencies of textural types in relation to fineware at all sites

Table 5.38 Relationship of textural types to vessel groups at Százhalombatta (Szaz), Dunaújváros-Kosziderpadlás (K-padlas) and Dunáujváros-Duna-dűlő (Duna)

Cups	**Szaz**		**Duna**		**K-padlas**	
●	26.4%	37	35.4%	17	30.8%	16
▲	12.9%	18	25.0%	12	23.1%	12
■	35.1%	49	4.2%	2	9.5%	5
NA	25.7%	36	35.4%	17	36.6%	19
Total	**100.0%**	**140**	**100.0%**	**48**	**100.0%**	**52**
Dom.	**Szaz**		**Duna**		**K-padlas**	
●	43.6%	24	19.1%	8	21.5%	9
▲	14.6%	8	33.3%	14	23.8%	10
■	19.9%	11	40.4%	17	47.6%	20
NA	21.8%	12	7.1%	3	7.1%	3
Total	**100.0%**	**55**	**100.0%**	**42**	**100.0%**	**42**
Urns	**Szaz**		**Duna**		**K-padlas**	
●	47.8%	30	25.0%	14	60.0%	18
▲	6.4%	4	24.9%	14	3.3%	1
■	34.8%	22	21.5%	12	29.9%	9
NA	11.1%	7	28.6%	16	6.7%	2
Total	**100.0%**	**63**	**100.0%**	**56**	**100.0%**	**30**
Fineware	**Szaz**		**Duna**		**K-padlas**	
●	52.6%	51	22.3%	12	71.1%	27
▲	6.2%	6	16.6%	9	7.9%	3
■	14.4%	14	29.7%	16	10.5%	4
NA	26.8%	26	31.4%	17	10.5%	4
Total	**100.0%**	**97**	**100.0%**	**54**	**100.0%**	**38**

5.5 Skill variability: change and continuity through time

5.5.1 Discussion of data collection, analysis strategy and reliability

In order to carry out this analysis a point scoring system was adopted. Each individual vessel was scored by taking the Good, Moderate and Poor skill definitions and giving them a numeric value. Thus, Good = 3 points, Moderate = 2 points and Poor = 1 point. Each vessel has a potential total, dependent upon the technological variables present, based on the optimum possible score. The actual total is the sum of the scores achieved across all variables. This actual total is then divided by the possible total and multiplied by 100 to give a percentage value for each individual vessel. The scores were then divided into units of 10% to create 'skill groups'. This division is seen as fine grained enough to display variability without overly fragmenting the data.

The groups are categorised as follows: group A = 31/40%; group B = 41/50%; group C = 51/60%; group D = 61/70%; group E = 71/80%; group F 81/90%; group G 91/100%.

Through use of context and typology (see Chapter 2) the data is sub-divided into the known periods and transitional phases of Nagyrév, Nagyrév/Vatya, Vatya, Vatya/Koszider and Koszider. In this way change or continuity in skill variability through time is assessed. Before moving to the discussion it is important to draw attention to the particularly small size, especially in the case of Dunaújváros-Kosziderpadlás, of the Nagyrév/Vatya sample. However, despite this the general trends at both sites mirror each other closely enough to suggest that the inferences made are probable.

An additional consideration is the possibility of the data being skewed by the particular degree of presence of certain vessels groups at each period or transitional phase. While every attempt was made to select a reasonable sample of each vessel group some vessels were only available in more limited numbers within the period / phase classifications. Given that it has been established that different vessels are associated with varying degrees of skill it may be expected that a heightened presence or absence of any particular vessel may be thought to skew the data for this particular analytical process. In order to be clear about this problem the representation of the four vessels types through time has been established for each period, and for each site (Tables 5.38, 5.39, 5.40; Figures 5.41, 5.42, 5.43).

Table 5.39 Percentage and numeric frequency of each vessel group across the temporal span of the periods studied for Százhalombatta (Szaz)

Szaz	Nagyrév	Nagyrév/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	3	12	87	24	14	**140**
Domestic	2	1	32	17	3	**55**
Fineware	19	0	38	15	25	**97**
Urns	8	0	32	12	11	**63**
						355

Szaz	Nagyrev	Nagyrev/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	2.1%	8.6%	62.1%	17.1%	10.0%	**100.0%**
Domestic	3.6%	1.8%	58.2%	30.9%	5.5%	**100.0%**
Fineware	19.6%	0.0%	39.2%	15.5%	25.8%	**100.0%**
Urns	12.7%	0.0%	50.8%	19.0%	17.5%	**100.0%**

Table 5.40 Percentage and numeric frequency of each vessel group across the temporal span of the periods studied for Dunaújváros-Kosziderpadlás (K-padlas)

K-padlas	Nagyrev	Nagyrev/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	6	4	27	10	5	**52**
Domestic	5	4	24	7	2	**42**
Fineware	9	0	8	9	12	**38**
Urns	7	0	15	5	3	**30**
						162

K-padlas	Nagyrev	Nagyrev/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	11.5%	7.7%	51.9%	19.2%	9.6%	**100.0%**
Domestic	11.9%	9.5%	57.1%	16.7%	4.8%	**100.0%**
Fineware	23.7%	0.0%	21.1%	23.7%	31.6%	**100.0%**
Urns	23.3%	0.0%	50.0%	16.7%	10.0%	**100.0%**

Table 5.41 Percentage and numeric frequency of each vessel group across the temporal span of the periods studied for Dunáujváros-Duna-dűlő (Duna)

Duna	Nagyrev	Nagyrev/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	11	1	24	5	7	**48**
Domestic	3	4	23	7	5	**42**
Fineware	16	2	15	4	17	**54**
Urns	19	2	21	8	6	**56**
						200

Duna	Nagyrev	Nagyrev/ Vatya	Vatya	Vatya/ Koszider	Koszider	Total
Cups	22.9%	2.1%	50.0%	10.4%	14.6%	**100.0%**
Domestic	7.1%	9.5%	54.8%	16.7%	11.9%	**100.0%**
Fineware	29.6%	3.7%	27.8%	7.4%	31.5%	**100.0%**
Urns	33.9%	3.6%	37.5%	14.3%	10.7%	**100.0%**

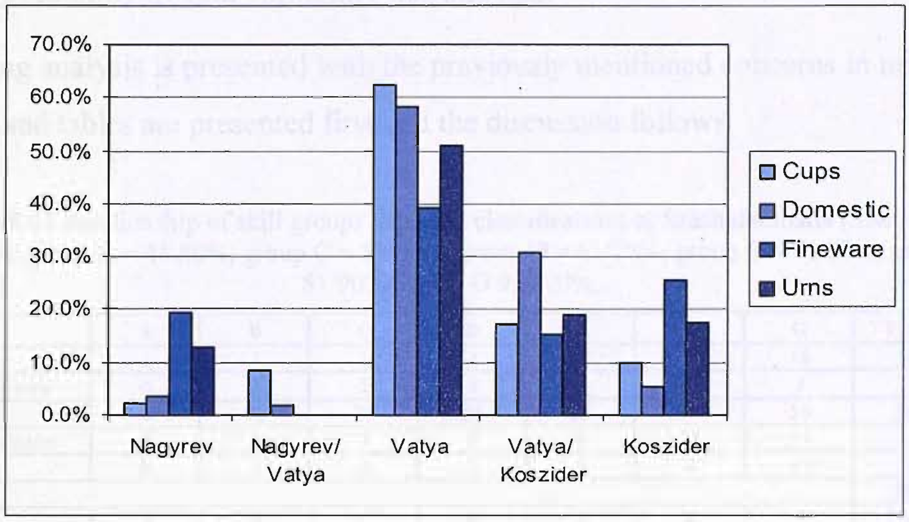


Figure 5.41 Percentage frequency of each vessel group across the temporal span of the periods studied for Százhalombatta (Szaz)

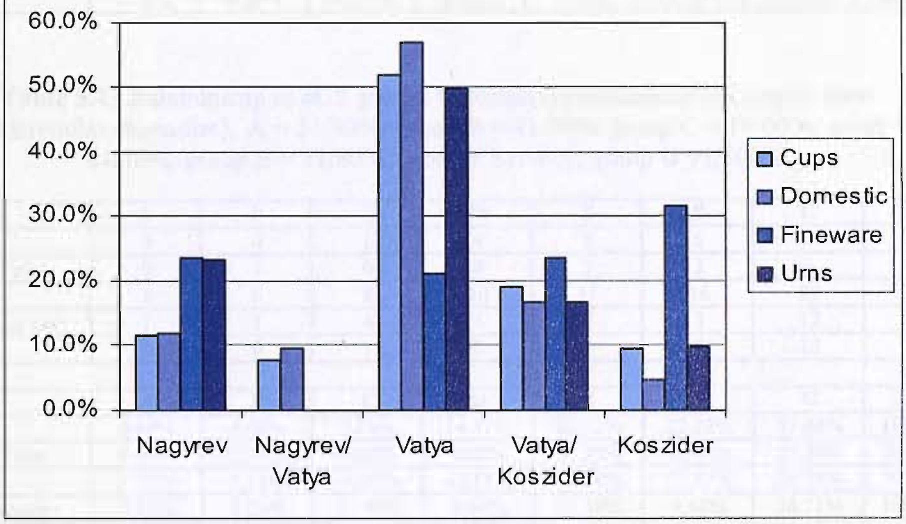


Figure 5.42 Percentage frequency of each vessel group across the temporal span of the periods studied for Dunaújváros-Kosziderpadlás (K-padlas)

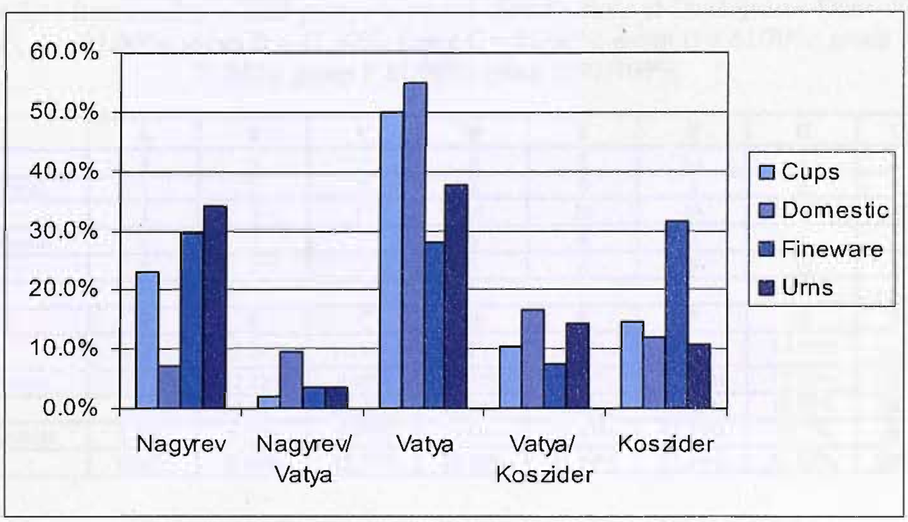


Figure 5.43 Percentage frequency of each vessel group across the temporal span of the periods studied for Dunáujváros-Duna-dűlő (Duna)

5.5.2 The possibility of skill variability through time

The following analysis is presented with the previously mentioned concerns in mind. Data charts and tables are presented first and the discussion follows.

Table 5.42 Relationship of skill groups to period classifications at Százhalombatta (Szaz); A = 31/40%; group B = 41.50%; group C = 51/60%; group D = 61/70%; group E = 71/80%; group F 81/90%; group G 91/100%.

Szaz	A	B	C	D	E	F	G	Total
Nagyrev	1	1	1	2	3	8	16	32
Nagyrev/Vatya	0	2	1	4	2	1	3	13
Vatya	6	12	20	26	22	47	56	189
Vatya/ Koszider	3	1	3	7	8	13	33	68
Koszider	0	0	6	3	5	8	31	53
								355
	A	**B**	**C**	**D**	**E**	**F**	**G**	**Total**
Nagyrev	3.13%	3.13%	3.13%	6.25%	9.38%	25.00%	50.00%	100.00%
Nagyrev/Vatya	0.00%	15.38%	7.69%	30.77%	15.38%	7.69%	23.08%	100.00%
Vatya	3.17%	6.35%	10.58%	13.76%	11.64%	24.87%	29.63%	100.00%
Vatya/ Koszider	4.41%	1.47%	4.41%	10.29%	11.76%	19.12%	48.53%	100.00%
Koszider	0.00%	0.00%	11.32%	5.66%	9.43%	15.09%	58.49%	**100.00%**

Table 5.43 Relationship of skill groups to period classifications at Dunaújváros-Kosziderpadlás (K-padlas); A = 31/40%; group B = 41.50%; group C = 51/60%; group D = 61/70%; group E = 71/80%; group F 81/90%; group G 91/100%.

K-Padlas	A	B	C	D	E	F	G	Total
Nagyrev	0	0	1	4	6	6	10	27
Nagyrev/Vatya	0	1	0	0	3	2	2	8
Vatya	1	6	8	10	11	16	22	74
Vatya/ Koszider	1	1	4	3	7	3	12	31
Koszider	0	0	1	0	1	5	15	22
								162
	A	**B**	**C**	**D**	**E**	**F**	**G**	**Total**
Nagyrev	0.00%	0.00%	3.70%	14.81%	22.22%	22.22%	37.04%	100.00%
Nagyrev/Vatya	0.00%	12.50%	0.00%	0.00%	37.50%	25.00%	25.00%	100.00%
Vatya	1.35%	8.11%	10.81%	13.51%	14.86%	21.62%	29.73%	100.00%
Vatya/ Koszider	3.23%	3.23%	12.90%	9.68%	22.58%	9.68%	38.71%	100.00%
Koszider	0.00%	0.00%	4.55%	0.00%	4.55%	22.73%	68.18%	**100.00%**

Table 5.44 Relationship of skill groups to period classifications at Dunáujváros-Duna-dűlő (Duna); A = 31/40%; group B = 41.50%; group C = 51/60%; group D = 61/70%; group E = 71/80%; group F 81/90%; group G 91/100%.

Duna	A	B	C	D	E	F	G	Total
Nagyrev	3	6	9	6	8	12	5	49
Nagyrev/Vatya	1	2	0	2	0	1	3	9
Vatya	1	9	17	16	10	15	15	83
Vatya/ Koszider	1	2	2	6	4	8	1	24
Koszider	0	0	9	5	4	6	11	35
								200
	A	**B**	**C**	**D**	**E**	**F**	**G**	**Total**
Nagyrev	6.12%	12.24%	18.37%	12.24%	16.33%	24.49%	10.20%	100.00%
Nagyrev/Vatya	11.11%	22.22%	0.00%	22.22%	0.00%	11.11%	33.33%	100.00%
Vatya	1.20%	10.84%	20.48%	19.28%	12.05%	18.07%	18.07%	100.00%
Vatya/ Koszider	4.17%	8.33%	8.33%	25.00%	16.67%	33.33%	4.17%	100.00%
Koszider	0.00%	0.00%	25.71%	14.29%	11.43%	17.14%	31.43%	**100.00%**

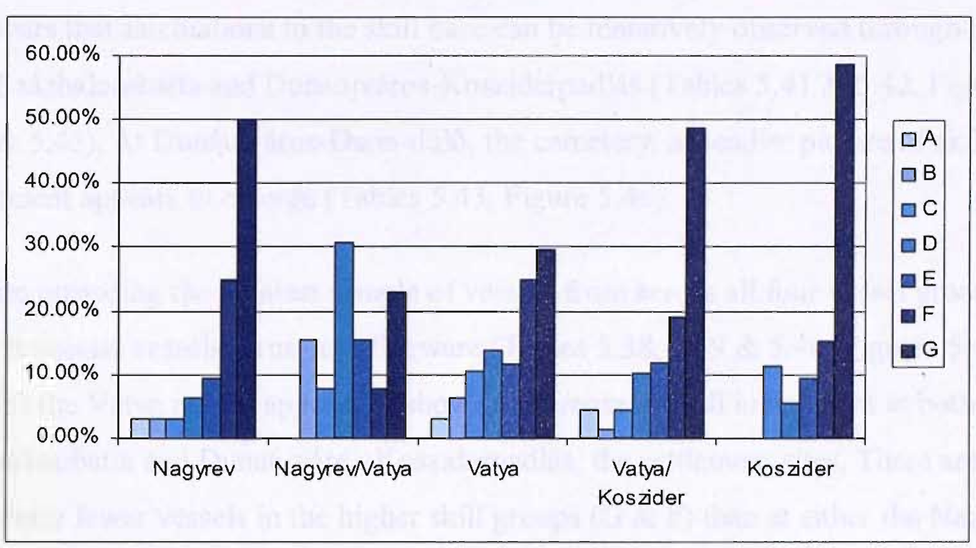


Figure 5.44 Relationship of skill groups to period classifications at Százhalombatta (Szaz)

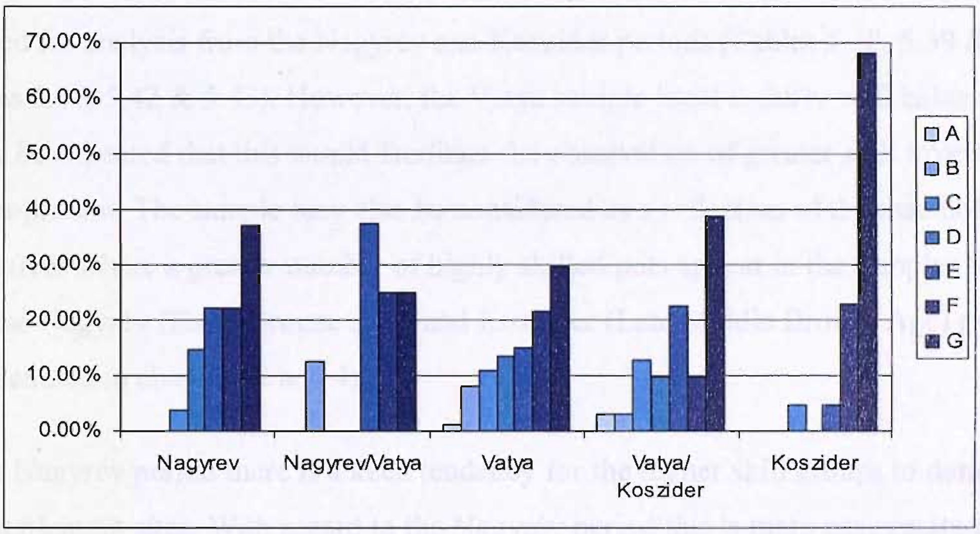


Figure 5.45 Relationship of skill groups to period classifications at Dunaújváros-Kosziderpadlás (K-padlas)

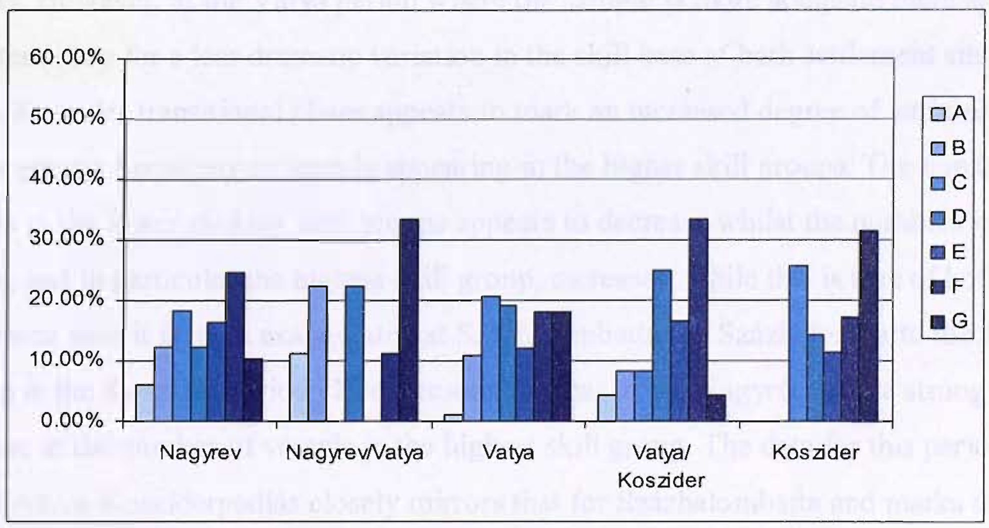


Figure 5.46 Relationship of skill groups to period classifications at Dunáujváros-Duna-dűlő (Duna)

It appears that fluctuations to the skill base can be tentatively observed through time at both Százhalombatta and Dunaújváros-Kosziderpadlás (Tables 5.41 & 5.42, Figures 5.44 & 5.45). At Dunáujváros-Duna-dűlő, the cemetery, a steadier picture of skill investment appears to emerge (Tables 5.43, Figure 5.46).

Despite providing the greatest sample of vessels from across all four vessel groups: cups; domestic vessels; urns; and fineware (Tables 5.38, 5.39 & 5.40, Figures 5.41, 5.42 & 5.43) the Vatya period appears to shows a decrease in skill investment at both Százhalombatta and Dunaújváros-Kosziderpadlás, the settlement sites. There are apparently fewer vessels in the higher skill groups (G & F) than at either the Nagyrév or Koszider periods (Tables 5.41, 5.42, 5.43, Figures 5.44, 5.45, 5.46). This may reflect, to a certain extent, the balance of the sample with higher numbers of fineware and urns selected for analysis from the Nagyrév and Koszider periods (Tables 5.38, 5.39 & 5.40; Figures 5.41, 5.42 & 5.43). However, the Vatya sample itself is fairly well balanced and it may be expected that this would facilitate the observation of greater skill investment were it present. The sample may also be considered as a reflection of the assemblages themselves where a greater number of highly skilled pots appear in the samples from both the Nagyrév (Early Bronze Age) and Koszider (Late Middle Bronze Age) periods (as discussed in chapters 2 and 4).

At the Nagyrév period there is a keen tendency for the higher skill groups to dominate at both settlement sites. With regard to the Nagyrév period this is more exaggerated at Százhalombatta. The Nagyrév/Vatya transition is seen as too poorly represented to discuss. However, at the Vatya period where the sample is more adequate there appears to be tendency for a less dramatic variation in the skill base at both settlement sites. The Vatya/Koszider transitional phase appears to mark an increased degree of variability with a greater frequency of vessels appearing in the higher skill groups. The number of vessels in the lower ranking skill groups appears to decrease whilst the numbers in the higher, and in particular the highest skill group, increases; while this is true of both settlement sites it is most exaggerated at Százhalombatta. At Százhalombatta the data pattern at the Koszider period closely resembles that of the Nagyrév with a strong increase in the number of vessels in the highest skill group. The data for this period at Dunaújváros-Kosziderpadlás closely mirrors that for Százhalombatta and marks the possibility of a far higher frequency of skilled vessels in production than at any other time bar the Nagyrév period.

It is of particular note that whilst similar samples were drawn from both Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő (Tables 5.33 & 5.34, Figures 5.42 & 5.43), the accompanying cemetery for Dunaújváros-Kosziderpadlás, the degree of variability noted at Dunaújváros-Kosziderpadlás does not hold true for Dunáujváros-Duna-dűlő. This suggests the possibility of a differing deployment of skill in relation to vessels present in these two differing social contexts.

With regard to the settlements it may be tentatively suggested that there is a tendency for the higher skill groups to dominate at either end of the time continuum; in the Nagyrév and Koszider periods. Both these periods represent societies at a peak of organisation with highly defined social institutions (chapter 2). Between these two social epochs the data suggests a degree of hiatus in the skill base and deployment of skill.

Chapter Six

Interpretation and Discussion: Skill and Learning Strategies Revealed

> *"Although the reconstruction and understanding of the past is the main aim of archaeology, it is often as if pottery is only a means to the reconstruction and understanding of other things, and as if archaeologists believe that those wider aims can be achieved without understanding the pottery itself"*
>
> Sander van der Leeuw 1999: 121

6.1 Introduction

It has been argued the decisions surrounding what pots to make and how to make them are enmeshed within institutionalised practices that involve potters in specific performances of action as they transfer discursive knowledge into procedural knowledge (section 3.3.1). This, in turn, creates a scenario of repeatability as potters aiming to produce a socially appropriate item repeat prescribed processes of technical action as they go about their work. This results in repeated classes of pots, which share the same technological signatures of production. Due to the physical properties of clay these technological signatures are permanently embedded within each vessel group at the time pots are fired. Variability in degrees of skill, as potters work to acquire skill, and variability of technological complexity inherent to different vessel types, in relation to the transfer of discursive knowledge into procedural knowledge make it possible to see which vessels, or parts of vessels, have been made by predominately more skilled or less skilled practitioners.

In this chapter the arguments previously presented, and briefly recapped on above, are applied to the data collected. The strategy adopted for the following interpretation is based on the core hypotheses of this thesis. First, if all pots are made by equally skilled potters simple vessels should exhibit the least degree of skill variability while complex pots should display the greatest degree of skill variability. Second, that skill is the outcome of socially appropriated learning strategies, institutionalised practices, and has a relationship to processes of continuity and change. Third, that learning strategies may be exercised differently in the differing social arenas of the settlement and cemetery and that this may give rise to different arenas of skill. Given the complexity of the data there will be times when these topics overlap but every effort is made to keep within the remit of each area of interpretation.

In section 6.2 each vessel group is explored in turn. The technological variables are used in combination as an indicator of skill variability. Individual technological variables are discussed where it is felt that they demonstrate certain traits of skill investment that may be particular to a certain vessel group, social context, or arena of skill. Reference is also made to fabrics and textural types where it is felt they have a bearing on the interpretation of a particular vessel group. In section 6.3 the interpretation is related to broader social mechanisms and institutionalised practices and the role of learning strategies within the Early to Late Middle Bronze Age of the Carpathian Basin. The relationship of learning strategies to continuity and change from the Early to Late Middle Bronze Age is discussed in section 6.4.

6.2 Skill variability and learning strategies: the vessel groups explored

6.2.1 Introduction

In this section the aim is to explore the variability of skill investment for each vessel group and consider this in relation to the degree of technological complexity that each group represents. The relationships between vessel groups in terms of skill investment are also explored. It will be seen that vessel groups are subject to various degrees of skill investment both within each assemblage and depending on their presence within the differing social contexts of the settlement and the cemetery. Because of this each social context is discussed in turn. Following from this a discussion surrounding the relationship of vessels to tempering materials and fuel resources is made. Finally, the role of each vessel group within a cultural and social context is explored in relation to learning strategies.

Before embarking on the interpretation it is important to draw attention to Table 5.2b which shows five significant differences between Százhalombatta and Dunaújváros-Kosziderpadlás. This initially gives the appearance of representing a divide in skill between the two settlement assemblages for cups, not seen to this extent for other vessel groups. Initially the author attributed this to the disturbed history of the Dunaújváros-Kosziderpadlás assemblage. However, this notion is dispelled by closer observation of the nature of these significant differences. With regard to cups it is of key importance to note that significant differences are not always in favour of a particular site. When the significant differences in Table 5.2b are carefully observed in 3 are seen to be in favour of a higher investment of skill at Százhalombatta, 1 is in favour of Dunaújváros-Kosziderpadlás and 1 is in favour of Dunaújváros-Duna-dűlő. A similar situation is also observed within Tables 5.2c and 5.2d. In order for further clarification the reader should observe the text between pages 114 and 164. This has repercussions for the following interpretation which will suggest that cups are possibly subject to more than one arena of skill and predominately produced by less skilled potters.

6.2.2 Cups: skill and technological complexity

Although cup morphology changes through time (Figure 2.13) cups represent the smallest and least technologically complex vessel group to manufacture (Table 4.2). Despite this the data has shown that cups are subject to a low investment of skilled practice (Figures 5.1–5.12, Tables 5.2a–5.2d). They receive the lowest investment of skill in the settlement context and an overall low investment of skill within the cemetery assemblage. If all vessel groups were subject to the same standards of skill investment it would be expected that the opposite of this situation should be true (Rye 1981: 58). In this scenario cups should display the highest degree of skilled practice. Given that this is not the case it is suggested that the majority of cups are being produced by potters still in the process of acquiring a high degree of skill (procedural knowledge). In other words, many learners or inexperienced potters are engaged in the manufacture of cups.

6.2.3 Cups in the settlement context: skill in relation to other vessel groups

It is of note that the difference in skill investment, within the settlement context, is represented across an increasing number of technological variables when cups are compared with domestic vessels, urns, and fineware respectively (for a summary see Tables 5.24–5.26). The significance of this is that cups share a different relationship in terms of skill investment with each of the other vessel groups but always receive the least degree of skill. The degree of skill variability between cups and domestic vessels is less exaggerated than it is between cups and urns, or cups and fineware where the largest discrepancy appears.

6.2.3.1 *Cups and domestic vessels:*

Within the settlement assemblages the significant differences noted between cups and domestic vessels are expressed through reference to a different range of technological variables for each assemblage (Tables 5.3, 5.10 & 5.24, 5.25). It is, however, of note that manufacturing and rim deviation on the horizontal plane are amongst the variables indicating significant between cups and domestic vessels present within both settlement assemblages. Meanwhile, within the Dunaújváros-Kosziderpadlás assemblage the variable of rim symmetry is also noted. This is of particular interest as these variables would all be expected to reflect the core processes of skilled manufacture. Given the disparity in size between cups and domestic vessels these variables would be expected to show a higher degree of variability (error) in the larger and more technologically complex of these two vessel groups were all vessels manufactured by similarly skilled potters. This suggests that the majority of cups are subject to manufacture by potters with a lower degree of procedural knowledge (skill) compared with domestic vessels in the settlement context.

6.2.3.2 *Cups and urns:*

One particular way of demonstrating the gulf in skill investment between cups and urns within the settlement assemblages is to consider the very high number of significant differences demonstrated (Tables 5.4, 5.11 & 5.24, 5.25). In particular it is worth drawing attention to the variable of profile symmetry. It was noted in the methodology, chapter 4 (Caiger-Smith 1995: 109-110) that it becomes increasingly harder to control clay as the form of a pot increases and widens. This particular technological variable may then be expected to be under great stress as the proportions of pots increase and yet it is marked, along with numerous other variables, with a higher degree of skill investment within the urn vessel group than within the far less technologically demanding cup vessel group (Tables 5.4, 5.11). This suggests that within the settlement context cups are being produced by potters with a far lower degree of procedural knowledge, skill, than those producing urns.

6.2.3.3 *Cups and fineware:*

The situation with regard to cups and fineware is even more exaggerated than that observed for cups and urns. The number of significant differences increases by one to implicate all technological variables bar firing (Tables 5.5, 5.12 & 5.24, 5.25). The same argument as for cups and urns applies here. Given the disparity in the degree of technological complexity were both vessel groups being produced by similarly skilled potters it may be expected that fineware would suffer from a greater degree of technological error. Clearly this is not the case so it is argued that cups are again subject to a far lower degree of skill investment.

6.2.4 Cups in the cemetery context: skill in relation to other vessel groups

6.2.4.1 *Cups and domestic vessels*

Within the cemetery assemblage cups receive higher investment of skill than domestic vessels. This is expressed through the presence of four significant differences in favour of a higher degree of skill investment in cups (Tables 5.17 & 5.26). It is of note that of these variables wall thickness, rim deviation on the horizontal plane, and profile symmetry may all be expected to be harder to execute skilfully in a larger vessel form (Caiger-Smith 1995). In reverse to the trend shown within the settlement assemblages, it seems that in the cemetery context the more technologically complex domestic vessels are indeed subject to a poorer investment of skill. This is what may be expected if potters with similar degrees of procedural knowledge where working on both these vessel types within this social context. This suggests that similarly skilled, but given the overall analysis not highly skilled, potters are working on these two vessel types within the context of the cemetery assemblage. This has implications regarding the possibility of more than one arena of skill. It should also be mentioned that no significant difference is observed between these two vessel groups for the firing variable suggesting they are subject to similar firing processes.

6.2.4.2 *Cups and urns*

Within the cemetery context cups receive a lower investment of skill than urns. This is expressed as five significant differences (Table 5.18). Of these variables three; additions, interior surface treatment, and decoration can be argued not to relate to the structural integrity of the vessels. They do, however, have an important role with regard to visual performance characteristics. The implication of these variables showing a significant difference between cups and urns is that the visual characteristics of these two vessel groups has been seen as being of less importance where cups are concerned. The only variables that may be seen as relevant to the structural integrity of vessels are the manufacturing (the core of the pot) variable, and the firing variable (Table 5.18). The firing variable shows a significant difference representing a frequency of 50% of softly-fired cups and a frequency of 25% softly fired urns. Together these factors suggest that cups are produced by potters with a lower degree of procedural knowledge than those producing urns. In particular there appears to be a lower investment of skill in technological variables related to visual performance.

6.2.4.3 *Cups and fineware*

Within the cemetery context cups receive a higher investment of skill than fineware. Three significant differences are observed (Tables 5.19 & 5.26). However, one of these, the decoration variable shows a significant difference in favour of fineware. Meanwhile, the variables of wall thickness and rim deviation on the horizontal plane show a significant difference in favour of cups. This means that the difference in skill investment between these two groups is marked by just two significant differences in favour of cups. This means that within the cemetery context cups receive a slightly higher investment of skill than fineware. It is of note that cups are not the recipient of a greater degree of skill where the decoration variable is concerned, suggesting a lower expectation being placed on the visual performance characteristics of cups compared with cemetery fineware. These results indicate a similar situation to that described for cups and domestic vessels; that the more technologically complex fineware vessels are indeed subject to a poorer investment of skill. This, again, is what may be expected if potters with similar degrees of procedural knowledge were working on both these vessel types within this social context. This suggests that similarly skilled, but given the overall analysis not highly skilled, potters are working on these two vessel types within the social context of the cemetery.

6.2.5 Cups: the relationship of skill between the settlement and cemetery contexts

It is clear that the investment of skill for cups is being articulated slightly differently within the contrasting social arenas of the living and the dead. Within the settlement assemblages it is seen that cups unequivocally receive the least investment of skill (section 6.2.3). The significant differences observed show that the gap in skill investment is least between cups and domestic vessels and becomes greater in relation to cups and urns, and cups and fineware (Tables 5.24, 5.25). This scenario suggests that cups receive low investments of procedural knowledge within the settlement context, compared to the other three vessel groups. A different situation appears to exist within the cemetery assemblage (section 6.2.4). However, this may have as much to do with a decreased investment of skill in cemetery fineware and domestic vessels as any increased investment in cups within the cemetery context. (Figures 5.1-5.12, Tables 5.2a, 5.2b, 5.2c)

6.2.6 Resources: fuel and tempering materials in relation to cups

6.2.6 *Cups: fuel and firing*

A major disparity between the settlement assemblages and the cemetery assemblages relates to the firing of cups. Within the Dunaújváros-Duna-dűlő assemblage 50% of cups are under-fired (softly-fired) while within the settlement assemblages there are just 2% of softly-fired cups at Százhalombatta and none at Dunaújváros-Kosziderpadlás (Figures 5.17, 5.22, 5.27). This variability is substantiated by significant differences (Table 6.2c, 6.2d). To recap on arguments presented within the methodology (section 4.5.8) under-firing vessels will seriously affect the performance characteristics of vessels, and their longevity. This does not appear, then, to be a desirable outcome for vessels potentially intended to serve a utilitarian function.

With regard to this phenomenon it is worth noting that smaller items, such as cups, are also generally much easier to fire with a lower risk of cracking and spalling occurring. They also require fewer resources especially in terms of fuel. This situation suggests that some cups implicated in the cemetery context are being selected out to be exposed to a different firing strategy. What is of interest here is that this is not necessarily a less rigorous strategy as the softly-fired vessels within the Dunaújváros-Duna-dűlő are all subjected to a similar firing treatment and according to the use of Moh's scale of hardness (section 4.5.8) exhibit a very similar degree of 'hardness' (or softness!) suggesting some control over firing procedures. Erratic firing procedures may be expected to produce irregularly fired vessels with both over-fired and under-firing occurring — even within a single vessel (Rye 1981; Rice 1987). It would then, seem plausible to suggest that certain numbers of cups are selected out for a different firing strategy that is designed to protect resources, or differential access to resources. The low temperatures that these vessels are subjected to would require little use of substantive fuels (Rice 1987). If a certain number of cups are implicated purely in the burial rite, possibly as a facsimile of the 'real' thing, and do not have to serve a prior utilitarian function low firing would cease to matter in terms of daily activity or longevity.

6.2.6.1 *Cups: tempering materials*

There is some evidence to suggest that there is a restriction being placed on the selection of tempering materials for the production of cups in both social contexts. Generally, fewer fabrics are used for the production of cups than for other vessel groups. All of the fabrics not used in the production of cups are ones that, in overall terms, appear infrequently (Figure 5.28, Table 5.29). Meanwhile, a quite restricted range of fabrics are used in reasonable frequencies within all assemblages suggesting that for the most part there is a limited selection of fabrics used for the production of cups. It is worth noting that (G) fabrics and (GL) together account for roughly 50% of the frequency of fabrics within all three assemblages. Grog as a tempering material is argued to have as strong a relationship to social choice as it does to technological choice and a link to notions of ancestry (c.f. Shepard 1956, Sterner 1989: 458, David 1990, Barley 1994; Sillar 1997; Stilborg 1997; Gosselain 1998; Gosselain & Livingstone 2005). Meanwhile, it is worth noting that other technical choices were available to the populations of this region both in terms of local geology (Rónai *et al.* 1967, Rónai *et al* 1972) and environmental resources (Gyulai 1993). It cannot be discounted that the use of grog may have had social implications with regard to the production of cups.

If, as is argued, cups form an important part of the articulation of social dynamics at the time of burial, the link between the reincorporation of 'ancestral' vessels into new vessels may suggest the articulation of kinship and familial connections at the time of death or other 'rites of passage'. In support of this suggestion it is worth noting that at Százhalombatta grog wasn't only incorporated into pots but also into the daub used to build clay ovens (Sofaer 2006: 132). In this setting grog is unlikely to have any technological benefit. Rye (1981: 39) argues that any non-plastic inclusions making up less than 10% of the volume of the clay is unlikely to have any observable, technological, effect on the working properties of any kind of clay. If the incorporation of grog into clay ovens represents the articulation of a social dynamic, rather than a technical necessity, it is worth drawing attention to the possibility of technical and social exchanges noted by Sofaer (2006: 135) at Százhalombatta between different craft media, and craftspeople. These are suggested not only to represent a transfer of processes but also a transfer of meaning. The excessive use of grog fabrics related to the production of cups are suggested to be just as likely associated to socially agreed choice as a technical choice – even given the excellent technical coefficients offered by grog as a tempering material (Rice 1987: 222). The use of grog in this way may be seen to reflect the structured nature of the mortuary domain and the concern with kinship groups within the cemetery layout (Bona 1975; Vicze 2001).

Of interest with regard to fabrics is the deployment of fabrics Q1● and Q3● in relation to cups (Table 5.31, Figure 5.29). Both these quartz fabrics are particularly fine but are nonetheless distinctively different in character (Table 5.28). Q1● appears in the Százhalombatta (settlement) assemblage and the Dunaújváros-Duna-dűlő (cemetery) assemblage, in almost the same frequencies in relation to cups (Table 5.29, Figure 5.29), but does not appear at all in the Dunaújváros-Kosziderpadlás assemblage. This is interesting given Dunaújváros-Kosziderpadlás is the settlement for the Dunaújváros-Duna-dűlő cemetery. Instead fabric Q3● appears at Dunaújváros-Kosziderpadlás in almost the same frequency as fabric Q1● (Table 5.31, Figure 5.29). There are two tentative explanations for this phenomenon. Either, each community is using these fabrics in very specific ways in relation to cups and the deployment of Q1● within the Dunaújváros-Duna-dűlő assemblage is coincidental. Or it may be possible that cups implicated in 'rites of passage' are moved between sites. At this time this can only remain a speculative observation. Unfortunately with no cemetery material associated with Százhalombatta it is not possible to see if this pattern is 'mirrored'. The only other possibility would be to carry out chemical analysis of clay in order to establish clay sources. Within this thesis, however, the phenomenon of these two fabrics remains as an interesting observation.

Also of interest are the (L) limestone group of fabrics that appear within the Százhalombatta assemblage and the Dunaújváros-Duna-dűlő assemblage but are never present within the Dunaújváros-Kosziderpadlás assemblage. These traits in the data suggest a specific selection of some fabrics that is site specific in relation to cups. Exactly what this means is open to question. However, it does suggest another element of a structured approach to pottery manufacture.

Any distinction between the frequencies of textural types used in relation to cups seems site oriented rather than vessel group oriented (Table 5.37b, 5.38, Figure 5.37). At Százhalombatta textural type ■ is most frequently used followed by textural type ● in the production of cups. Meanwhile at both Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő textural type ● is most frequently present followed by textural type ▲.

<u>6.2.7 Cups: Pots for parties? The social role of cups in relation the learning strategies</u>

Cups are a ubiquitous item within the assemblages studied. They are most usually produced using the pinching method. However, from Vatya II onwards an increasing exaggeration of design, that incorporates tri-partite forms, makes this technically impossible for some cups and the manufacturing technique changes to a combination of pinching and coiling.

Their very small proportions (45-70 mm in height) suggest a limited capacity that is unlikely to represent a vessel designed purely for quenching thirst; this somewhat marks them out as a rather curious form of drinking vessel (in terms of today's society they would, by and large, provide a rather dainty cup of tea!). This suggests the possibility that these cups are related to the consumption of a drink that has more to do with social expression (Hamilakis 1998, 1999) than drinking to quench thirst. Unfortunately, no residue tests have been carried out and so the precise contents can only be surmised. However, the notion of drinking rituals is one that is common to interpretations of Bronze Age society (Kristiansen 2000; Harding 2000). Moreover, while the evidence for such vessels is limited it is worth noting that Poroszlai (2000: 24) and Vicze (2001: 155) have both drawn attention to fermenting vessels at Százhalombatta and Dunaújváros-Kosziderpadlás

Cups are also an integral part of the burial rite and despite other changes to the material culture repertoire included in burial contexts (Bona 1992b; Vicze 2001: 174) cups have a continuous presence in this sphere of activity throughout the entire temporal span covered. Their positioning within the burial setting is highly structured along with other elements of the material culture repertoire, and other vessel forms (Figure 6.1). This suggests that cups are not an insignificant part of the ceramic assemblage.

In terms of a formal arena of skill a learning strategy that encourages less skilled potters to gain procedural knowledge by working on a technologically less complex form makes a lot of sense. The modest size range of cups and the general simplicity of their form mean there is less scope for error and a greater chance of a potter engaged in a learning strategy to succeed (Rice 1987; Caiger-Smith 1995). Given the nature of procedural knowledge it would seem likely that anyone who cannot eventually master the procedural knowledge required to produce a simple item, such as a cup, would be unlikely to master the skills required to produce larger and more complex items such as domestic vessels, urns, or fineware. Were enough practitioners forced to do so it would not be in the best interests of maintaining an understood potting tradition (Longacre *et al* 2000). As noted previously (section 3.2.3), it would seem more likely that people who cannot, or do not wish to, develop potting skills would cease to try and do so (Hodder 1991; Crown 2001).

By encouraging, or directing, learners to acquire skill, through working on simple vessels, such as cups, investment of time and resources, tempering materials and fuel, are also protected. This is an issue that should not be dismissed. It has been shown, for example, that the consistent availability of resources (such as appropriate fuel for firing pots) is a key factor in determining continuity of successful production (Rye 1981; Braun 1983; Tobert 1984; Arnold 1988; Sillar 2000). To waste resources unnecessarily would not be a sensible strategy either in terms of protecting resources or continuity of the potting tradition.

A final aspect requiring consideration with regard to cups is that their very simplicity and diminutive size may render them as an item that could lie in more than one sphere of production — in some cases being produced within a more formal potting arena but also within a more personal arena linked to notions of family or broader kinship identities rather than broader social mechanisms. Despite the general circumstance of cups receiving a low investment of skill compared to other vessel groups within the settlement context, and a low investment alongside domestic vessels and fineware within the cemetery context, not all cups are of poor quality. The data (Figures 5.1–5.12) shows a range of 'poor', 'moderate' and 'good' cups within all three settings. There are examples of cups that show a very high investment of skill such as the example illustrated (PRN 171), a Koszider cup from Százhalombatta (Figure 6.1). Here, as in many other possible examples, there is a clear progression of skill with the vessel on the right (Figure 6.3) having been produced by a potter with poor procedural knowledge while the vessel in the centre (Figure 6.2) shows an incremental increase in procedural knowledge and the one on the left (Figure 6.3) illustrates an extremely high degree of procedural knowledge. While, according to the data results, this investment of skill is lower for cups than other vessel groups it would seem that cups that can be the subject of high degrees of procedural knowledge. This suggests that at least some cups may be implicated in a more formal skill arena where the acquisition of very high degrees of procedural knowledge is possible and standardisation is being sought.

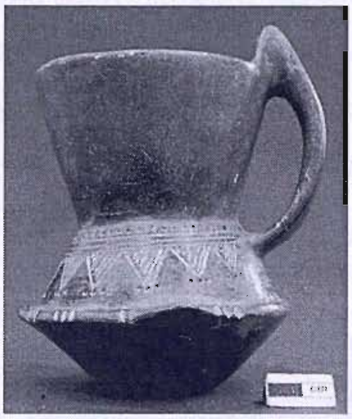


Figure 6.1 An example of a Koszider cup (PRN 171) from Százhalombatta, illustrating a high degree of procedural knowledge. Photograph by the author

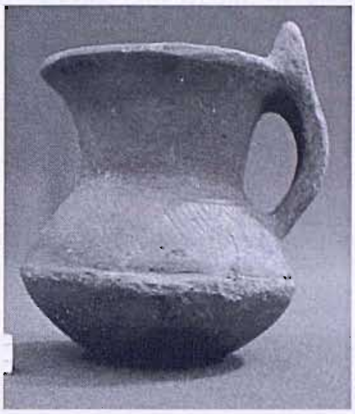


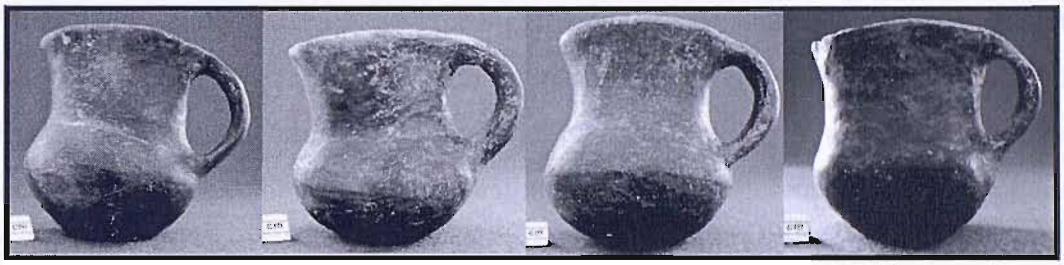
Figure 6.2 An example of a Koszider cup (PRN 136) from Százhalombatta, illustrating a moderate degree of procedural knowledge. Photograph by the author.

Figure 6.3 An example of a Koszider cup (PRN 157) from Százhalombatta, illustrating a low degree of procedural knowledge. Photograph by the author.

However, it must also be considered that as a comparatively simple item cups may be a vessel type that can lie in more than one arena of production and be subject to learning strategies that are drawn from more than one set of institutionalised practices. It may be that while cups are produced within a more formal skill arena that controls the incremental development of procedural knowledge (as illustrated above), their small size also makes them a manageable item for potters with a less advanced degree of procedural knowledge and, therefore, an object that can be produced within an informal skill arena. If so, it may be that cups in this setting are personal to specific 'familial' or 'kinship' groups (Kristiansen 2000) such as those expressed through the highly structured spatial arrangement of the burial pattern in the Dunaújváros- Duna-dűlő cemetery (Vicze 2001: 23-24, 227-228). Of the cups inspected at Százhalombatta there are definite traits of several 'groups' of cups which share such a strongly defined technological signatures expressing a 'style' of potting that suggests the likelihood of each group representing the work of a single potter. For example, this is the case with PRN 139, PRN 140, PRN 141 and PRN 143 (Figure 6.4) shown below.

The interesting thing about these cups is that they consistently share the same lack of technological skill, and an apparent inability to work toward an incremental improvement of procedural knowledge. They are all excessively heavy, they are all curiously burnished with a high sheen but onto an extraordinarily poorly executed and lumpy surface – that interferes with the burnishing process and spoils the end effect, they all have poorly applied patches at the handle, and the handles are all poorly formed and poorly attached, hence the patches (for discussion and presentation of these technological signatures see appendix 2). All these traits indicate that these cups are made by a potter with a poor (and potentially static) degree of procedural knowledge so that a low degree of skill investment is inevitable.

Figure 6.4 Group of Vatya cups from Százhalombatta which all repeat the same technological signatures of production. From left to right PRN 139, PRN 140, PRN 141 and PRN 143.



Taking all the factors addressed so far into account; the very small capacity of cups, the nature of skill acquisition associated with them, the possibility of differential access to fuel and resources, and firing circumstances — it is suggested here that the possibility cannot be ignored that cups may be produced within two differing arenas of skill. An informal arena of skill may relate to the social articulation of family and kinship ties at times such as burial and 'rites of passage'. In this case cups may be produced within a 'family' setting where the opportunity to acquire high degrees of procedural knowledge is not available. The result is a static investment of skill marked by continuously repeated error as potters fail to increase their procedural knowledge. A bye-product of this is the appearance of a 'familial' potting style as illustrated in Figure 6.4. If this is the case, then alongside this there clearly exists a more formal skill arena where cups form part of a structured learning strategy that encourages incremental development of procedural knowledge aimed at creating standardised products, by using cups as an introduction to more complex potting skills. This arena of skill may be more likely to be related to ideas of expressing status through the visual display of elite items.

6.2.8 Domestic vessels: skill and technological complexity

Domestic vessels have been argued to be of intermediate technical complexity (Table 4.2), although of greater proportions than cups the vessel morphologies of domestic vessels are generally quite neutral (Figure 2.14). While the increase in size makes them more complex to produce (Caiger-Smith 1995) than cups, the neutral shapes avoid many of the technological difficulties associated with urns and fineware.

6.2.9 Domestic vessels in the settlement context: skill in relation to other vessel groups

6.2.9.1 *Domestic vessels and cups*

Within the settlement assemblages the significant differences noted between domestic vessels and cups are expressed through reference to a different range of technological variables for each assemblage (Tables 5.3, 5.10 & 5.24, 5.25). It is, however, of note that present amongst the variables indicating significant differences between domestic vessels and cups, within both settlement assemblages, are; manufacturing and rim deviation on the horizontal plane. Meanwhile, within the Dunaújváros-Kosziderpadlás assemblage the variable of rim symmetry is also noted. As noted previously (section 6.2.3.1), this is of particular interest as these variables would all be expected to reflect the core processes of skilled manufacture. Given the disparity in size between domestic vessels and cups these variables would be expected to show a higher degree of variability (error) in the larger and more technologically complex of these two vessel groups were all vessels manufactured by similarly skilled potters. This is not the case, suggesting that the majority of domestic vessels are subject to a higher degree of procedural knowledge compared to cups in the settlement context.

6.2.9.2 *Domestic vessels and urns*

Within the settlement context both assemblages show just two significant differences between domestic vessels and urns (Tables 5.6, 5.13). While this indicates a lower investment of skill in domestic vessels compared to urns within the settlement context it cannot be seen as considerable. It is of note that, of the technological variables implicated in expressing a significant difference, exterior surface treatment and decoration are both evident. While the immediate conclusion for this may be seen to lie with the very different nature of these vessels it should be remembered that within this thesis vessel groups are only compared 'like with like'. It is suggested, therefore, that for some reason less investment is made with regard to the visual performance characteristics of domestic vessels compared with urns. This may be seen to reflect a deliberate strategy relating to their different social roles.

6.2.9.3 *Domestic vessels and fineware*

The number of significant differences observed within the settlement assemblage between domestic vessels and fineware leaves no doubt as to a lower investment of skill in domestic vessels compared to fineware (Tables 5.7, 5.14). It is interesting to observe that one of the technological variables indicating a significant difference is wall thickness. Wall thickness, in particular, is generally considered to be of great importance as a factor in achieving a good 'workaday' domestic pot that will withstand both thermal shock, essential for cooking vessels, and mechanical shock, essential for storage vessels. Wall thickness is then related to sound performance and longevity of domestic vessels (Braun 1983; Rice 1987; Skibo & Schiffer 1995). Despite this, wall thickness shows poor investment of skill, compared to fineware. It may also be expected, given the acutely exaggerated morphology of much fineware and the finesse of wall thickness associated with it that a greater degree of technological variability may be expected in this vessel group compared with the less technologically complex domestic vessels. That this is not the case suggests that domestic vessels receive a lower degree of procedural knowledge.

Other technological variables of particular relevance, in that they are recorded for both settlement assemblages and because they relate to the 'structural integrity of the pots' are: clay preparation, profile symmetry, rim deviation on the horizontal plane, and exterior surface treatment. All of these variables are known to be important to the integrity of domestic vessels (Rye 1981; Braun 1983; Rice 1987; Skibo & Schiffer 1995; Longacre *et al.* 2000) and yet they receive a lower investment of procedural knowledge than fineware. The suggestion is that within the settlement context domestic vessels have been selected out to receive a lower investment of procedural knowledge compared to fineware.

6.2.10 Domestic vessels in the cemetery context: skill in relation to other vessel groups

6.2.10.1 *Domestic vessels and cups*

Within the cemetery assemblage domestic vessels receive a lower investment of skill than cups. This is expressed through the presence of four significant differences in favour of a higher degree of skill investment in cups (Tables 5.17 & 5.26). It is of note that of these variables wall thickness, rim deviation on the horizontal plane, and profile symmetry may all be expected to be harder to execute skilfully in a larger vessel form (Caiger-Smith 1995). In reverse to the trend shown within the settlement assemblages, it seems that in the cemetery context that the more technologically complex domestic vessels are indeed subject to a poorer investment of skill. This is what may be expected if potters with similar degrees of procedural knowledge were working on both these vessel types within this social context. This suggests that similarly skilled, but given the overall analysis not highly skilled, potters are working on these two vessel types within the context of the cemetery assemblage. It should also be mentioned that no significant difference is observed between these two vessel groups for the firing variable suggesting they are subject to similar firing processes.

6.2.10.2 *Domestic vessels and urns*

The ten significant differences observed between domestic vessels and urns in the cemetery context express an unequivocal difference in skill investment between these two vessel groups in the cemetery context. Domestic vessels receive a far lower investment of skill than urns (Table 5.20, Figures 5.23–5.27). This situation is straightforward in as much as urns quite clearly receive the highest degree of skill investment at Dunaújváros-Duna-dűlő (Tables 5.18, 5.20, 5.22). However, it also appears to occur as a result of domestic vessels receiving a far lower investment of skill within the cemetery assemblage when compared to the settlement assemblages (Figures 5.1–5.12 & 5.14, 5.19, 5.24). Given the difference, in terms of technological complexity, of these two vessel groups it may be expected that domestic vessels would be subject to less skill variability (error) than urns if both vessel groups were made by similarly skilled potters. The fact that this is not so suggests potters with a far lower degree of procedural knowledge are implicated in producing domestic vessels within the cemetery setting.

6.2.10.3 *Domestic vessels and fineware*

Within the cemetery context domestic vessels receive a marginally lower investment of skill than fineware with only two significant differences noted (Table 5.21, Figures 5.23–5.27). These two significant differences relate to the technological variables of interior surface finish and exterior surface finish. It is interesting that domestic vessels are not singled out for this extra investment of procedural knowledge while fineware is; especially given the significance of surface finishes to the successful performance of domestic vessels (Rye 1981; Braun 1983; Rice 1987; Schiffer 1990; Schiffer *et al.* 1994; Longacre *et al.* 2000). This may be seen to relate to the different roles that these vessel groups play within social dynamics with a greater importance being placed on the visual performance of fineware. It is important to stress here that the overall investment of skill in domestic vessels is very low in this social setting. This is born out by the numbers of significant differences to be observed when each settlement is compared with the cemetery. There are ten significant differences between Százhalombatta and Dunaújváros-Duna-dűlő, and seven between Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő (Tables 5.3a, 5.3b, 5.3c, 5.3d).

6.2.11 Domestic vessels: the relationship of skill between the settlement and cemetery contexts

The same argument applies to domestic vessels as for cups. If domestic vessels, with an intermediate degree of technical complexity, were only manufactured by skilled potters, with high degrees of procedural knowledge, they should show a high level of skilled practice but this is not the case. In the settlement contexts the investment of skill in domestic vessels falls between cups, and urns and fineware. The difference is, however, notably less exaggerated between domestic vessels and urns than it is between domestic vessels and fineware. While domestic vessels receive a lower investment of skill than these other two vessel groups the numbers of significant difference suggest the differences are modest. Domestic vessels may not be subject to the very high investment of skill as fineware but they are subject to quite a high degree of procedural knowledge, It is interesting to consider why, in the settlement context, such an important vessel group in terms of daily utilitarian subsistence activities should be invested with a more moderate degree of skilled practice than urns or fineware. It would seem that less social emphasis is placed on these utilitarian vessels.

In the cemetery context there is a strong contrast to the settlement assemblages. Domestic vessels, surprisingly, receive the least investment of skill. This suggests that in this social context the majority of domestic vessels are produced by potters toward the lower end of a skill continuum; in other words by potters who have not acquired a sophisticated level of procedural knowledge. It is interesting that domestic vessels receive such a low investment of skill within the cemetery context compared to the settlement context. This suggests a deliberate strategy of skill investment that differentiates between domestic vessels implicated in daily utilitarian activities and those implicated in the burial context. This may relate to a more formal arena of skill where certain domestic vessels (for the cemetery) are implicated in a learning strategy, or that some domestic vessels are produced in a less formal skill arena.

6.2.12 Resources: fuel and tempering materials in relation to domestic vessels

6.2.12.1 *Domestic vessels: fuel and firing*

As with cups, it is worth noting the disparity between firing conditions within the settlement and cemetery contexts. Within the cemetery 37% of domestic vessels are softly fired. Meanwhile, there are no softly-fired domestic vessels at Százhalombatta and just 2.3% of softly-fired vessels at Dunaújváros-Kosziderpadlás. This difference is further born out by chi square tests which show no difference for the firing variable between the settlements but does show significant differences between both settlements compared with the cemetery (Tables 5.2a-5.2d). As with cups under fired vessels do not appear to be a desirable outcome for yet another vessel group where it may be expected that a utilitarian function is required. If, however, a certain number of domestic vessels are implicated purely in the burial rite without having any expectation that they will serve a prior utilitarian function it would again make sense to preserve important substantive fuel resources. The same situation as for cups exists. The softly-fired vessels are all accorded a similar firing strategy with an outcome that does not appear random — as may be expected from a firing situation where little control is exercised. As previously noted in this scenario it may be expected that there could be some over-fired or irregularly fired vessels, but this is not the case. If a certain number of domestic vessels are implicated purely in the burial rite, possibly as a facsimile of the 'real' thing, and do not have to serve a prior utilitarian function, low firing would again cease to matter in terms of daily activity or longevity. It may also be that some domestic vessels are produced within an informal skill arena where access to substantive fuel resources is limited in some way.

6.2.12.1 *Domestic vessels: tempering materials*

There appears to be scant evidence to suggest that there is any particular restriction being placed on the selection of raw materials (tempering agents) for fabrics to produce domestic vessels (Table 5.32, Figure 5.30). A greater variety of fabrics are used than for cups at all three sites. Any apparent variability seems to appear as a difference between Százhalombatta and the other two assemblages. There is a far greater use of the G (grog) fabric group at Százhalombatta than at either Dunaújváros-Duna-dűlő or Dunaújváros-Kosziderpadlás (Table 5.32, Figure 5.30). However, within these latter two assemblages there is a quite clearly an increased frequency of (GL) fabrics. It is worth noting that, again, (G) fabrics and (GL) account for the greatest frequency of fabrics within all three assemblages. As noted before with regard to cups, the use of grog as a tempering agent has been argued to have a great deal of social significance linked to ideas of identity a mediation of 'rites of passage'(c.f. Shepard 1956, Sterner 1989: 458, David 1990, Barley 1994; Sillar 1997; Stilborg 1997; Gosselain 1998; Gosselain & Livingstone 2005). Its use may then have social connotations as much as technological ones.

With regard to textural types (Table 5.38, Figure 5.38) the chi square results (Table 5.37a, 5.38) show, in combination with the percentage frequencies (Figure 5.38), that there is no significant difference between Dunaújváros-Duna-dűlő and Dunaújváros-Kosziderpadlás (Table 37a) with regard to the selection of textural types for the production of domestic vessels. The results reflect the more frequent use of type ● for the production of domestic vessels at Százhalombatta than at either Dunaújváros-Kosziderpadlás or Dunáujváros-Duna-dűlő. At Dunaújváros-Kosziderpadlás and Dunáujváros-Duna-dűlő types ▲ and ■ are used more frequently for the production of domestic vessels.

6.2.13 Domestic vessels: feeding the living feeding the dead

While domestic vessels are rarely the most visually appealing group of vessels in pottery assemblages they are accepted as requiring, and usually receiving high degrees of technical skill in order to perform their functional roles well (Rice 1987; Skibo & Schiffer 1995; Longacre *et al* 2000). It should not be assumed that this vessel group automatically lends itself to a lower investment of skill. It should also be remembered that in this research each vessel is only compared within the technological parameters normal to that vessel group and that the aesthetic value of vessel groups are not compared one with the other (see chapter 4). It is with this in mind that the interpretation for skill variability in domestic vessels is discussed.

The utilitarian role that domestic vessels play within the assemblages studied is attested by the usewear evidence found on domestic forms from the Early to Late Middle Bronze Age. The observation of sooting, abrasion and limescale deposits has been regularly noted during the lengthy study (2000-2007) of pottery from Százhalombatta by the University of Southampton SAX project. The utilitarian role of domestic vessels places them in a very particular role within the social sphere.

Ethnographic evidence suggests that domestic pots may hold as much social value within their particular sphere of activity as cups, urns or fineware do within other social spheres (Marshall 1985, Skibo & Schiffer 1995; Longacre *et al.* 2000). Skibo & Schiffer (1995) have, in particular, argued for the complex technology involved in the production of cooking pots. It is certain that dependability and longevity are an essential characteristic of domestic vessels which are integral to subsistence activities of storing, cooking and consuming food. Vessels that consistently fail would surely cause unwelcome discontinuity to important subsistence tasks. This is clearly undesirable and again turning to ethnographic literature it is suggested that well made cooking vessels would be prized items (Marshall 1985, Skibo & Schiffer 1995; Longacre *et al.* 2000). If pots were made seasonally (see Jones 1997, 2000), which, given the environmental conditions in this region throughout the Bronze Age period (Gyulai 1993: 17), seems a possible scenario, it is essential that they will function at least until the next round of potting activity can occur (Longacre *et al.* 2000).

Even if seasonal potting was not the norm it is still essential that domestic items do not consistently fail thus wasting important fuel resources; resources that come under increasing stress as crop cultivation incrementally increases from the Early Bronze Age agrarian economy to the Late Middle Bronze Age agrarian economy (Sümegi & Bodor 2000) when increasing deforestation places a stress on substantive fuel resources.The context of deposition of domestic vessels within houses (Poroszlai 2003) suggests that they were stored carefully, the smaller vessels on shelves, close to the cooking or domestic area. The lack of repair holes, found in reasonable numbers in British Bronze Age settlement and cemetery assemblages (Ellison 1975: 23), is rarely evident in Hungary suggesting that vessels are disposed of once damaged rather than repaired, but in the meantime are carefully looked after.

It has been argued that domestic vessels are of intermediate technological complexity. (Table 4.2) Despite this and the recognised importance that they have in day to day subsistence activity, it has been seen that while domestic vessels receive a higher investment of skill than cups they receive a lower investment of skill than urns or fineware in the settlement context; this being most exaggerated between domestic vessels and fineware (Tables 5.3, 5.6, 5.7 & 5.10, 5.13, 5.14). Given the difference in technological complexity it may be expected that domestic vessels would be easier to produce than either urns or fineware. The fact that they are subject to a lower investment of skill suggests that domestic vessels are produced by potters with a somewhat lower degree of procedural knowledge than either urns (albeit marginal) or fineware.

Meanwhile, within the Dunaújváros-Duna-dűlő assemblage it has been seen that domestic vessels receive a lower investment of skill than both cups (Table 5.17, Figures 5.23–5.27), fineware or urns (Tables 5.17, 5.20, 5.21, Figures 5.23-5.27). The difference between domestic vessels and cups (Table 5.26) being greater than the difference between domestic vessels and fineware (Table 5.26) (the latter being marginal, with just one significant difference noted). Domestic vessels receive a far lower investment of skill than urns in this social context. (Table 5.20, Figures 5.23-5.27). This situation is apparently straightforward in as much as urns will be seen to unequivocally receive the highest degree of skill investment within the Dunaújváros-Duna-dűlő assemblage (Tables 5.19, 5.21, 5.23). However, this situation also arises as a result of domestic vessels receiving a far lower investment of skill within the cemetery assemblage when compared to the settlement assemblages (Tables 5.2a-5.2d, Figures 5.1–5.12 & 5.14, 5.19, 5.24).

The differently articulated investment of skill within the settlement assemblages, compared to the cemetery assemblage gives rise to two possibilities. It would seem some domestic vessels are clearly produced within a skill arena where the incremental acquisition of skill is facilitated. This is attested to by the degree of procedural knowledge invested in them within the settlement context where it is argued that domestic vessels are the recipient of quite moderate degrees of procedural knowledge.

The suggestion is that in the settlement context the majority of domestic vessels are produced by potters with a moderate to high degree of procedural knowledge while in relation to the cemetery context they are produced by potters with a poor degree of procedural knowledge. It is interesting to consider why, in either setting, such an important vessel group in terms of utilitarian function should be invested with only a poor (the cemetery) to moderate (the settlement) degree of skilled practice and why such a poor investment of skill is so keenly articulated within the cemetery assemblage. As with cups, it has to be considered that domestic vessels, which are seen to relate to the contrasting social arenas of the dead and the living, are being treated differently.

Before pursuing this discussion it is worth noting that the large domestic bowls placed over the rim of burial urns (Figure 6.1) form a constant and important role within the burial rite being used to 'seal' the urn and its contents (Vicze 2001) and it may be that, unlike other domestic items which do not appear within the burial repertoire in such a repeated manner, a percentage of large domestic bowls are being made specifically as grave furniture. It has been observed previously (section 4.5.5) that it is harder to control the form of large vessels as a form widens and gets bigger (Caiger- Smith 1995: 109-110) and this applies particularly to forms with a flaring rim circumference, such as the domestic bowls which are inverted over the orifice of urns (Figure 6.1).

Within a more formal skill arena it may be that some domestic bowls are made specifically as part of the burial rite. In this case it would also make sense for the incremental acquisition of procedural knowledge, skill, to be acquired on items that did not actually have to perform tough workaday duties. It would certainly make very little sense to under-fire vessels intended for daily use as important functioning items while it might make perfect sense not to waste important substantive firing resources on pots that are essentially only required as a visual representation. This, in itself offers, one possible explanation for the difference in skill investment observed between domestic vessels implicated in the context of the living – where the concerns of durability and reliability come into play – or those related to the context of the burial rite where all that is required is a facsimile of a vessel that would form a part of one's daily pattern of social life. In other words, domestic vessels implicated in the burial rite would provide an appropriate metaphor for necessary 'domestic accoutrements' required for the deceased in their 'after-life', and display an agreed notion of what should go with the deceased on their 'passage of rite' to the afterlife. In a wider sense, the provision of the carefully orchestrated range of vessel forms (Figure 6.1) that form part of the burial rite may be seen as the 'manipulation of a material category' (Sørensen 1997: 95) to construct a highly structured appearance of an after-life that can be understood through reference to the highly structured appearance of existing life in Bronze Age Europe (Sørensen 1997).

Meanwhile, if a number of domestic vessels are made within an informal skill arena, as another element of the burial rite they may suffer from the same 'static' investment of procedural knowledge previously noted for cups (Figure 6.4). It would seem probable that if the skills to produce cups, a much simpler form, are severely limited within this more informal skill arena it is unlikely that the skill to produce domestic vessels is going to be any better. Unlike cups, there is no evidence to support the idea of 'groups' of domestic vessels that can be attributed to individual potters so this line of argument cannot be pursued here. However, it is of note that domestic vessels related to the cemetery context receive an even poorer investment of skill than cups (Table 5.17, Figures 5.23–5.27) and that this is what may be expected if similarly, but poorly skilled, potters where working on both these vessel groups. Also of note is that two of the significant differences observed between these two vessel groups within the cemetery context are 'rim deviation on the horizontal plane' and 'profile symmetry' both of which may be expected to suffer if the potter has indeed 'lost control' of the form being produced – as appears to be the case with many domestic vessels in this setting. These factors may indicate that the previously noted static performance of procedural knowledge argued for cups within an informal skill arena may indeed also apply to domestic vessels.

With regard to domestic vessels it has been seen that the frequency of (G) and (GL) fabrics are seen to increase within all three assemblages, compared to cups (Table 5.35, Figures 5.33, 5.34). With respect to this, the same arguments, as for cups surrounding the possible articulation of kinship relations expressed through tempering practices applies.

6.2.14 Urns: skill and technological complexity

Urns have been argued as being very technically demanding. They are clearly of far greater technical complexity than either cups or domestic vessels and are always at least as technically demanding as fineware (Table 4.2). As well as their large physical size (up to and occasionally exceeding 90cm) the majority of urns are characterised by a tripartite morphology and further embellished with handles, lugs, and plastic, impressed and incised decoration further adding to their elaborate visual performance characteristics (Figure 2.15). Although there are some simpler urn forms, particularly in the Nagyrév phase, these are often finely decorated with fingertip impressions (Figure 2.15, also see Appendix 2; PRN 2067, PRN 523, PRN 553 for comparisons of degrees of skill in executing a similar task) which illustrate perfectly the kind of physically embedded nature of procedural knowledge required to repeatedly produce the same task many times (section 4.4). Additionally, as with any other embellishment correct timing with regard to the plasticity of the clay is required to execute these designs (chapter 4). The anthropomorphic urns that also appear at this time are also seen to require an investment of skill far beyond anything required in the production of cups or domestic vessels.

Given their technological complexity it might be expected that urns would be prone to a higher degree of technological error (poor or variable skill investment) were all potters engaged in there manufacture of an equal ability and shared an equal degree of procedural knowledge. It is, however, clear that within all three assemblages, but somewhat more noticeably within the settlement assemblages, urns receive an investment of skill that marks a sophisticated degree of procedural knowledge (Tables 5.4, 5.11, 5.18, Figures 5.13-5.17, 5.18-5.22, 5.23-5.27).

In other words urns are being made predominantly by skilled potters within the settlement context and by more highly skilled potters in the cemetery context than any other vessel group for this social setting. It is of interest that urns are clearly the most technically competent item within the cemetery assemblage (Table 5.27) and that they are the only vessel group to vie with fineware for a high investment of skill within the settlement context.

6.2.15 Urns in the settlement context: skill in relation to other vessel groups

6.2.15.1 *Urns and cups*

The high number of significant differences noted between urns and cups in relation to the technological variables attests to the wide disparity in skill investment between these two vessel groups (Tables 5.4, 5.11 & 5.24, 5.25). In particular it is worth drawing attention to the variable of profile symmetry. It was noted in the methodology, chapter 4 (section 4.5.5), that it becomes increasingly harder to control clay as the form of a pot increases and widens. This particular technological variable may then be expected to be under great stress as the proportions of pots increase and yet it is marked, along with numerous other variables, with a higher degree of skill investment within the urn vessel group than within the far less technologically demanding cup vessel group (Tables 5.4, 5.11). This suggests that within the settlement context urns are being produced by potters with a far higher degree of procedural knowledge and thus skill, than those producing cups.

6.2.15.2 *Urns and domestic vessels*

Within the settlement context both assemblages show just two significant differences between urns and domestic vessels (Tables 5.6, 5.13). While this indicates a higher investment of skill in urns compared to domestic vessels it cannot be seen as considerable. It is of note that, of the technological variables implicated in expressing a significant difference, exterior surface treatment and decoration are both evident. Given the importance of surface treatments to the successful performance of domestic vessels previously discussed in chapter 6 (section 6.2.10.3) it is particularly interesting that this is one of the technological variables implicated in revealing a higher degree of skill investment in urns. While the immediate conclusion for this may be seen to lie with the very different nature of these vessels it should be remembered that within this thesis vessel groups are only compared ‘like with like’. It is suggested, therefore, that a higher investment of skill is being targeted at urns in relation to visual performance characteristics which may be seen as socially essential for a vessel group that has been argued (section 4.5.4), and will be more extensively argued in section (6.2.16) as being a central component of the vessels associated with the burial rite.

6.2.15.3 *Urns and fineware*

Within the settlement context the significant difference between urns and fineware is negligible and is expressed as just one significant difference at Százhalombatta (Tables 5.8, 5.15). This is for the technological variable of interior surface treatment. It is worth noting that the complex morphologies of fineware vessels and comparatively closed orifices of fineware jug forms would imply greater difficulty at accessing interiors for the purposes of surface finishing. Both urns and fineware are, then, subject to a very high investment of procedural knowledge within this social setting. It is suggested this degree of skill investment comes about as part of a structured learning strategy that has promoted the incremental acquisition of procedural knowledge.

6.2.16 Urns in the cemetery context: skill in relation to other vessel types

6.2.16.1 *Urns and cups*

Within the cemetery context urns receive a higher investment of skill than cups. This is expressed as five significant differences (Table 5.18). Of these variables three, additions, interior surface treatment, and decoration, can be argued not to relate to the structural integrity of the vessels. They do, however, have an important role with regard to visual performance characteristics. The implication of these variables showing a significant difference between urns and cups is that the visual characteristics of urns can be seen as being of greater importance than that of cups. It will be argued throughout this section that urns play a central role in the burial rite and that this seems to be born out by the emphasis placed on a structured investment of skill that ensures the appropriate visual characteristics of these vessels. The only technological variables that may be seen as relevant to the structural integrity of vessels are the manufacturing (the core of the pot) variable, and the firing variable (Table 5.18). The firing variable shows a significant difference representing a frequency of 50% of softly-fired cups and a frequency of 25% softly-fired urns. Together these factors suggest that urns are produced by potters with a higher degree of procedural knowledge than those producing cups and in particular these practitioners have a high degree of procedural knowledge in the areas relating to visual performance.

6.2.16.2 *Urns and domestic vessels*

Within the Dunáujváros-Duna-dűlő assemblage 10 significant differences are observed between urns and domestic vessels indicating a far higher investment of skill invested in urns in this context than in domestic vessels (Table 5.20, Figures 5.24, 5.25). As mentioned previously this situation is straightforward in as much as urns unequivocally receive the highest degree of skill investment within the Dunaújváros-Duna-dűlő assemblage (Tables 5.19-5.5.22, Figures 5.23-5.27). However, it also appears to occur as a result of the, previously discussed (section 6.2.11), much lower investment of skill in domestic vessels within the cemetery assemblage when compared to the settlement assemblages (Figures 5.14, 5.19, 5.24). This is born out by chi square test which show a very low difference between the two settlements but a number of significant differences between the settlement assemblages when compared to the cemetery assemblage (Table 5.2a, 5.2d).

6.2.16.3 *Urns and fineware*

There are seven significant differences observed between urns and fineware in the cemetery context. The range of variables implicated includes; manufacturing, wall thickness, additions, interior surface treatment, exterior surface treatment, profile symmetry and firing. Urns are seen to receive a much higher investment of skill than fineware. Again, this may relate to the central role of urns within the burial rite and the visibility of urns within this social setting.

6.2.17 Urns: the relationship of skill between the settlement and cemetery context

Urns, although receiving a higher investment of skill within the settlement assemblages compared to the cemetery assemblage (Tables 5.2c, 5.2d) are nonetheless the recipient of the highest investment of any vessel group in the social context of the cemetery (Tables 5.17- 5.22, Figures 5.23-5.27). It is interesting that two of the technological variables that show significant differences between the settlements and the cemetery urns are profile symmetry and (Százhalombatta / Dunaújváros-Duna-dűlő) and rim deviation on the horizontal plane (Dunaújváros-Kosziderpadlás / Dunaújváros-Duna-dűlő). These are both variables that may reflect a less experienced potter, with a lower degree of procedural knowledge, having difficulties in controlling the production of a larger vessel form (see chapter 4, section 4.5.5), suggesting that potters working on urns associated with the cemetery are less skilled than those working on urns related to settlement contexts.

6.2.18 Resources: fuel and tempering materials in relation to urns

6.2.18.1 *Urns: fuel and firing*

This different investment of skill between urns related to the settlement context and those related to the cemetery context is also born out through reference to firing conditions. There are 25% of under fired urns within the Dunáujváros-Duna-dűlő assemblage, non within the Dunaújváros-Kosziderpadlás assemblage and just 1.5% within the Százhalombatta assemblage. This difference between the settlements and the cemetery were seen to be significant (Table 5.2c, 5.2d). However, it is also of note that the 25% of under fired vessels present within the Dunáujváros-Duna-dulo assemblage represents the lowest frequency of under fired vessels for any of the vessel groups within this social context (Figure 5.27). This suggests the possibility that some urns are again selected out for an alternative firing strategy. As with cups and domestic vessels this may mean that some urns are not intended to perform a utilitarian function prior to a sacred one and this is a deliberate strategy to protect resources. It also seems undesirable for a vessel group with excessively large proportions, which requires the maximum investment of raw materials and time to produce to be the inadequately fired unless this is part of a deliberate strategy.

6.2.18.2 *Urns: tempering materials*

As with cups and domestic vessels, (G) and (GL) fabrics together make up the majority of fabric types within all three assemblages (Table 5.35, Figures 5.33-5.36). Given the preceding discussion (section 3.4.2) highlighting issues of categories of people and relationships between people, identity and material objects (Sofaer & Sørensen 2006) this overriding concern with grog tempering is possibly even more significant in relation to urns. Analysis of the textural types further bears out the difference in skill investment between the settlements and the cemetery with a more frequent use of type ● for the production of urns at both Százhalombatta and Dunaújváros-Kosziderpadlás while within the Dunáujváros-Duna-dűlő assemblage there is a very even frequency distribution of all three textural types associated with urns (Table 5.38, Figure 5.39). This indicates a different selection of fabrics for the production of urns in relation to the social context of the settlement and the social context of the cemetery.

6.2.19 Urns: a question of identity? The social role of urns in relation to learning strategies

Urns are argued to play a pivotal and highly significant role in the social articulation of identity from the Early to the Late Middle Bronze Age. From the Szigetszentmiklós phase of the Nagyrév through to the final Koszider phase of the Vatya group (Table 2.1) they are central to the burial rite. They are described by Vicze (2001: 227) as the "most significant identity marker within a burial" throughout the Late Early to Late Middle Bronze Age pottery assemblages, and are generally the last item within the ceramic repertoire to respond to change. This slow response to change may mirror the technical complexity involved in their manufacture but also the core social dynamic they have in expressing identity at the time of the burial rite. Vicze (2001: 79, 155-158) argues a number of cases where the urn has some sort of special character or symbolism and that the articulation of identity linked to urns may be expressed in various ways.

The urn may provide a metaphor to an earlier time through a 'hybrid' of current and preceding potting styles (Vicze 2001: 79 Dunaújváros-Duna-dűlő, Graves 715 & 720), or by explicitly articulating the traditions of the present – through, for example, very distinctive plastic decoration mimicking an elaborate Koszider style pendant (Vicze 2001: 185 Dunaújváros-Duna-dűlő, Grave 829). There are also, albeit few examples, where urns are seen as related to particular activities, such as fermenting (discussed earlier in relation to cups). Vicze (2001) suggests these are lent a certain mystery connected to potentially expressing identity once transferred to the 'strict canonical burial' custom of Vatya society (Vicze 2001: 155-158). Vicze (2001: 157) argues "that any symbolic meaning must be expressed through the most substantial grave furniture". Thus the fermenting vessel (urn) may be seen as reflecting the special status of the deceased and implies a link between the individual and 'mystic' notions surrounding alcohol and fermenting. These examples are acknowledged as representing a small number of urns. However, it is suggested here that if such examples exist suggesting a relationship between expression of identity and funeral urns then other less obvious examples are possible.

Urns may also be argued to physically form the 'structural item' of material culture around, which, or within which, other forms of grave goods are placed (Figure 6.5). Just as dress is subject to a structural arrangement on the body (Sorensen 1997: 99;

Kristiansen 1999: 541) so too, it is suggested, are urns part of a carefully structured arrangement of vessels that appear within an appropriate ordered way in relation to other grave goods. The central positioning of urns within the burial ritual may be argued to be another expression of the social structuring of concepts of an after-life that can be understood through reference to the highly structured categories of material culture that are articulated in numerous ways throughout the life course. For example, the highly structured organisation of the burial complex is itself a reflection of the structured social organization of the living (Vicze 2001: 24, 27–51; 2003: 155). Meanwhile, if identity and categories of people are expressed through dress (Sørensen 1979) why not also through urns? Urns can wear bracelets and pendants, have breasts, or carry daggers (Poroszlai 2003) in a way not dissimilar to that noted by David (1990) and Thomas & Tilley (1993).

This possibility is most clearly illustrated through reference to the anthropomorphic vessels found at Százhalombatta, Mende- Leányvár, and Dunaújváros-Duna-dűlő (Figure 6.6). It should be noted that the 'male' vessel found at Dunaújváros-Duna-dűlő is thought to have been transferred to this social context from Dunaújváros-Kosziderpadlás (Bọna 1992c). Poroszlai (2000: 20) notes the important implication of both male and female vessels eventually coming to light on a single site, Százhalombatta, suggesting the likelihood that this may be the case elsewhere. These vessels all display an exceptional degree of procedural knowledge, as do the majority of urns, and were found in association with burnt cereal grains. Given the importance of cereals to this increasingly agrarian community Poroszlai (2000: 22) argues for a link between these special urns, gender – as in male / female – and fertility. There are two connotations that can be suggested here; fertility of the population or fertility of the ground and successful crops which not only ensure subsistence but continued ability to create the kind of "significant surplus" that facilitates trade, specialisation and stability allowing populations to remain static (Laszlo 2003: 53). All of these are seen as characteristic of this cultural milieu (Kristiansen 1989; 2000a; 2000b; Harding 2000; Laszlo 2003). The anthropomorphic vessels discovered are rare and seen as 'elite' items (Poroszlai 2000a; 2003), however, they may represent a concern with storage of surplus that is ultimately going to effect the wider community and be implicated in power relations. Barrett (1989a: 310) suggests that grain may have,

> "…quite distinct meanings in a cycle of arable production; it is both the seed grain to instigate the cycle, and the food product resulting from that cycle. Grain may be stored for human consumption, or as the seed-grain of a future arable cycle. If ideas of fertility are important, and if such cycles lie behind notions of political authority, then the treatment of grain in these cycles will be socially distinct"
>
> Barrett 1989a: 310

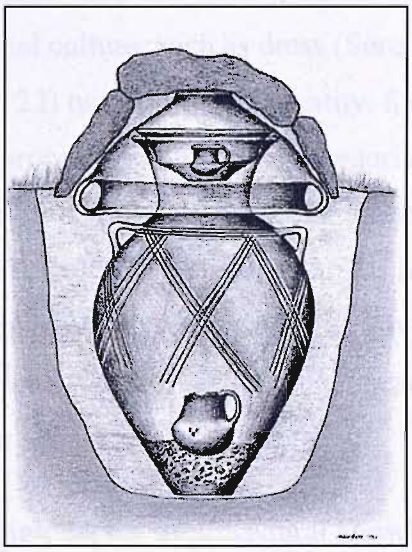


Figure 6.5 Reconstruction of an urn burial from the Vatya culture. (After Vicze 2003 155)

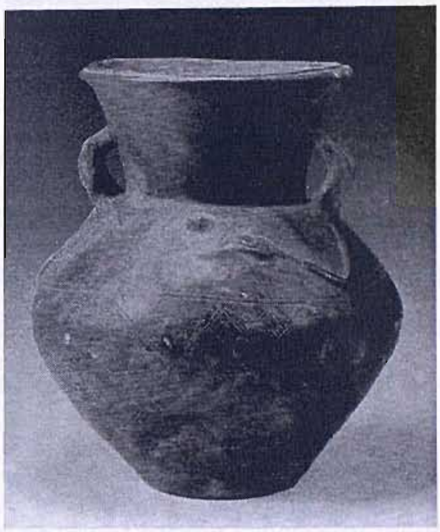


Figure 6.6 Two handled urn symbolising 'femaleness' from pit 2 Százhalombatta (After Poroszlai 2000: 31)

Both, or either, scenarios — fertility of the ground or fertility of the population — may be reason enough to bring about a cultural and social desire to protect (and revere) cereal grain, a part of which is to join it to a significant material object which will help to mediate its social value (Sofaer & Sorenson 2006). Poroszlai (2000: 22) and Kreiter (2005: 13) go so far as to see these vessels as symbolising fertility gods and goddesses. Whether or not this is the case, these vessels certainly symbolise an important relationship between essential subsistence resources, and equally important surplus. The requirement of skill that is required for a vessel of enough significance (or presence) to become available for this piece of social articulation is in itself worth protecting. The important link these anthropomorphic vessels are considered to have in relation to ideas of gender and fertility may be argued to relate to the general trend for strong categorisations of identity throughout this period of the Bronze Age (Sørenson 1997). While these anthropomorphic vessels are rare it is worth remembering that if pots can have a recursive power of their own (Yoffee & Sherratt 1999) these particular urns may be implicated in processes of "emulation and permutation" that Kristiansen (1999b: 538) argues to be "formal properties that characterise certain central symbols that can be applied in a variety of contexts".

Such categorisations are multifaceted and expressed through all forms of material culture. Indeed it is the relationship between objects and people that give them meaning (Sofaer & Sørenson 2006). In this respect it is interesting that the 'female' pot *wore* bracelets while the 'male' pots *carried* daggers. Items noted within other realms of material culture, such as dress (Sørensen 1997: 99, 107), and elite warfare (Kristiansen 1989: 22) used to signify identity. Such meaning is recursive in that it forms part of the very process of interaction, categorisation and institutionalised practise (chapter 3, c.f. Bloor 1997: 34). It may be that while such processes do indeed encompass all forms of material culture some things are so fundamental to the articulation of categories or identity that they have particular advocacy. It is suggested here that urns may be representative of this kind of advocacy in Early to Late Middle Bronze Age social dynamics.

The high degree of procedural knowledge required for the successful incorporation of these many characteristics into a single vessel form is in no doubt. It is of particular note that urns not only receive an outstanding investment of skill within settlement assemblages but also receive the highest investment of skill within the cemetery assemblage. This provides a contrast to other vessel groups and seems to offer confirmation of their overall social importance – whether sacred or profane.
It may be that the majority of urns are produced to perform in the social arena of the living, and transferred to the cemetery setting at a later point. In this case urns would have to perform a utilitarian function prior to a sacred, ideological one that expresses ideas embedded within the social practices of burial rites. This is certainly a situation known to exist in certain African communities where pots are used as water containers, or storage vessels, while they wait to be used as a container for the spirit of the deceased (David 1990). Meanwhile, it may be that if some urns are produced directly for the burial context, with there being no intent of a preceding role within the settlement, it would make sense to protect fuel resources and encourage the further acquisition of skill by potters who have not yet reached their full potential to work urns intended for the

settlement.

Their size and the dual roles, both sacred and profane (not necessarily in a segregated manner) which they serve, are all factors which may underpin the reason for the high investment of skill they receive within the settlement assemblages, and the comparatively high degree of skill they receive, compared to other vessel groups within the cemetery assemblage. Despite the apparent difference in the investment of skill in urns within the settlement assemblages and the cemetery assemblage, the comparatively high investment of skill they receive compared to other vessel groups in the cemetery context suggests there is a less clear argument to be made for the production of urns in more than one skill arena. The presence of under-fired urns within the cemetery context may be an indicator of production within a less formal skill arena. However, as noted previously for cups and domestic vessels this may have as much to do with protecting resources when vessels are known to be going to serve no utilitarian function.

It is strongly suggested that the majority of urns are produced within a more formal skill arena that facilitated an incremental increase in procedural knowledge with an ultimate outcome of a high investment of skill. Remembering that skill does not come out of nowhere but must be incrementally acquired (Roux 1990: 148; Greenfield 1984: 118; Wallaert Pêtre 1999: 1) this can be the only explanation for the high investment of skill invested in the manufacture of urns. Within this situation it would be necessary, at some point, for moderately skilled potters who have mastered the procedural knowledge required for the production of easier items such as cups and domestic vessels, to progress to more technologically complex items. Perhaps urns destined directly for the mortuary domain are implicated in the higher end of a strategy designed to facilitate incremental skill acquisition.

6.2.20 Fineware: skill and technological complexity

Fineware jugs and bowls, either settlement or cemetery, have been argued to be technologically complex (Table 4.2) and, therefore require a high degree of procedural knowledge to ensure a successful outcome. The fact that there is such an apparent divide in the investment of skill in this vessel group, dependent on its social context, raises the suggestion that while a high investment of skill is possible, as seen in relation to settlement fineware, the social structuring of skill is such that it was not deployed on fineware vessels implicated in the burial rite. Were all potters producing fineware equally skilled then fineware, in overall terms, may be expected to display a higher degree of skill variability (error) than cups and domestic vessels. The opposite of this scenario holds true for settlement fineware suggesting it is produced by potters with high degrees of procedural knowledge. Meanwhile, in relation to the cemetery potters are clearly less skilled and less able to cope with the technological demands of this complex vessel type.

6.2.21 Fineware in the settlement context: skill in relation to other vessel groups

6.2.21.1 *Fineware and cups*

The degree of difference between the investment of skill for fineware and cups in the settlement context is unequivocally significant with fineware receiving a far greater investment of skill. This is born out by the range of significant differences observed (Tables 5.4, 5.12 & 5.24, 5.25). It is apparent that fineware in the settlement context receives an investment of skill that could only be the result of skilled potters that have acquired an advanced degree of procedural knowledge (Figures 5.1-5.12). If all vessels are made by equally skilled potters this highly technologically complex vessel group should display a greater degree of skill variability and possible error (see Appendix 2) than the technologically less complex cups. However, the opposite of this scenario has been demonstrated. This suggests that fineware has been selected out to receive an investment of skill that could only be the outcome of a high degree of procedural knowledge. Such a high degree of procedural knowledge is argued to be the outcome of a learning strategy that facilitates the incremental acquisition of skill.

6.2.21.2 *Fineware and domestic vessels*

The number of significant differences observed within the settlement assemblage between fineware and domestic vessels leaves no doubt as to a higher investment of skill in fineware (Tables 5.7, 5.14). It is interesting to observe that one of the technological variables indicating a significant difference is wall thickness. As previously noted (section 6.2.9.3), wall thickness is particularly significant with regard to the sound performance and longevity of domestic vessels (Braun 1983; Skibo & Schiffer 1995). Despite this, wall thickness shows poor investment of skill, compared to fineware. It may be expected, given the acutely exaggerated morphology of much fineware and the finesse of wall thickness associated with it that a greater degree of technological variability may be expected in this vessel group compared with the less technologically complex domestic vessels. That this is not the case suggests that fineware is the recipient of a higher degree of procedural knowledge. Other technological variables of particular relevance, in that they are recorded for both settlement assemblages and because they relate to the 'structural integrity of the pots' are; clay preparation, profile symmetry, rim deviation on the horizontal plane, and exterior surface treatment. All of these variables, but in particular profile symmetry, may be expected to be harder to accomplish on the more technologically complex fineware forms. That this is not the case suggests that potters with a higher degree of procedural knowledge are working on fineware compared to domestic vessels.

6.2.21.3 *Fineware and urns*

Within the settlement context the significant difference between fineware and urns is negligible and is expressed as just one significant difference at Százhalombatta (Tables 5.8, 5.15 & 5.24, 5.25). This is for the technological variable of interior surface treatment. Both urns and fineware are, then, subject to a high investment of procedural knowledge within this social setting. It is suggested this high degree of skill investment comes about as part of a structured learning strategy that has promoted the incremental acquisition of procedural knowledge.

6.2.22 Fineware in the cemetery context: skill in relation to other vessel types

6.2.22.1 *Fineware and cups*

In the cemetery context fineware receives a lower investment of skill than cups. Three significant differences are observed (Table 5.19 & 5.26). The variables of wall thickness and rim deviation on the horizontal plane show a significant difference in favour of cups. Meanwhile, the decoration variable shows a significant difference in favour of fineware. It is may be argued as important that fineware is the recipient of a greater degree of skill where the decoration variable is concerned, suggesting a higher expectation being placed on the visual performance characteristics of cemetery fineware compared to cups. These results indicate a similar situation to that described for cups and domestic vessels; that the more technologically complex fineware vessels are indeed subject to a poorer investment of skill. This is, again, what may be expected if potters with similar degrees of procedural knowledge were working on these vessel types. This suggests that similarly skilled, but given the overall analysis not highly skilled, potters are working on these two vessel types within the social context of the cemetery.

6.2.22.2 *Fineware and domestic vessels*

Within the cemetery context finewares receive a marginally higher investment of skill than domestic vessels with only two significant differences noted (Table 5.21, Figures 5.23–5.27). These are for the technological variables of interior and exterior surface treatment. In the case of exterior surface treatment this, again, relates to the visual characteristics of fineware. Neither of these vessel groups can be argued to have high degrees of procedural knowledge invested in them in this social context. The low investment of skill for fineware in the cemetery context is attested to by the ten significant differences observed between the Százhalombatta and Dunaújváros-Duna-dűlő assemblage and the nine significant differences observed between Dunaújváros-Kosziderpadlás and Dunaújváros- Duna-dűlő for fineware (Tables 5.2c, 5.2d).

6.2.22.3 *Fineware and urns*

There are seven significant differences observed between fineware and urns in the cemetery context. The range of variables implicated includes; manufacturing, wall thickness, additions, interior surface treatment, exterior surface treatment, profile symmetry and firing. Urns are seen to receive a higher investment of skill than fineware. These results emphasise the low investment of skill in fineware in this social context. It is interesting to note that within the burial rite fineware items are generally placed within the urn and are not highly visible. Fineware in relation to the mortuary domain is clearly the recipient of a low degree of procedural knowledge suggesting they have been selected out in some way to receive a lower investment of skill.

6.2.23 Fineware: the relationship of skill between the settlement and cemetery context

The different treatment of fineware, in terms of skill investment, between the settlements and cemetery is so apparent that it is impossible not to be drawn immediately into discussions as to the social meanings of this phenomenon. Fineware in the cemetery context receives a far lower investment of skill than that associated with the settlement (Tables 5.2a, 5.2c, 5.2d). Within the cemetery context fineware not only receives a lower investment of skill than urns (Table 5.22) but also a lower investment of skill than cups (Table 5.19). Fineware does receive a higher investment of skill than domestic vessels in this setting, but it is marginal (section 6.2.22.2).

The high numbers of significant differences observed between Százhalombatta and Dunaújváros-Duna-dűlő (10) and settlement Dunaújváros-Kosziderpadlás and Dunaújváros-Duna-dűlő (9) (Tables 5.2c, 5.2d) for fineware demonstrates the unequivocal difference between investment of skill in fineware dependent on its social conntext. This scenario suggests that there is a very strong distinction being made between the investment of skill within the settlement and cemetery contexts where fineware is concerned. While fineware related to the settlements are being produced by highly skilled potters, with a refined and deeply embedded sense of procedural knowledge to draw from, this is clearly not the case with regard to fineware in the cemetery context. This differentiation is so pronounced that it is suggested it must be the result of a deliberately articulated social decision to invest skill differently in this vessel group depending on its social arena.

6.2.24 Resources: fuel and tempering materials in relation to fineware

6.2.24.1 *Fineware: fuel and firing*

Of particular interest with regard to resources is the issue of firing fineware. Within the Dunaújváros-Duna-dűlő assemblage 56% of fineware vessels are under-fired (Figure 5.27). This represents the highest percentage frequency of under fired vessels for any vessel group within the cemetery assemblage. Chi square tests show that there is a significant difference between fineware and urns (Table 5.22), but no significant difference between fineware and cups, or fineware and domestic vessels (Tables 5.19, 5.21) for the firing variable within the Dunaújváros-Duna-dűlő assemblage. This suggests a similarly low investment of skill with regard to firing fineware, domestic vessels and cups within the cemetery assemblage. Meanwhile, within the Százhalombatta assemblage 1% of fineware vessels are under-fired (soft) and at Dunaújváros-Kosziderpadlás none are under fired (Figures 5.17, 5.22). This further confirms the low investment of skill in fineware associated with the cemetery context and the stark contrast that this presents when compared to the high investment of skill found within the settlement assemblages for fineware (Figures 5.1-5.12, Tables 5.2a-

5.2d). This seems to represent a deliberate decision to treat fineware differently depending on its social context. Again, this firing strategy would work to protect resources by conserving important fuel by selecting out fineware intended as facsimiles linked to the burial rite.

6.2.24.2 *Fineware: tempering materials*

The divide between settlement and cemetery fineware is further expressed through the interesting appearance of fabrics Q1● and Q3●, noted in regard to cups. These two fabrics re-emerge in relation to fineware but in a somewhat different format. Fabric Q1● is again related to the Százhalombatta assemblage and does not appear at all within the Dunaújváros-Kosziderpadlás assemblage. Meanwhile, fabric Q3 ● is again strongly linked to the Dunaújváros-Kosziderpadlás assemblage and although in this instance it does also appear within the Százhalombatta assemblage, it has a very low frequency of 2.1% (Table 5.34, Figure 5.32). Of particular interest is that neither of these fine ● quartz fabrics appears in relation to fineware at Dunaújváros-Duna-dűlő (Table 5.34, Figure 5.32). This suggests that, in this case, these fine and potentially prestigious, (Q) fabrics stay firmly within the realms of settlement fineware – potentially implicated in the production of elite vessels. This again, suggests a distinct difference in the way this vessel form is treated dependent upon its social context.

Grog fabrics continue to have a high frequency presence within both the settlement assemblage, while the Dunaújváros-Duna-dűlő assemblage shows higher frequencies of the (GL) and (L) fabric groups (Table 5.34, Figure 5.32). Attention is drawn, again, to the social implications of grog as a tempering material.

In terms of textural types there is yet another increase in the use of type ●, over and above that observed for urns, within the Dunaújváros-Kosziderpadlás assemblage. Type ● is also the most frequently present textural type within the Százhalombatta assemblage (Table 5.38, Figure 5.40). Within the Dunaújváros-Duna-dűlő assemblage a different situation occurs and there is a fairly even spread of all three textural types being implicated in the production of fineware. The highest percentage frequency is, however, for type ■ (Table 5.38, Figure 5.40). Given the description offered in Table 5.27 this is suggested to be an inappropriate fabric with which to produce fineware vessels. This emphasises a further distinction between investment of skill and resources depending on the social arena in which fineware is located. When the percentage frequency results are taken in combination with chi square tests the differences seen between the cemetery and settlement assemblages are confirmed as significant (Table 37a).

6.2.25 Fineware and stratification: the social role of fineware in relation to learning strategies

Finewares are a constant element of ceramic assemblages throughout the Early to Late Middle Bronze Age and are expressed as a series of bowl and jug (or jar) forms (Figure 2.16). The size range of finewares can vary greatly and range from small Nagyrév bowls (top row left of Figure 2.16) to large Koszider 'Swedish helmet bowls' (bottom row far left of Figure 2.16). Despite the potential size range of finewares they all share a high degree of technological complexity brought about by often exaggerated forms, a fine wall thickness, complex additions of bosses, lugs, elaborate handles and finely executed burnishing or applied plastic decorations. It has been argued that such finewares are associated with elite and high ranking members of society (Poroszlai 2000: 15). Given that a highly structured and stratified social order is seen to exist at the final (Kulcs) phase of the Nagyrév and again by the final closing Koszider phase of the Vatya period (Poroszlai 1996, 2000a, 2000b, 2003; Bona 1992c; Vicze 2001, 2003; Shennan 1993; Csányi 2003; László 2003) it is highly likely settlement fineware of this cultural milieu was linked with the performance of negotiating and maintaining status. Fineware vessels, along with other items of material culture such as elaborate houses (Csányi 2003: 144), prestigious items of metalwork (Bona 1992b), and modes of dress (Sørensen 1997: 99, 107) are seen as having been implicated in articulating, and structuring social identity, including notions of social rank.

It is suggested that in order to perform the social function of expressing elite status settlement fineware must be able to meet close scrutiny and to perform in both a visual and utilitarian sense; both equally important characteristics. To make settlement fineware the recipient of the greatest investment of skill protects the resources of time, clay, tempering materials and fuel. The particular use of very fine quartz fabrics implicated in the production of fineware in the settlement context suggests a deliberate selecting out of better resources for those vessels which will receive the highest investment of skill. As well as ensuring the longevity of pots intended to serve important utilitarian functions, the high investment of skill also works to protect the continuity of a prestige item and hence the continuity of prestigious social enactments. Such items are well documented as being implicated in mechanisms to negotiate and re-negotiate social relationships (Bradley 1982; Shanks & Tilley 1987, Barrett 1989b; Hodder 1991; Barley 1994; Sørensen 1997; Day & Wilson 1998; Kristiansen 1999b; Sofaer Derevenski 2000; Sofaer & Sørensen 2006).

One of the prime characteristics of elite items is argued to be intended visibility. Settlement fineware would, therefore, be expected to encompass not only a high technological standard of utilitarian function — given their morphological and technological characteristics most probably for the elaborate serving of food (Rice 1987), — but also to exhibit highly desirable visual performance characteristics that would suffer the close scrutiny of actual use. Visual characteristics have been argued not only to be integral to the social display of wealth through consumption itself but also for a prestigious visual display of wealth or status when not in use Sofaer (2006: 140). It is argued that a learning strategy was adopted that worked to protect not only the visual characteristics of fineware in the settlement context but also that of fineware implicated in the cemetery context where despite a poor investment of skill the visual appearance of vessels appears to have been protected (see sections 6.2.22.1 & 6.2.22.2).

For settlement fineware to reach such a high technological standard it is argued that it was produced within a skill arena that facilitated highly developed sense of procedural knowledge. This is most likely to occur within a more formal skill arena with a structured learning strategy. This suggestion may be cautiously underpinned by the evidence of a pottery-workshop found during the excavation campaign at Százhalombatta in 1989 (Poroszlai 1992a). Eleven kilns (or ovens) and outdoor fireplaces were found arranged in a distinctive horseshoe pattern suggesting an organised working space. Also found in situ were "dozens of typically unadorned bowls with handles belonging to the Vatya culture" … and … "richly adorned vessels with 'anza- lunata' handles of the Koszider period" (Poroszlai 1992b: 153). Unfortunately no evidence of wasters or tools have been recorded so this scenario must be taken as speculative. However, given known evidence for metalworking workshops it presupposes that pottery workshops related to specialisation should not be ruled out.

The different treatment of fineware, in terms of skill investment, between the settlements and cemetery is so apparent, attested to by the numerous significant differences observed (Tables 5.2c, 5.2d), that it is impossible not to be drawn immediately into discussions as to the social meanings of this phenomenon. Within the settlement contexts there is no doubt whatsoever that fineware receives an outstanding investment of skill. Although there appears to be little difference in the investment of skill between fineware and urns when the entire scenario is taken into account fineware, within the settlement context, is unequivocally the vessel group that shows the highest degree of procedural knowledge. Meanwhile, within the cemetery context the absolute converse of this investment of skill applies. This situation suggests that this vessel group is strongly divided depending on which social context it is going function in. It, therefore, becomes necessary to discuss fineware as either 'settlement' fineware or 'cemetery' fineware in order to address the apparent choices made regarding skill investment.

Cemetery fineware may be argued to play a parallel role in negotiation of social identity through a mechanism of protecting the appearance of a socially important material item at the time of the burial ceremony. There would seem that there is little point in producing cemetery fineware to the same standard as settlement fineware if its central role was as a facsimile to create an appropriate visual image. The fact that cemetery finewares receive such a low investment of skill strongly suggests that they were not intended to serve a utilitarian function prior to a sacred function (given their incredibly poor technological characteristics this could not be possible) or suffer particularly close scrutiny. It remains the case, however, that cemetery fineware was implicated in the highly visual, and structured (Vicze 2001), performance of burying the dead. This does not mean that they were necessarily subject to the close scrutiny of vessels actually in use in the way described for settlement fineware. Cemetery fineware, if indeed produced as facsimiles would not suffer the close scrutiny implicated in actual utilitarian use.

To this end another aspect of a structured learning strategy appears to come into operation that highlights a very clear targeting of skill, and the strong possibility of a formal skill arena. Fineware vessels intended for funery purposes may form part of a strategy to facilitate incremental degrees of skill while still satisfying the need for an appropriately visually satisfying facsimile. A number of fineware vessels reveal a mixture of skill investment for different technological signatures. So while one part of the pot receives a high investment of skill others receive a poor investment of skill. It is interesting that in the context of fineware this phenomenon does not seem arbitrary. While there are no significant differences at all between the settlement assemblages for the production of fineware vessels (Table 5.2b) it has been noted that there are numerous significant differences between both settlement assemblages and the cemetery assemblage (Table 5.2c, 5.2d). What is interesting is that among the few technological variables *not* showing a significant difference are decoration and handle symmetry (Százhalombatta/ Dunáujváros-Duna-dűlő), and decoration, rim symmetry and handle symmetry (Százhalombatta/Dunaújváros-Kosziderpadlás). This strongly suggests manufacture by more than one person with a targeting of different parts of the pot to be worked on by potters with incrementally varying degrees of skill. In this instance, technological variables related to visual performance have been targeted to receive a higher investment of skill than the rest of the pot within the cemetery context thus creating an appropriate visual performance (even if it is one that would not bear close scrutiny). Thus the facsimile of the 'real' fineware fulfils the requirement of what has been considered appropriate for a given individual to have with them in an afterlife, or at least during the burial rite. It is, then, strongly suggested that a formal arena of skill may be implicated in the production of both settlement and cemetery fineware.

It cannot be ruled out, however, that cemetery fineware is also produced within a less formal skill arena. The close, but rather poor investment of skill, related to cups, fineware and domestic vessels associated with the cemetery context suggest that these are all subject to a low investment of skill that could result from limited opportunity to gain incremental procedural knowledge. This would result in the kind of static skill arena suggested for some cups (Figure 6.4, Section 6.2.7). Cups being technologically far easier to produce than fineware it may be that in this situation they would indeed receive a higher investment of skill, which is seen to be the case. This scenario doesn't completely explain the role of domestic vessels which might be expected to be easier to produce than fineware but actually receive the lowest investment of skill of all these vessel groups in this social context. One explanation for this may be the tendency, as noted previously (section 6.2.13) that the majority of domestic vessels implicated in the mortuary domain are domestic bowls which have wide, flaring orifices with carinated rims. These may well be hard for a novice potter with poor procedural to control (section 4.5.5). What is interesting is that these vessel groups are not subject to great differences in skill within the cemetery assemblage as attested to by the percentage frequencies and relatively low numbers of significant differences (Figures 5.25–5.26, Tables 5.17, 5.19, 5.21) suggesting that a static and rather poor investment of skill may be the product of an informal skill arena with limited possibilities to extend procedural knowledge.

If this were the case, it may be may be that some fineware vessels produced for the burial rite are produced within an informal skill arena in which case they may be seen tokens of familial or kinship ties. This is an equally valid argument in terms of explaining the vast discrepancy between firing circumstances. The seemingly inappropriate tempering choices for cemetery fineware may also be seen to reflect the potential for an informal arena of skill where potters do not have access to the finest quality clays or tempering materials. However, this may equally be another conscious strategy within a formal skill arena to protect valuable resources required for fineware items within the settlement context that are invested with considerable social importance.

In either a formal or informal skill arena it is of particular note that of all the vessel groups within the Dunáujváros-Duna-dűlő assemblage there is a higher frequency of under fired vessels in the fineware group (57%). Again, this suggests that a certain number of fineware vessels, those associated with the cemetery, are being selected out to be fired in a certain way. If it is understood that some fineware for the cemetery are facsimiles of 'real' fineware – to serve the deceased in a sacred manner rather than the living in a utilitarian manner – it may again be an expedient decision to preserve important fuel resources. It may also reflect a differential access to resources depending on which arena of skill is implicated, formal or informal, in production of these vessels. In an informal skill arena there may be prohibitions on the use of resources made available for specialist production.

It is suggested that more than one arena of skill may be involved in the production of fineware. In a structured or formal arena of skill fineware intended for burial purposes may offer the chance to tackle forms that, while demanding of greater expertise, are not intended to perform a utilitarian function, so technological failure or reduced longevity becomes inconsequential. They also are not going to suffer the close scrutiny of vessels implicated in the utilitarian function of serving food. Meanwhile, the social appropriateness of the vessel is protected by ensuring that its visual integrity is maintained through the targeting of a higher investment of skill on the areas of decoration and embellishments, such as handles. It may be that knowing these vessels are not going to be subject to close scrutiny or serve any pragmatic function they are deliberately subjected to poorer firing circumstances as a strategy to preserve substantive fuel resources. A formal arena of skill also works to protect the future production of fineware vessels involved in the daily display and negotiation of high status identity. As suggested previously, settlement finewares are just one among a complex web of prestigious objects used to express status. The scenario suggested here with regard to protecting fineware vessels, both those already in circulation and intended future products, underpins the deeply social value placed on items as status objects.

Meanwhile a less formal arena of skill may relate to a family or kinship oriented production where the same opportunity to extend procedural knowledge through repeatedly enacting sequences of production is not available. This may result in a static acquisition of skill where a certain degree of skill is acquired but where the opportunity to extend procedural knowledge in an incremental manner is limited.

6.2.26 Vessel groups: skill differences exposed

The review of the vessel groups has demonstrated that there is a different deployment of skill between vessel groups both within each assemblage and between the different assemblages. The strong patterns revealed suggest that these differences are not arbitrary but rather that potters with incrementally differing degrees of skill are working on certain vessel groups in a structured manner. This may relate somewhat to the individual social role of each vessel group. However, it is important not to forget that this discussion centres on a carefully orchestrated range of vessels which are inter-related. As well as the different investment of skill within each assemblage there is also an obvious difference with regard to skill investment depending on the social context of pots. If this set of circumstances is not arbitrary then it must relate to socially derived decisions. In turn, these decisions have to be endorsed by a wider consensus, which may be argued to be socially mediated and embedded within institutionalised practices, in order for repeated processes and practices of manufacture to come into play (section 3.3.3).

It is argued that this structure tracks back to a carefully constituted learning strategy that is facilitated through a more formal skill arena. However, the possibility also arises for a less formal arena of skill that is based around expression of kinship. This suggests the possibility of two arenas of skill acquisition existing side by side. These two arenas of skill may have different ideas about the structuring of skill and hence quite different approaches to learning strategies, each of which is related to a particular set of institutionalised practices. An important point to make is that these two arenas of learning may be embedded within differing institutionalised practices but as stated earlier such practices should be remembered to be interconnected and cross-cutting (section 3.4.2).

6.3 Learning strategies as part of the social order in the Early to Late Bronze Age of the Carpathian Basin

In the following discussion the social implications of both arenas of learning will be discussed separately and then the interaction between them is addressed. This discussion will embrace how these strategies inform broader social issues related to the Early to Late Middle Bronze Age in the Carpathian Basin

6.3.1 Social implications: a formal arena of learning

Given the strong patterning of the data it is argued that from the Early to Late Middle Bronze Age in the Carpathian Basin there were highly prescribed learning strategies in place within a formal arena of skill. The continuity of this formal skill arena was protected by a highly structured learning strategy that controlled the incremental acquisition of procedural knowledge. This strategy ensured the continuity of a standardised and culturally determined range of vessel types. Settlement fineware and urns may be argued to represent the technological excellence of this range of vessel forms representing the kind of elite pottery items noted by Schreiber (1967), Poroszlai (1996, 2000a), and Vicze (2001). Additionally, this strategy ensured the protection and continuity of valuable resources, in particular fuel, which came under increasing stress from the Early to Late Middle Bronze Age (section 2.5.1).

The standardisation of vessel types can be argued to reflect the highly structured nature of other material categories throughout this period. Categories of metalwork (Kristiansen 1989, 1998, 1999a, 2000b; Bogdanović 1998; Vicze 2001; Engedal 2005), dress (Sørensen 1997), and houses (Csányi 2003) have all been argued as being highly prescribed throughout this time span and deeply implicated in the creation and maintenance of identity through visual display of material categories; categories through which people make sense of their world and role within it (c.f. Ingold 1981; Barrett 1989; Latour 1993; Barley 1994; Kristiansen 1999b; Gosselain 2000; Sofaer 2000; Sofaer & Sørensen 2006). This doesn't suppose a single expression of identity but rather identity expressed in a number of cross cutting ways, as kinship, gender, age, occupation or status, through an equally cross cutting range of material objects. However, ensuring the highest investment of skill is centred on elite objects such as pottery fineware suggests a deliberate strategy to protect notions of elite identity and social stratification.

By employing a prescribed and structured learning strategy the high investment of skill for urns and settlement fineware is protected. These two items are seen as highly implicated in the expression of identity albeit in slightly different ways. From discussions centred on urns from the cemetery assemblage (Vicze 2001) it seems that urns articulate identity in terms of kinship, age, and possibly the activity most associated with the deceased persons life course. Meanwhile, settlement fineware appears to be implicated in identity in terms of status and hierarchy (Poroszlai 2000). Given the strategies adopted to protect the continued technological excellence of these forms it can be argued that they were regarded as an essential element in the negotiation of social expression. Protecting their continued production also protects the continuity of social organisation and the established institutions surrounding expressions of status.

To this end a complex learning strategy is adopted that directs potters, still in the earlier stages of acquiring skill to increase their range of procedural knowledge, to work on items that are technologically less complex, such as cups. It also makes perfect sense to further facilitate skill acquisition by directing these same potters to work on items that will serve no pragmatic function, such as cups, domestic vessels (particularly cemetery bowls), and finewares implicated in mortuary practices. These vessels have all been argued to be produced as facsimiles of pottery items that were considered appropriate for the 'rite of passage' into the next world. Importantly, by having access to a range of vessels types with incremental degrees of technological complexity, procedural knowledge can be acquired without causing risk to vessels implicated in secular activities; or causing risk to the important visual characteristics of elite items. The fact that there is such an apparent divide in skill investment in fineware depending on its social context, confirms the suggestion that while a high investment of skill is possible the learning strategy adopted within this cultural milieu was such that it was deliberately not deployed on fineware vessels implicated in the burial rite.

Meanwhile, the overall visual image of the items implicated within the learning strategy as facsimiles (for the mortuary domain) is protected by investing different degrees of skill onto different areas of the pots (for example see section 6.2.22.1). This in itself is not such a surprising strategy. The author's own experience suggests that not all 'apprentices' progress through skill acquisition of every required task to make a pot at the same rate. In a structured skill arena it would be easy enough to direct incrementally skilled practitioners to work on various parts of pots in order to achieve the desired outcome; in this case to preserve the appearance of the vessel so that it provides an appropriate facsimile of the original. This further confirms a high degree of structured organisation with regard to learning strategies.

Settlement fineware is one element of a structured range of vessel types which are argued, given the repeated characteristics that they display to be linked to some form of specialisation. It is argued here that specialisation cannot occur without a process that allows the incremental acquisition of procedural knowledge. By adopting a learning strategy that develops incremental skill acquisition the final result will be the standardisation of categories of objects which further reinforces and protects the continuity of production in a prescribed manner. Standardisation is argued here to be an outcome of specialisation. However, not in the manner of "brute" repetition that Longacre (1999: 45) describes. But it is the acquisition of skill that allows standardisation to come into force. The repeated processes of action involved in producing the same item (specialisation) eventually results in the ability to produce specific articles that vary little one from the other. This works to protect categories of objects that are deeply implicated in the mediation of cultural and social relationships and institutions. Once a particular, or specialised, form has been fully mastered, through the incremental acquisition of procedural knowledge a final skill comes into play.

This is indeed the ability to produce standardised items. Not, it should be stressed in the sense of producing a single item to an exceptional standard such as in the case, for example, of the San Juan Batista potters (Longacre 1999; Longacre *et al.* 2000) but in the sense of producing a standardised *range* of items that are part of a single cultural repertoire. As argued in chapter 3 (section 3.3.3) it is the repeated performance of procedural knowledge that gives rise to cognitively and physically embedded skill. Over time this means that the process of producing an item is deeply engrained and it becomes 'second nature' to produce the intended object. Once an object has been produced enough times just the simple observation of previous items is enough to enable a potter to repeat the characteristics of a vessel type with comparative ease. In modern parlance this is referred to as 'production potting' and is an essential skill for potters where standardised *ranges* of products are required (Figures 6.7 & 6.8).

Figure 6.7 Production throwing at the author's workshop c. 1982. The wine goblet placed on the end of the 'throwing' board provides a visual template to allow standardisation

Figure 6.8 The same production sequence of wine goblets at various stages of manufacture.

6.3.2 Social implications: an informal arena of skill

While the arguments for a formal arena of skill are argued to be clearly reflected through analysis of the data the arguments for an informal arena are acknowledged as being less robust. There is less data to support this notion and yet just enough evidence that it must be seen as a possible element in the overall structuring of learning strategies.

The most alluring evidence comes from the skill investment in cups. These have been argued to be the least technologically complex vessel group, but nonetheless prone to the lowest investment of skill in the settlement context and an overall low investment of skill within the cemetery context. It has been suggested that as a comparatively easy item to produce they may be produced within more than one arena of skill. While novice potters may work on them as part of a structured learning strategy a certain number of cups may also be produced within a less formal skill arena. One argument to suggest an informal arena of skill is the evidence for certain 'groups' of cups that are prone to a static investment of skill (Section 6.2.7, Figure 6.4), resulting specific 'styles' of potting. This suggests that each 'cup group' may be the work of a specific potter. Within these cup groups there is no evidence of any incremental acquisition of skill which may be expected from a more formal potting arena.

In addition to the argument surrounding cups is the close and rather complex investment of skill seen regarding cups, domestic vessels and fineware (section 6.2.25) in relation to the Dunáujváros-Duna-dűlő, cemetery assemblage. It was argued that the close, but rather poor, investment of skill, related to these three vessel groups may suggest a little opportunity to accrue incremental degrees of procedural knowledge. The particular pattern of skill investment revealed suggested that potters with similar degrees of procedural knowledge may work on these vessel types. However, the same stylistically similar 'groups' of vessels detected for cups has not been observed for either domestic vessels or cemetery fineware — this would prove an interesting investigation for the future. The issue of under-fired vessels may just as well be seen as limited access to better (substantive) fuel resources by potters practicing outside of a formal skill arena as a deliberate strategy to protect resources within a more formal skill arena.

If a less formal skill arena exists it may be that these vessel groups would be subject to a different understanding of institutional practices that relate more strongly to personal and specific 'familial' or 'kinship' groups (Kristiansen 2000) rather than notions of maintaining status and social stratification. The idea of kinship groups is argued by Vicze (Vicze 2001: 23-24, 227-228) to be strongly articulated through the highly structured spatial arrangement of the burial pattern in the Dunaújváros- Duna-dűlő cemetery. The burial rite itself is also seen as a highly structured and possibly rule bound occasion. It may be that to provide the appropriate repertoire of vessel forms for the 'rite of passage' (Figure 6.1), families had to acquire an adequate degree of procedural knowledge for this set of circumstances.

A less formal skill arena does not have to imply an 'ad hoc' approach to potting and it is worth noting that if two skill arenas did exist they adhered to the same range of socially negotiated vessel types. This suggests that while two differently socially constituted learning strategies may be in operation at the same time, a cultural repertoire is adhered to. This reinforces the concern with prescribed and controlled social action that ensures the continuity of understood material categories that are intended to be stable and underpin social continuity. This situation also draws attention to distinct but overlapping institutionalised practices related to learning strategies. Also the disparity between skill investment in urns and other vessel groups in relation to the cemetery should be remembered. This suggests that if an informal skill arena does exist the social value placed on urns continues into this potting sphere.

6.3.3 Learning strategies and institutionalised practices

At the outset of this thesis it was stated that pots may act as a metaphor for other technologies (1.2.2). It is suggested here that the institutionalised practices that may be seen to have given rise to a highly prescribed and structured learning strategy, in the Early to Late Middle Bronze Age in the Carpathian Basin, in relation to pottery production may, therefore, provide a metaphor for other material categories.

A highly prescribed learning strategy situated within a formal arena of skill is argued to be linked to institutionalised practices that are implicated in control and continuity of both cultural and social identity. The nature of learning has been seen, through analysis of the vessel groups and the contrasting social arenas of settlement and cemetery, to offer the opportunity for the incremental acquisition of procedural knowledge. This is not dissimilar to Greenfield's (1984: 118, see section 3.2.3) description of scaffolded learning which she describes as a process of "closing the gap between task requirements and the skill level of the learner". This is exactly what the incremental acquisition of procedural knowledge through a structured learning strategy may be expected to provide.

Such structured learning strategies were argued at the beginning of this thesis (section 1.2.1) to be related to highly institutionalised practices that facilitate continuity. It is suggested here that within a formal skill arena a highly prescribed learning strategy did just that in the Early to Late Middle Bronze Age in the Carpathian Basin with regard to pottery production. Just as Greenfield and Lave (1982) have described a learning strategy that generated the replication of cultural and social tradition, so too may this be the case for this period of prehistory. This scenario fits entirely with previously understood notions surrounding social stratification and highly prescribed ways of mediating, and articulating, identity and social dynamics at this time (c.f. Kristiansen 1989, 1999, 2000b; Sørensen 1991,1997; Shennan 1993; Harding 2000; Poroszlai 2000a; Sofaer Derevenski 2000; László 2003; Sofaer & Sørensen 2006)

However, life courses are not only understood or mediated through objects, or material categories, (Sofaer Derevenski & Sørensen 2002; Sofaer & Sørensen 2006) but also through a complex web of relationships (Barrett 1989b: 113). These imply affinities, demands and obligations that are constantly open to negotiation (Barrett 1989b: 114; Sofaer Derevenski & Sørensen 2002: 118). In this sense it is worth remembering earlier arguments surrounding the social performance of procedural knowledge (3.3.2). Potters working within a formal skill arena are going to have a range of variously developed degrees of procedural knowledge at any one time. However, within this situation there are going to be a certain number of potters who have acquired extremely high degrees of procedural knowledge; this is born out through the data. In a formal skill arena the social performance of highly skilled practitioners may then be seen as a performance imbued with a degree of power that can be exercised in social negotiations of status. Such potters are deeply implicated in protecting the continuity of items charged with social meaning and related to institutionalised practices that regulate a stratified society. Highly skilled potters as well as smiths may, therefore, be seen as implicated in power relations. Sofaer (2006: 140) draws attention to the link between ability to produce prestige items and "the enhanced social value of craftspeople as a group".

Meanwhile, the institutionalised practices relating to an informal arena of skill are suggested to relate to notions of familial and kinship identities which are particularly expressed at times such as burial. While this skill arena is seen as less formal it is argued that the institutionalised practices driving it are also prescribed and structured in that the same vessel forms are repeatedly produced. So while this apparently less structured arena of skill may be driven by a different range of social practices these practices overlap with a more formal arena. Both are implicated not only in articulating a range of social understandings but also an adherence to a culturally appropriated understanding of identity that is regulated.

6.4 Peaks and troughs: learning hiatus through time?

The data for this analysis has already been the subject of a degree of caution within chapter 5. The interpretation of the data is then presented with the same degree of caution. When the point scoring system (section 5.1.1) is reviewed it seems apparent that there is a higher investment of skill firstly at the final (Kulcs) phase of the Nagyrév period and then to an even greater extent at the closing, Koszider, phase of the Vatya period. This suggests that at these two points in time the acquisition of procedural knowledge is somehow different to that seen during the Vatya I and early Vatya II period (Tables 5.42, 5.43, 5.44, Figures 5.44, 5.45, 5.46). Given the social nature of skill acquisition (chapter 3) this apparent disturbance in skill has to be linked to broader social mechanisms.

Dealing, first, with the dip in skill, it has been seen that at the close of the Nagyrév period there is, according to Hungarian literature, a supposed intermingling of two cultural traditions – that of the Nagyrév and Kisapostag groups (Figure 2.6), (Bona 1992b, 1992c). It is suggested that the Kisapostag moved eastward into Nagyrév territory (Bona 1992c; Poroszlai 1996, 2000a; Vicze 2001) and that ultimately this resulted in a peaceful merging of the two cultural groups. How one wishes to interpret this supposed demographic shift, as the wholesale movement of entire cultural groups or the gradual filtering of new ideas between co-existing populations, it is certain that at this time change did occur, as witnessed through changes to the material culture repertoire.

However this particular change occurred, for cultural transition to proceed there must be a necessary intermingling of concepts and renegotiation of the material world in order for people to define or redefine social relations and social boundaries (Barrett 1989: 114). How to proceed is partially constructed through categories of objects. As previously noted, such negotiations, and renegotiations, are articulated through human interaction with a range of material categories (Kristiansen 1999b; Sofaer 2000; Sofaer & Sørensen 2006). It is through the created relationships of such categories that people come to understand and define the social world around them (Bloor 1997) and create institutionalised practices. In a world with changing categories of objects negotiation is the only potential route towards consensus about what things mean (Sofaer & Sorensen 2006). In part, such negotiation must be subject to the ability of artisans to physically (that is technologically) recreate, or redefine, categories of objects. With regard to the ceramic repertoire, Vicze (2001: 127) notes the difficulties potters faced in fulfilling the expectations of a new era. As the expectation for new forms emerges alongside new social expectations, potters are faced with the dilemma of extending their repertoire through the acquisition of new advances to their procedural knowledge.

No matter how skilled each group of potters may have been at repeatedly enacting the procedural knowledge required for a previous potting repertoire, acquiring the skills to produce new forms is only possible by the enactment of a multitude of potentially new technical procedures. These must be repeated until the new procedural knowledge is perfected. Change cannot occur rapidly or seamlessly, as attested to by the struggles to achieve profound changes to vessel morphology and technology in other settings (Gosselain 1992; Gelbert 1999). A particularly apt archaeological example is the transition from round-based to flat-based vessels in the Neolithic. Both in Neolithic Orkney (Budden 2001) and the Neolithic Juras (Pétrequin 1993) this technological transformation was played out over a considerable period of time. It was not achieved simply but through repeated experimentation and practice, in line with the nature of procedural knowledge, until the desired outcome was achieved and the new forms became the established norm. In both situations, observation was made of transitional forms occurring as potters endeavoured to establish and consolidate the new range of forms – or the newly desired outcome. Vicze (2001: 37, 127, 131) draws attention to exactly the same phenomenon with regard to early Vatya communities and notes the formative processes that occur which are observable through a range of transitional forms. In respect of urns, an already technologically complex item, Vicze (2001: 137) notes a quite significant change to forms, proportions and the general "sensation" of this vessel form. She comments on the difficult task potters faced in meeting the challenge of transferring their previous knowledge, based in the Kisapostag and Nagyrév traditions into a new Vatya repertoire. This scenario suggests a necessary cooperation between potters as they work to acquire new forms of procedural knowledge.

Turning now to the peaks in skill seen at both the closing (Kulcs) phase of the Nagyrév and the closing (Koszider) phase of the Vatya it is necessary to look at some rather different social mechanisms that may come into play. Both these periods, although temporally divided, may be perceived as experiencing similar social dynamics. Consolidation of tradition has already occurred and ceramic repertoires are established entities with each vessel group implicated in its own way within a web of social relations. However, at both these points in time change begins to occur and the social order may be seen to be facing changes to the understood social order. As suggested earlier, in this section, how exactly this change about there is still an element of instability when understood categories, material or human come under threat (Sofaer & Sørensen 2006).

Such change is not necessarily received with inactivity. It has been shown that faced with uncertainty communities may respond by consolidating or elaborating existing material cultural repertoires (Hodder 1982; Braithwaite 1984; Bradley 1984). Such a strategy may have as much to do with internalised recursive signalling of identity (Sterner 1989) in order to resist destabilising effects to the accepted social order. Of course it may also be an attempt to challenge the new concepts and ideas that accompany destabilising change. In either scenario, it may be expected that the further enhancement of existing skills may come into play as artisans strive for an even greater investment of skill. It is this investment that will enable them to push the technical boundaries necessary to encompass new embellishments and exaggeration of forms, that will strengthen understandings of and confidence in existing material categories. This is certainly a phenomena witnessed in relation to the Koszider period where multiple elements of material culture, including metalwork (Kemenczei 2003) and pottery (Poroszlai 2000, 2003; Vicze 2001) are seen to reach an epoch of elaboration prior to the demise of this cultural complex.

It is suggested that at the close of the Nagyrév phase and again at the close of the Vatya phase social circumstances encouraged both the consolidation and further embellishment of existing and well established categories of pottery vessels. This meant an increase in skill levels as potters aimed to meet new requirements of excellence.

Given the skill investment presented in this chapter in relation to the vessel groups this excellence is suggested as having been facilitated through structured learning strategies that encouraged the acquisition of heightened degrees of procedural knowledge.

Chapter Seven

Conclusion and Contributions

"Pottery has its own language and inherent laws, and words have theirs, and neither can be bound by the other. Nevertheless a certain amount of translation and interpretation is possible provided a potter can find the words, or a writer insight into pottery."

Bernard Leach 1945: xxv

7.1 Learning Strategies and the Early to Late Middle Bronze Age in the Carpathian Basin

In this thesis a deep understanding of the principles of pottery manufacturing has been placed at the centre of the search for learning strategies in a prehistoric context. Alongside this an attempt has been made to create a theoretical understanding of learning and skill as complex cognitive mechanisms related to socially instigated institutionalised practices. The aim has been to bring these elements together to provide a fine grained, synchronic and diachronic picture of learning strategies. This work starts form the principle that no material category can be fully understood without recourse to a thorough understanding of the technological skill that brings it into being.

This research has built on a long standing awareness that potting actions become permanently embedded at the time a pot is fired. Such things as coil joins or slab joins have been observed by many archaeologists and recorded as a way of assessing how the pots of different communities have been manufactured. By making such a close observation of manufacturing principles related to pottery manufacture it has been possible to extend this awareness to encompass an entire range of technological observations. These are presented within this thesis as the technological signatures of production and are the core component of the methodology developed in this thesis. Moreover, through the same close awareness of the technological processes of pottery manufacturing, combined with an equally profound understanding of the nature of the skill acquisition; it has been possible to assess the degree of skill related to each technological signature of production. Skill starts with the way in which discursive knowledge is turned into procedural knowledge through the repetitive enactment of a skill. This in turn leads to repeated processes of production and specific classes of pots that share specific socially constituted technological signatures.

These elements, working in combination, have made it possible to track skill within and between contemporaneous pottery assemblages. Observation of the way in which skill is deployed both within and between assemblages has been shown to be a valuable mechanism through which social structures may be viewed in a prehistoric context. One way that this is possible is through understanding the way that skill is articulated differently between different vessel groups depending on the nature of their social roles. By a thorough investigation of skill it is observed that each vessel group is implicated within society in differing ways which, in turn, impacts on the nature of skill invested in them. This is an important advance on simplistic notions of fineware vs. coarse-ware. It has also been seen that a profound difference exists between the nature of skill investment between the very different social contexts of the cemetery and settlement in the Early to Late Middle Bronze Age. In particular, a striking difference in skill investment was observed in relation to fineware depending on which of these two social arenas it appears in.

Arising from this approach it has also been possible to suggest that of two arenas of skill, a formal and less formal one may co-exist. These two arenas of skill are suggested to be implicated in differing institutional practices. The formal arena of skill appears to be associated to institutionalised practices that protect the continuity of the potting repertoire, and therefore also the continuity of the continual negotiation of rank within a stratified society. This strategy not only works to confirm existing notions of stratification and specialisation at this time but also underpins the importance attached to visual categories that work to display and confirm ones place in the social order. Meanwhile a less formal arena of skill is suggested to articulate institutionalised practices related to family and kinship. The likelihood that these two arenas of skill are implicated in differing social practices is underpinned by the data. This suggests that while in a formal arena of skill there is access to incremental degrees of procedural knowledge that can lead to highly developed skill base, within an informal arena of skill a static skill base appears to be more probable. This suggests a less structured control in the informal skill arena in the sense of potters being directed to gain incremental degrees of procedural knowledge. Rather, it seems that within an informal skill arena a different expectation is exercised. This potentially relates to being able to express kinship at times of 'rites of passage'. Burial being the most visible of these it is possible to track this association through the deployment of skill in vessel types associated with the mortuary domain.

The ability to suggest two arenas of skill is an advance on previous understandings of potting practices at this time which have previously focused on tracking material change through time and using this to determine chronologies and typologies. This thesis offers an insight into the complex and overlapping nature of institutionalised practices related to learning strategies and, it is argued, therefore to broader social mechanisms.

The conclusions of this research have given rise to the suggestion that a highly structured learning strategy, related to a formal arena of skill, worked to protect the continuity of elite pottery forms that were implicated in articulating high status social relations and social rank. By operating a rule bound learning strategy potters gained incremental degrees of procedural knowledge that ultimately led to them being able to work on technologically complex items without a high risk of failure. The institutionalised practices underlying this strategy reflect the degree of structure required to maintain a stratified society. It also reflects the importance placed on all material categories in articulating social relationships throughout the Early to Late Middle Bronze Age in this region. Meanwhile, the possibility of a less skilled arena offers an interesting insight in that it is a reminder that within stratified societies there are multiple layers of institutionalised practices, not all of which relate to the articulation of rank. It has been suggested that a less formal arena of skill more probably relates to practices surrounding identity linked to kinship and family relations, particularly at times of 'rites of passage' such as burial. It is not hard to imagine how the social practices implicated in these two arenas of skill may cross cut one another. For example, it may well be that not all kinship members are also in a position of rank.

Another interesting insight is that the apparent overriding concern with securing continuity of production of elite items, as part of social display, may actually be a causal factor in determining a conversely low investment of skill invested in pottery implicated in the mortuary domain (with the exception of urns). By placing cemetery fineware, domestic vessels, and cups within the learning arena in a very specific way the pots for the dead appear as they should but in real terms could serve no utilitarian function. They become the focus for potters needing to acquire greater degrees of procedural knowledge. Thus it is a social decision that investing high degrees of skill in vessels implicated in the social dynamics of the living is more important than marking the rite of passage of deceased in terms of vessel quality. This suggests that 'show' is all important and that as long as the appropriate 'social image' is maintained other concerns are of less importance. To this end this strategy may also articulate a desire to conserve the best resources, clay, temper and fuel, in order that continuity of production and continuity of social discourse is ensured. This again leads back to image being a priority within social dynamics.

The analysis of urns is useful in underpinning this suggestion. They are the one vessel group that receive a high (or at the very least moderate) investment of skill across the social divide of the living and the dead. These vessels are argued to be a highly visual material category that is implicated in notions of expressing identity in a number of potentially cross cutting ways. They are also bound to ideas surrounding fertility and storage of important seed or surplus. The relationship of urns to skill reveals that they are perceived differently to other vessel groups related to the mortuary domain.

Another important insight that this perspective has offered is the window onto the role of potters within social dynamics. So long as elite material categories are required as a fundamental vehicle to articulate social or power relations then so too are competent and highly skilled craftspeople required. In that their skill in indispensable it is not hard to imagine that they come to have a close and recursive relationship to powerful people. This in itself is not a particularly new insight but it is one that is confirmed from a new viewpoint.

7.2 Limitations of this research

While this thesis has successfully provided a window on learning strategies in the Early to Late Middle Bronze Age of the Carpathian Basin this is seen as a beginning rather than an end. While conclusions have been drawn in relation to this particular study it is hoped that this thesis provides the opportunity to begin a new discourse in archaeology about material culture in relation to skill, both skilled and less skilled practitioners, and learning strategies.

This work has, to a certain extent, been of an experimental nature in that a new methodological approach had to be developed. There are some elements of pottery production, presented within the methodology that has barely appeared within the final analysis. This is because in the end there was too much data. In further use of the methodology on another assemblage it may be desirable to decide which of the many technological signatures (variables) available would best suit the assemblages to be studied and the research questions to be asked. The caveat to this would be that an appropriately broad selection was made that reflected the nature of assemblages and the social contexts being investigated.

Additionally, further consideration needs to be given as to how best to incorporate fabric studies within this methodology. A lot of data was collected in relation to fabrics but it has not yielded a vast amount of interpretive information. The attempt to use 'textural types' as an analytical tool may not have proved as fruitful as hoped for. On reflection more may have been gained by sticking to tried and tested methods as it is the full description of fabrics, types and range of inclusions that ultimately proved more interesting. For example, further analysis of fabrics Q1• and Q3• may have proved to be of great interest, particularly if clay sourcing had been carried out.

There are also some limitations surrounding the interpretive nature of this thesis. In pursuing the discovery of two arenas of skill it became clear that a further exploration of how overlapping and cross cutting institutionalised practices are played out in reality needs to be pursued.

7.3 The future

The approach that this research has adopted to studies of ceramic assemblages in prehistoric contexts offers the opportunity for further explorations of cultural and social mechanisms underpinning change and continuity. With further refinement it should be possible to bring the methodology and theoretical approach forward into more complex interpretive fields. One area of exploration being currently considered is that of cultural flux in Central Europe during the transition from the Late Bronze Age to the Early Iron Age. The relationship of learning strategies to social mechanisms has shown that they can be used to identify change and continuity. Given the link between these two relative positions to either liberal or highly controlled learning strategies it is expected that an understanding of learning strategies across a period of cultural transition will lead to insights of underlying social mechanisms as the period of transition is played out socially.

The methodological and theoretical approach adopted in this thesis offers the opportunity to view culturally and socially driven institutionalised practices through examination of primary data. There is no apparent reason why the same approach could not be used on Neolithic, Iron Age or even Roman assemblages so long as an appropriate exploration of the specific technology and social mechanisms in play at the time were appropriately explored.

The approach adopted in this thesis gives rise to the possibility of placing another analytical layer beneath more traditional approaches to the social production of pottery. It may be expected that an institution related to learning will determine the rules of acquiring skill to make pots. As no institution stands alone the rules of that institution may be seen to reflect and influence the nature of other institutions and of broader social understandings. To understand what the rules surrounding skill acquisition may be it is argued as logical to focus on skill itself. If pots, and even parts of pots, are considered as selected through institutionalised practices as a central context of learning and placed as another analytical layer sitting beneath production locale, or mode of production, it is possible to get a finer grained picture of learning structures.

7.4 Concluding Remarks

The theoretical perspective adopted in this thesis rested to a great extent on making a separation between skill and learning, and placing skill as a particular outcome of learning strategies. This separation was facilitated by understanding the nature of procedural knowledge as the outcome of discursive knowledge. It is, therefore, possibly a paradox that one of the hardest aspects of this thesis, for the author, has been to return 25 years of procedural knowledge gained as a professional studio potter back into discursive knowledge. This is an ongoing process as the methodological and theoretical perspectives continue to be developed in order to enable increasingly complex questions to be addressed.

It is a deeply held belief of the author that in its search for continually refined understanding of material culture, archaeology must engage with the processes that bring material culture into being. Understanding the cultural and social mechanisms related to the skill, that is learning strategies, that allows these many material categories to come into existence is surely a vital enterprise. This thesis has tried to bridge the gap between social knowledge and technical knowledge in order to understand the learning strategies surrounding pottery production within a particular cultural milieu, there seems little reason not to pursue the same goal in relation to other material categories. In relation to the Early to Late Middle Bronze Age in Carpathian Basin this approach has provided a new window through which to explore the relationship between pottery and social dynamics.

Appendix 1

Codes for data collection

It is important to note that this appendix works in conjunction with Appendix 2 where detailed descriptions and photographs are offered to illustrate classifications specific technological signatures of production and the categories of 'good', 'moderate' and 'poor'.

PRN = Pottery Record Number
HID = Hungarian ID

Period:
NG = Nagyrév
N/V = Nagyrév/Vatya
V = Vatya
V/K = Vatya/Koszider
K = Koszider

Form:
C = Cup
FI = Fish-dish
ST = Strainer
SV = Storage Vessel
LB = Large Domestic Bowl
FJ = Jug
FB = Fineware Bowl
U = Urn

Grouped Forms:
C = Cup
DV = Domestic vessel (Fish-dishes, Strainers, Storage vessels, Large domestic bowls)
FW = Fineware (Fineware Jugs and Fineware Bowls)
U = Urn

Vessel part present:
WH = Whole pot or whole profile
PP = Profile but nowhere near whole pot
R = Rim
RS = Rim and shoulder
RSB = Rim, shoulder and base
B = Base
BB = Base and body part

Base Type:
R = Round
F = Flat
O = Omphalos
S/O = Shallow Omphalos
R/F = Round and flattened by weight of the clay – pinch pots
FR = Foot-ring
P = Pedestal

Error in clay preparation:

NE = No error
SP = Spalling is present
AI = Air pockets are trapped within the clay matrix
SV = Surface voids
IBS = Inclusions breaking the finished surface

No error = Good
One error = Moderate
Two or more = Poor

Fabric Series:

A fabric series has been established. It has been used to correlate fabrics with vessel groups and the three different assemblages. It is also used to assess appropriate use of tempering materials in relation to vessel types and the different social contexts of settlement and cemetery.; the Fabric Series in introduced in chapter 5, data analysis.

Textural Types:

Textural types form part of the fabric analysis and are used as an additional means of assessing the appropriate, skilled use, of fabrics in relation to vessel types.

● = Tight, fabrics with predominately very well and well sorted inclusions/temper with a modest size range and a well sorted, clean, clay matrix. These combined elements suggest probable drying of the raw clay, sieving to remove any detritus and to grade inclusion or temper size and a thorough wedging process.

▲ = Looser fabrics than above, with predominately moderately sorted inclusions/temper with a moderate size range of grains and a moderately clean clay matrix. These combined elements suggest probable drying of the clay with moderate grading of inclusion size range. Less time has been spent on the wedging process resulting in moderately sorted inclusions and a moderately open fabric.

■ = Coarse, open fabrics with predominately poorly sorted inclusions, a broad size range of inclusion grains and a ragged clay matrix. These combined elements suggest the unlikelihood of much cleaning or sorting of the clay or inclusions/temper and little time spent wedging the clay.

Manufacturing evidence:

C = Coiling
RB = Ring building
SL = Slab building
L = Lamellar (associated with paddle and anvil production)
P = Pinching

Manufacturing Errors:

NE = No error
SPR = Splitting at rim — *Pinch pots*
SLY = Slumping is present — *Coiling, Ring building, Slab building*
UFI = Uneven finger indentations — *Pinch pots*
EUWT = Erratic/Uneven wall thickness — *Pinch pots*
CJF = Coil join fractures — *Coiling, Ring building*
SLJF = Slab join fractures — *Slab building*
PCJ = Poor coil join — *Coiling, Ring building*

PSLJ	=	Poor slab join — *Slab building*
SSF	=	Star shaped fractures — *Paddle and Anvil*
LSEF	=	Laminar sherd edge fractures — *Paddle and Anvil*
LSF	=	Lens shaped fractures — *Paddle and Anvil*
EW	=	Excessive weight for volume/size — *All pot types*
PA	=	Patching — *All pot types*

No error	= Good
One or two errors	= Moderate
More than two errors	= Poor

Wall thickness:
Wall thickness measurements will be given as an actual figure in mm. and taken at the rim, neck, shoulder, belly and prior to the basal join. On large body sherds and on partial profiles measurements are taken at three points on the circumference of each part of the pot.

* Suffixes G, M, P, will denote good, moderate or poor execution of wall thickness. Details of wall thickness variability are discussed within the methodology, chapter 4. Descriptions of the classifications of wall thickness variability are given in Appendix 2 and clarified with photographic evidence.

Additions:

H	=	Handle
L	=	Lugs
PB	=	Pedestal base

* Suffixes G, M, P, will denote good, moderate or poor execution of each addition. Details of additions variability are discussed within the methodology, chapter 4. Descriptions of the classifications of additions variability are given in Appendix 2 and clarified with photographic evidence.

Surface Finishes (internal and external) and Decoration

BU	=	Burnishing
SM	=	Smoothing
W	=	Wiped / washed
SL	=	Application of slip
CO	=	Combed
RU	=	Rusticated
RO	=	Roughened
INC	=	Incised
IMP	=	Impressed into wet clay
AP	=	Applied plastic decoration – including bosses
FT	=	Finger tip

* Suffixes G, M, P, will denote good, moderate or poor execution of each type of surface finish or decoration. Details of surface finish and decoration variability are discussed within the methodology, chapter 4. Descriptions of the classifications of surface finish and decoration variability are given in Appendix 2 and clarified with photographic evidence.

Rim deviation on the horizontal plane:
This reflects the uniformity of the rim and the lip of the vessel as viewed on the horizontal plane.

* Suffixes G, M, P, will denote good, moderate or poor execution of rim deviation on the horizontal plane. Details of rim deviation are discussed within the methodology, chapter 4. Descriptions of the classifications of rim deviation variability are given in Appendix 2 and clarified with photographic evidence.

Symmetry:
Assessment will be made of the rim symmetry, handle symmetry and profile symmetry. Determinations of symmetry will be confirmed through the analysis of digital images.

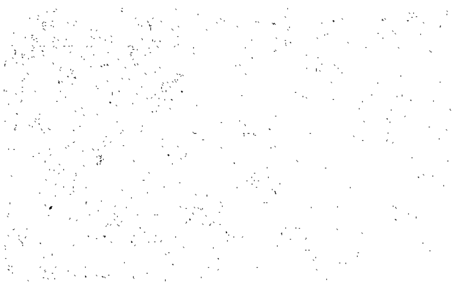
* Suffixes G, M, P, will denote good, moderate or poor execution of rim deviation on the horizontal plane. Details of symmetry are discussed within the methodology, chapter 4. Descriptions of the classifications of symmetry variability are given in Appendix 2 and clarified with photographic evidence.

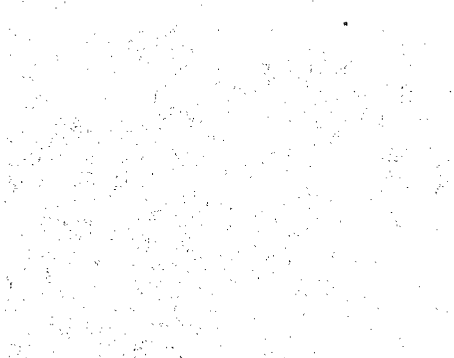
Firing temperature:
As described in the methodology, chapter 4, Mohs scale of hardness was adopted to ascertain over-firing, normal firing, or –under-firing of vessels. The importance of the firing procedure is discussed within the methodology, chapter 4.

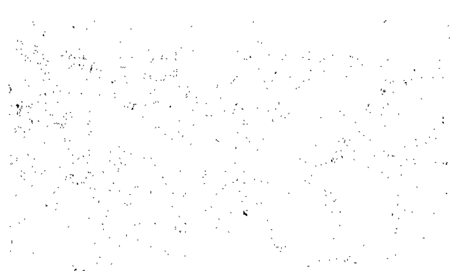
OF	=	Over-fired (vitrified - glassy)
SF	=	Softly/under-fired (very soft - will slake down and degrade in water)
NF	=	Firing conditions are within normal parameters

Appendix Two

Classifications and illustrations of degrees of skill







Error in Clay Preparation

Each possible error is scored as present or absent: No Error = Good; 1 Error = Moderate; 2 or more errors = Poor. The rational for the classifications is offered below and clarified through photographic evidence. Further discussion surrounding the technology of clay preparation is to be found in the methodology, chapter 4.

Spalling is present

Spalling is considered to have occurred when it can be clearly seen that clay has lifted away from the vessel surface as a result of either an air pocket or detritus having been present. The example given is **PRN (Pottery Record Number) 561**, a handle from the Százhalombatta assemblage. Spalling has occurred due to an air pocket, exposing a large inclusion of limestone.

Air pockets are trapped within the clay matrix

Air pockets are recorded when their presence can be clearly observed within the vessel wall. The example given is the base of a cup, **PRN 220** from Százhalombatta.

Surface voids

Surface voids are recorded as an error when they are present over at least 5% of the vessels surface. The example shows the exterior surface of a 'fish-dish', **PRN 2016** from Dunaújváros-Kosziderpadlás.

Inclusions unintentionally breaking the finished surface

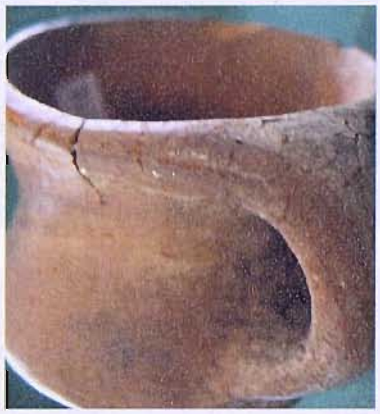
This is recorded as an error where it is understood that there has been no particular intent for inclusions to be visible on the vessel surface. Unlike, for example, flint and quartzite tempered pottery such as British Neolithic Peterborough Ware or Bronze Age Trevisker Ware. The example is the rim of a domestic vessel, **PRN 2004** from Dunaújváros-Kosziderpadlás

Error in Manufacturing

Again these are recorded as present or absent. No Error = Good; 1 or 2 errors = Moderate; 3 or more errors = Poor. Potential errors in manufacturing are also discussed within in the methodology, chapter 4.

<u>Splitting at the rim</u>

It can be clearly seen that over-working of the clay, usually in the pinching process causes, fine vertical splits at the rim. The example is a cup, **PRN 138** from Százhalombatta.



<u>Slumping</u>

The shape of the vessel is seen to have distorted through the addition of too much wet clay compromising the wet strength of the vessel during production. The example shown, **PRN 503**, an urn from Százhalombatta has slumped at the lower belly on the left hand side.

<u>Uneven finger indentations</u>

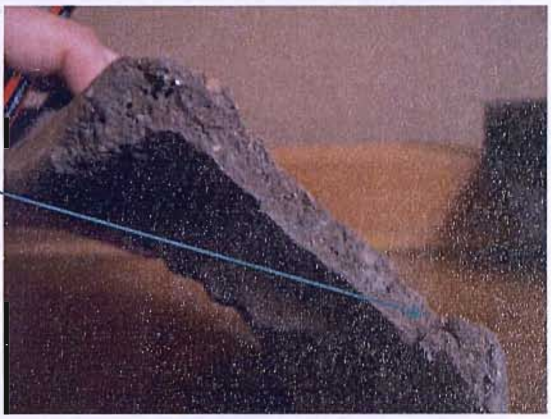
Finger indentations are clearly visible as imprints into the vessel surface that do not form any part of a decorative scheme. The example is a large body sherd from an urn, **PRN 2065** Dunaújváros-Kosziderpadlás

<u>Coil join fractures</u>

A coil join fracture will occur where two coils have been poorly bonded introducing a weakness into the vessel causing one section to shear away from another. In the example given, **PRN 453** from Százhalombatta, the coil join between the wall and base of the

vessel has caused a fracture between the base and the wall of this Vatya jug.

Slab join fractures
A slab join fracture will occur where two slabs have been poorly bonded introducing a weakness into the vessel structure causing one section to shear away from another. In the sample shown, **PRN 569** from Százhalombatta the outer wall of the domestic vessel has sheared away from the inner wall.



Poor coil join
The slight gap between the two coils at the carination of the pot indicates poor bonding of the coils to one another. In the example, **PRN 2020** a domestic vessel from Dunaújváros-Kosziderpadlás, the coil joins are poorly bonded but not so badly that it has caused a fracture.

Poor slab join
The slight gap between the two slabs indicates poor bonding of the two slabs to one another. In the example, **PRN 520** an urn from Százhalombatta, the vertical slab join is poorly bonded but no so badly that it has caused a fracture.

Excessive weight for volume/size
Excessive wall thickness for the volume or size of the vessel is considered to have occurred where the wall thickness or weight is considerably greater than is normal for that vessel type. In the example given, **PRN 218**, a cup from Százhalombatta, the wall thickness at the belly of the cup exceeds

1cm. The usual wall thickness would normally be 2-6mm for this vessel group.

Patching

Patching is the application of an extra pad of plastic clay used to repair a fault in manufacturing. Patches may occur at the joins of handles as an attempt to improve a poor join or on the wall of a vessel most probably to repair an area that has become thinner than desired (possibly where an air bubble has introduced a weakness into the vessel wall). Patches are seen as error when the clay has not been sufficiently bonded to the pre-existing surface.

In the first example given, **PRN 156 (top picture)** a cup from Százhalombatta, a patch has been applied under the top join of the handle and not worked into the pre-existing surface, thus introducing a weakness into the vessel structure. In the second example, **PRN 2111 (bottom picture)** a cup from Dunaújváros-Kosziderpadlás, the patch is clearly visible on the interior wall.

Star shaped fractures, laminar sherd edge fractures, lens shaped fractures

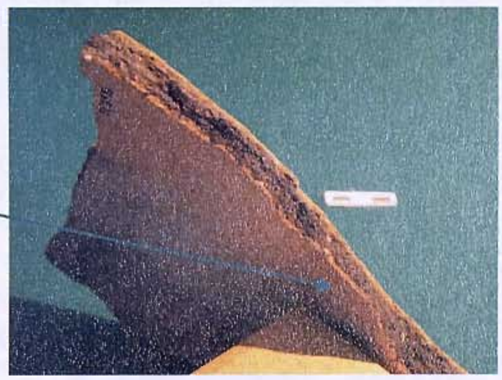
These technological signatures are related to pots that have been produced with the paddle and anvil technique. A full description of this technique and ensuing technological signatures is to be found in Chapter 4, the methodology. The fact that none of the characteristics were noted suggests little or no use of this manufacturing process within the assemblages studied.

Wall thickness

Wall thickness is scored as 'Good', 'Moderate' or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence. Further discussions surrounding wall thickness is to be found within the methodology, chapter four.

Wall thickness: Good

PRN 175 (top picture), a Vatya cup, and **PRN 211 (bottom picture)**, a Koszider cup, both from Százhalombatta, provide two examples of appropriate and uniform wall thickness for their particular vessel types. These would be classified as good. It is interesting to note that PRN 211 whilst exhibiting a good investment of skill for wall thickness also exhibits a poor investment of skill for decoration.



Wall thickness: Moderate

In this example, **PRN 442** a large body sherd of a Vatya/Koszider urn the wall thickness is generally quite well controlled. However, there is a tendency for the wall thickness to undulate between slab joins introducing thinner areas.

Wall thickness: Poor

Erratic, uneven wall thickness is seen as a serious error where the wall thickness can be seen to vary beyond reasonable limits so that it causes weakness to the integral structure of the vessel. In the example shown, **PRN 189** a cup from Százhalombatta, the variation between the thinnest and thickest wall thickness is 6mm. Another example of poor wall thickness would be where wall thickness was inappropriate for the vessel type. For example, very thick walls on a Koszider fineware jug or very thin walls on a large domestic bowl.

Additions

Additions include handles, lugs and foot-rings. Lugs are in effect just very small handles and exactly the same criteria apply. Very few lugs were recorded and separate classification is not made here. Additions are scored as 'Good', 'Moderate', or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence. Further discussion surrounding the technology of applying additions is to be found in the methodology, chapter 4.

<u>Handles (or lugs): Good</u>

A handle is considered as good when it is correctly, that is firmly, attached at both the top and bottom join without any sign of a fracture or weakness, or any patches applied, between the handle and the body of the pot. It also curves (arches) in an appropriate manner and has not cracked or sagged. It must also conform to the expected size, form and thickness for the vessel type. The example given is **PRN 171**, a Vatya-Koszider cup from Százhalombatta.

<u>Handles (or lugs): Moderate</u>

A handle is considered as moderate where either the top or bottom join is seen as not firmly attached to the body of the vessel. The form of the handle does not completely conform to the expected normal characteristics for the vessel type. In the example given, **PRN 115** a cup from Százhalombatta, the top join of the handle is not completely bonded to the body of the pot and a patch has been applied. The arch of the handle has splayed out and the handle thickness is uneven throughout.

<u>Handles (or lugs): Poor</u>

A handle is considered as poor where both the top and bottom joins are flawed and inadequately bonded to the body of the pot. The arch and form of the example given, **PRN 103** a Nagyrév cup from Százhalombatta, show that it has sagged and cracked owing to the clay being over-worked and becoming 'short'. This indicates a poor investment of skill. It does not conform to the expected form, size or thickness for the vessel type.

Foot-ring: Good

In the example given, **PRN 451 (top picture)**, the base of a Koszider jug from Százhalombatta, the applied clay used to form the foot-ring is of even thickness and has been well bonded to the body of the pot at the appropriate stage of drying – while the clay is still tacky. The foot-ring is well formed and follows the form of the pot very well. Note: there has been 'spade' damage to this sample during excavation causing it to look somewhat less well constructed that it really is. In the second example, **PRN 474 (bottom picture)**, a Nagyrév jug from Százhalombatta, the added 'foot' or pedestal base has been crafted with great finesse. The clay is well bonded to the body of the pot and the form of the foot-ring has been perfectly executed.

Foot-ring (feet!): Moderate

In the example given, **PRN 1139 (both pictures)**, a Vatya fineware bowl from Dunaújváros-Duna-dűlő, the added 'feet' have been adequately bonded to the pot at the appropriate stage of drying. However, the inexpert forming of the feet has aided in the overall distortion of the vessel, probably in the drying stage. The feet are all of different heights (not normal for a well executed example of this vessel form). The distortion is also added to by the varying wall thickness created when applying the feet to the pot.

Foot-ring: Poor
In the example given, **PRN 453 (both pictures),** the base of a Vatya jug from Százhalombatta, the attempt to make the same style of foot-ring **PRN 451**, shown above, has been inexpertly managed. The finished foot-ring is lumpy and the lower picture illustrates that the clay was poorly bonded causing a major fracture between the base and wall of the vessel.

Surface Treatments and Decoration

These are scored as 'Good', 'Moderate', or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence. Full descriptions of surface finishes can also be found in the methodology, chapter 4.

Burnishing
This surface treatment is achieved by polishing the surface of the pot with pebbles, beads, bone or leather whilst the pot is drying out. Burnishing may be carried out when the pot is 'leather' hard or dryer but not before. Within this study burnishing is most usually found associated with fineware, urns and cups.

Burnishing: Good
In the example given, **PRN 208** a Vatya cup from Százhalombatta, the burnishing is evenly applied with no sign of gaps, or impressed striations left from the tool being worked on the surface. The surface has a high and even sheen.

Burnishing: Moderate

In the example given, **PRN 2008** a Nagyrév cup from Dunaújváros-Kosziderpadlás there are some modest gaps and striations but the overall finish is one of a reasonable sheen covering most areas of the pot well.

Burnishing: Poor

In the example given, **PRN 210** a cup from Százhalombatta, the burnishing can at best be described as cursory. Large gaps occur across the burnished area and deep impressions from the burnishing tool have created an uneven surface.

Smoothing

This surface treatment is most probably carried out by rubbing the surface of the pot with either fingers or leather. The body of the pot must be firm but the surface must be damp. It is possible that it may be wiped with water before smoothing occurs. Within this study smoothing occurs on all vessel types.

Smoothing: Good

The smoothed area has no gaps and is worked to produce an even surface finish across the smoothed area. The example given is **PRN 191** a cup from Százhalombatta

Smoothing: Moderate

The smoothed area shows some signs of missed areas and some areas are still lumpy with a few voids and inclusions breaking the surface of the pot. The example given is **PRN 408** a jug from Szazhalombatta

Smoothing: Poor

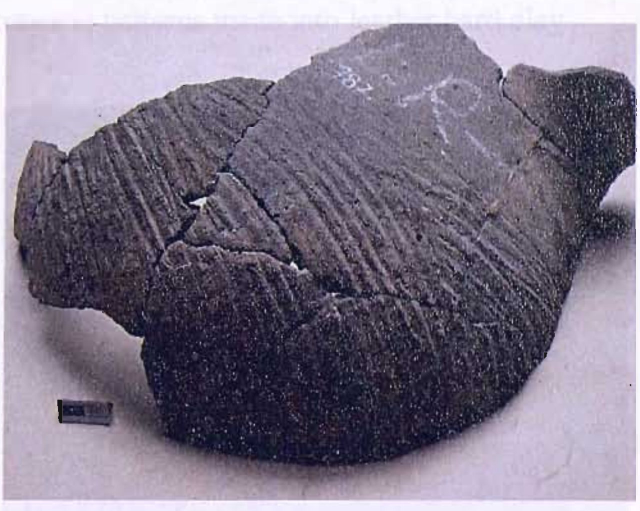
In the example given, **PRN 2035** a domestic vessel from Dunaújváros-Kosziderpadlás, although smoothing has occurred the surface remains pitted in many areas and the smoothing is patchy. Finger indentations and striations are present and the vessel surface is lumpy.

Rustication

This surface treatment involves the wiping of dried grasses or a tool across the surface of the pot into wet clay. It is probable that a self-slipped surface is applied in order for this to be carried out. Rustication within this study is most commonly found associated with urn and domestic vessels.

Rustication: Good

The area of the vessel intended to have rustication is evenly covered with no gaps and with an even depth to the striations formed when dragging dried grasses or a tool over the surface to roughen it. The example given is **PRN 1015**, an urn from Dunaújváros-Duna-dűlő.



Rustication: Moderate

In the example given, **PRN 2054** a domestic vessel from Dunaújváros-Kosziderpadlás, the clay surface has not been wet enough for the striations to work. Instead the tool has been dragged across the pot into soft rather than wet clay leaving crudely incised lines rather than the closely grouped striations shown in the previous example.

Rustication: Poor

The example given is **PRN 1050**, a domestic vessel from Dunaújváros-Duna-dűlő. The striations have been made into wet clay; however, they are very faint and far apart suggesting a very poor investment of skill.

Incised and impressed into leather hard clay

Within the assemblages studied this form of decoration most commonly comprises of combinations of incised and impressed geometric patterns made into leather hard clay

Good

The example given is **PRN 471**, a jug from Százhalombatta. The motif of impressed dots and incised triangles represents the decorative style common to much of the Vatya fineware. The impressed dots and the triangle motif are evenly spaced and the stylistic scheme is planned so as to work evenly around the pot. There is no evidence of any lines being reworked (rubbed over and re-drawn) or of lines overshooting the intended decorative zone.

Moderate
The example given is **PRN 469**, a jug from Százhalombatta. Although the motif is well planned to work its way around the pot with evenly spaced triangles a number of the incised lines have been reworked and the triangles are of varying shapes and sizes with some incisions transcending the planned decorative zone. The decoration has been uncharacteristically applied to a dry surface.

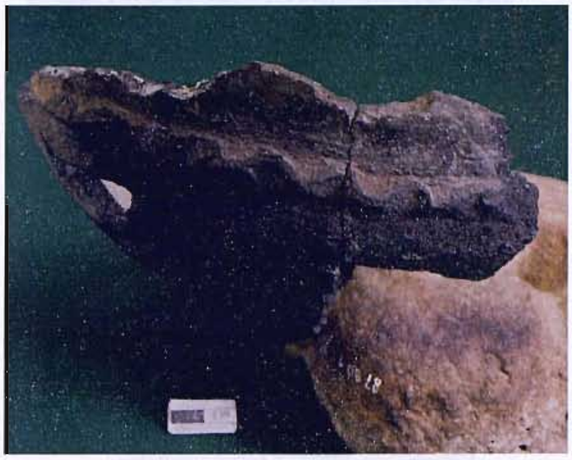
Poor
The example given is **PRN 211**, a cup from Százhalombatta. In this example the incised lines have been scratched into clay that is extremely dry. Many lines overshoot the outline of the triangle motif and also run into the three incised bands running around the collar of the vessel. The triangle motifs also overlap with one another through poor planning of the decorative scheme.

Applied cordons with finger tip impressions

Applied plastic cordons with impressed fingertip impressions appear on a number of vessel forms including storage vessels and urns and both domestic and fineware bowls.

Applied cordons: Good
In the example given, **PRN 2067** an urn from Dunaújváros-Kosziderpadlás, the cordon has been evenly applied and well bonded to the vessel surface. The fingertip impressions are carefully formed to create evenly sized and evenly spaced circular patterns.

Applied cordons: Moderate
In the example given, **PRN 523** an urn from Százhalombatta, the cordon is well bonded to the vessel surface. However, it varies in thickness and the impressions are uneven so that the effect varies sometimes creating a wavy pattern and sometimes creating single impressions.



Applied cordons: Poor
In the example given, **PRN 553** a domestic vessel from Százhalombatta, the cordon has been poorly bonded to the vessel surface and subsequently some of it has become detached. The cordon varies in thickness and the fingertip impressions are uneven. This is not necessarily typical of domestic vessels where cordons may be just as well executed as on urns or fineware.

Applied plastic decoration

Applied plastic decoration also occurs as bosses, lugs and embellishments such as Anza Lunata handles.

Applied plastic decoration: Good
PRN 469, a Koszider jug from Százhalombatta offers an example of the good application of an Anza Lunata handle. The additional plastic clay forming the decorative Anza Lunata is well defined and of equal wall thickness to the rest of the vessel.

Applied plastic decoration: Moderate

PRN 409, a Koszider jug from Százhalombatta offers an example of the moderate application of an Anza Lunata handle. Although the additional plastic clay begins to form the required shape it lacks definition and is excessively thick.

Applied plastic decoration: Poor

PRN 464, a Koszider jug from Százhalombatta offers an example of the poor forming of an Anza Lunata handle. The additional plastic clay has not been formed uniformly and as well as being excessively thick each point of the Anza Lunata is significantly different in thickness and form. The applied lugs around the join between the body and neck of the vessel are poorly applied, and unevenly positioned.

Rim Deviation on the Horizontal Plane

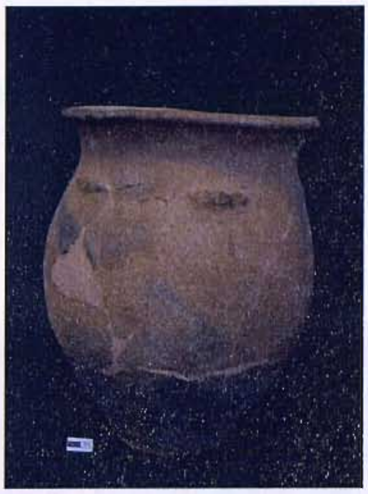
This is an assessment as to the degree to which the rim circumference conforms to a degree of evenness when viewed on the horizontal plane. Rim deviation is scored as 'Good', 'Moderate', or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence.

Rim Deviation on the Horizontal Plane: Good

PRN 419 (top picture), a Vatya urn from Százhalombatta, and **PRN 434 (bottom picture)**, a Koszider fineware bowl from Százhalombatta offer examples of no deviation on the horizontal plane and therefore score as good.

Rim Deviation on the Horizontal Plane: Moderate

PRN 478 (top picture), a Vatya storage jar from Százhalombatta and **PRN 465 (bottom picture)**, a large Vatya domestic bowl from Százhalombatta, offer examples of moderate rim deviation on the horizontal plane.



Rim Deviation on the Horizontal Plane: Poor

PRN 431 (top picture), a Vatya fineware bowl from Százhalombatta and **PRN 472 (bottom picture)**, a Nagyrév urn from Százhalombatta offer examples of a severe deviation of the rim on the horizontal plane. In both instances the potter has not had the required skill to avoid the vessel rim becoming distorted during production.

Rim Symmetry

Unlike rim deviation on the horizontal plane rim symmetry is the observation of the vessels circumference symmetry. A standard rim symmetry chart was used to asses varying degrees of variability. In order to safeguard this process a minimum of 20% of the vessel rim had to be available for analysis. Rim symmetry is scored as 'Good', 'Moderate', or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence.

<u>Rim Symmetry: Good</u>
PRN 406 (top picture), a large Vatya domestic bowl, from Százhalombatta, and **PRN 1019 (bottom picture)**, a Nagyrév fineware jug from Dunaújváros-Duna-dűlő, did not exhibit any degree of variation when set against a rim symmetry chart indicating perfect symmetry of the vessel circumference.

<u>Rim Symmetry: Moderate</u>
PRN 418 (top picture), a Vatya storage vessel from Százhalombatta, and **PRN 154 (bottom picture),** a Vatya cup from Százhalombatta are examples of moderate rim symmetry. The rim circumference of these vessels showed modest deviation from the rim circumference chart.

Rim Symmetry: Poor
PRN 233 (top picture), a Vatya cup from Százhalombatta, and **PRN 1139 (bottom picture)**, a late Vatya fineware bowl from Dunaújváros-Duna-dűlő both showed considerable deviation of the rim circumference when placed on the rim circumference chart.

Handle symmetry

Assessment of handle symmetry is based on the vertical alignment of the handle from the top to the bottom join. Where two handles are present it is also an assessment of the appropriate alignment of the handles with one another. It is important to bear in mind that most hand 'pulled' handles will have a degree of curvature present. What is important is that this is not excessive or that the alignment of top with bottom is not so variable as to cause the likelihood of affecting the vessels proposed appearance or utility. Handle symmetry is scored as 'Good', 'Moderate', or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence.

Handle Symmetry: Good
PRN 1136 (top picture), a Vatya/Koszider urn from Dunaújváros-Duna-dűlő, and **PRN 466 (bottom picture)**, a Nagyrév cup from Százhalombatta, both show excellent vertical alignment of top and bottom joins of the handle. PRN 1136 also shows perfect alignment of the handles with each other.

Handle Symmetry: Moderate

PRN 199 (top picture), a Vatya cup from Százhalombatta, and **PRN 410 (bottom picture)**, a Vatya / Koszider Jug from Százhalombatta, provide examples of a moderate deviation of the vertical alignment of the handles.

Handle Symmetry: Poor

PRN 138 (top picture), a Nagyrév / Vatya cup from Százhalombatta and **PRN 462 (bottom picture)**, a fineware Koszider jug, both from Százhalombatta demonstrate poor vertical alignment of the top and bottom handle joins.

Profile Symmetry

Profile symmetry is scored as 'Good', 'Moderate' or 'Poor'. The rational for these classifications is offered below and clarified through photographic evidence. Profile symmetry is integral to the production of a proposed vessel form. Extremely poor profile symmetry suggests a poor investment of skill and suggests the potter who was unable to adequately control the proportions of the form as it is being made. Poor profile symmetry may compromise the technical integrity of the vessel in a pragmatic sense and undermine any intended visual performance characteristics. The relevance of profile symmetry is also discussed within the methodology in the section on vessel form.

<u>Profile Symmetry: good</u>
PRN 1019 (top picture), a fineware Nagyrév jug from Dunaújváros-Duna-dűlő, and **PRN 1055 (bottom picture)**, a fineware Vatya jug from Dunaújváros-Duna-dűlő provide examples of good profile symmetry.

<u>Profile Symmetry: moderate</u>
PRN 2004 (top picture), a Nagyrév-Vatya storage vessel from Dunaújváros-Kosziderpadlás, and **PRN 1143 (bottom picture)**, a Koszider urn from Dunaújváros-Duna-dűlő,

Profile Symmetry: poor

PRN 1077(top picture), a Vatya urn from Dunaújváros-Duna-dűlo and **PRN 1028 (bottom picture)**, a Nagyrév fineware bowl also from Dunaújváros-Duna-dűlo, both offer examples of poor profile symmetry.

Firing

The criteria for showing firing differences cannot be illustrated digitally. There are, however, three criteria by which these are judged. Pots can be over-fired, normally-fired or soft/under-fired. Neither over-fired nor soft/under-fired pots are desirable. Details of firing processes and the criteria used to asses firing temperature are discussed in full within the methodology, chapter 4.

Note: all photographs within this Appendix are the author's and form part of a catalogue of photographs associated with this research.

Appendix 3

Contingency Tables

Clay preparation - all vessels

Count	Poor	Moderate	Good	Total
Szaz	39	84	232	355
Duna	48	103	49	200
K-padlas	27	45	90	162
%	Poor	Moderate	Good	Total
Szaz	11%	24%	65%	100%
Duna	24%	52%	24%	100%
K-padlas	17%	27%	56%	100%

Manufacturing - all vessels

count	Poor	Moderate	Good	Total
Szaz	45	111	199	355
Duna	63	94	43	200
K-padlas	21	59	82	162
%	Poor	Moderate	Good	Total
Szaz	13%	31%	56%	100%
Duna	32%	47%	21%	100%
K-padlas	13%	36%	51%	100%

Additions - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	40	54	104	198	157	355
Duna	31	46	47	124	76	200
K-padlas	9	21	43	73	89	162
%	Poor	Moderate	Good	Total		
Szaz	20%	27%	53%	100%		
Duna	25%	37%	38%	100%		
K-padlas	12%	29%	59%	100%		

Interior surface treatment - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	51	97	194	342	13	355
Duna	31	92	77	200		
K-padlas	22	62	78	162		
%	Poor	Moderate	Good	Total		
Szaz	15%	28%	57%	100%		
Duna	15%	47%	38%	100%		
K-padlas	14%	38%	48%	100%		

Exterior surface treatment - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	53	93	205	351	4	355
Duna	29	88	83	200		
K-padlas	11	49	102	162		
%	Poor	Moderate	Good	Total		
Szaz	15%	27%	58%	100%		
Duna	14%	44%	42%	100%		
K-padlas	7%	30%	63%	100%		

Decoration - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	21	40	91	152	203	355
Duna	26	37	52	115	85	200
K-padlas	11	15	52	78	84	162
%	Poor	Moderate	Good	Total		
Szaz	14%	26%	60%	100%		
Duna	23%	32%	45%	100%		
K-padlas	14%	19%	67%	100%		

Rim deviation on the horizontal plane - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	40	127	73	240	115	355
Duna	16	91	25	132	36	168
K-padlas	19	47	43	109	53	162
%	Poor	Moderate	Good	Total		
Szaz	17%	53%	30%	100%		
Duna	12%	69%	19%	100%		
K-padlas	17.4%	43.2%	39.4%	100%		

Wall thickness - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	69	92	187	348	7	355
Duna	63	57	76	196	4	200
K-padlas	38	43	80	161	1	162
%	Poor	Moderate	Good	Total		
Szaz	20%	26%	54%	100%		
Duna	32%	29%	39%	100%		
K-padlas	23%	27%	50%	100%		

Rim Symmetry - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	19	81	152	252	103	355
Duna	39	57	71	167	33	200
K-padlas	17	33	48	98	64	162
%	Poor	Moderate	Good	Total		
Szaz	8%	32%	60%	100%		
Duna	20%	33%	47%	100%		
K-padlas	17%	34%	49%	100%		

Handle Symmetry - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	19	44	131	194	161	355
Duna	14	42	72	128	72	200
K-padlas	3	14	53	70	92	162
%	Poor	Moderate	Good	Total		
Szaz	10%	23%	67%	100%		
Duna	11%	33%	56%	100%		
K-padlas	4%	20%	76%	100%		

Profile Symmetry - all vessels

count	Poor	Moderate	Good	Total	NA	Total
Szaz	40	67	116	223	132	355
Duna	31	81	65	177	23	200
K-padlas	21	22	39	82	80	162
%	Poor	Moderate	Good	Total		
Szaz	18%	30%	52%	100%		
Duna	17%	46%	37%	100%		
K-padlas	26%	26%	48%	100%		

Firing - all vessels

count	High	Normal	Soft	Total
Szaz	11	339	5	355
Duna	0	105	95	200
K-padlas	1	158	3	162
%	High	Normal	Soft	Total
Szaz	3%	95%	2%	100%
Duna	0%	52.5%	47.5%	100%
K-padlas	0.5%	98%	1.5%	100%

Clay preparation - cups

Count	Poor	Moderate	Good	Total
Szaz	26	47	67	140
Duna	10	24	14	48
K-padlas	10	19	23	52
%	Poor	Moderate	Good	Total
Szaz	18%	34%	48%	100%
Duna	21%	50%	29%	100%
K-padlas	19%	37%	44%	100%

Manufacturing - cups

count	Poor	Moderate	Good	Total
Szaz	39	49	52	140
Duna	10	25	13	48
K-padlas	7	28	17	52
%	Poor	Moderate	Good	Total
Szaz	28%	35%	37%	100%
Duna	21%	52%	27%	100%
K-padlas	13%	54%	33%	100%

Additions - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	32	25	34	91	49	140
Duna	11	15	12	38	10	48
K-padlas	6	12	8	26	26	52
%	Poor	Moderate	Good	Total		
Szaz	35%	27%	38%	100%		
Duna	29%	39%	32%	100%		
K-padlas	23%	46%	31%	100%		

Interior surface treatment - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	37	33	57	127	13	140
Duna	7	25	16	48		
K-padlas	11	28	13	52		
%	Poor	Moderate	Good	Total		
Szaz	29%	26%	45%	100%		
Duna	15%	52%	33%	100%		
K-padlas	21%	54%	25%	100%		

Exterior surface treatment - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	34	48	55	137	3	140
Duna	3	27	18	48		
K-padlas	2	21	29	52		
%	Poor	Moderate	Good	Total		
Szaz	25%	35%	40%	100%		
Duna	6%	56%	38%	100%		
K-padlas	4%	50%	46%	100%		

Decoration - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	9	1	14	24	116	140
Duna	0	4	3	7	41	48
K-padlas	3	2	5	10	42	52
%	Poor	Moderate	Good	Total		
Szaz	37%	4%	59%	100%		
Duna	0%	57%	43%	100%		
K-padlas	30%	20%	50%	100%		

Rim deviation on the horizontal plane - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	27	49	14	90	50	140
Duna	3	25	12	40	8	48
K-padlas	9	10	7	26	26	52
%	Poor	Moderate	Good	Total		
Szaz	30%	54%	16%	100%		
Duna	8%	62%	30%	100%		
K-padlas	35%	38%	27%	100%		

Wall thickness - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	43	34	58	135	5	140
Duna	8	20	20	48		
K-padlas	13	22	16	51	1	52
%	Poor	Moderate	Good	Total		
Szaz	32%	25%	43%	100%		
Duna	17%	41.5%	41.5%	100%		
K-padlas	26%	43%	31%	100%		

Rim Symmetry - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	5	36	43	84	56	140
Duna	9	14	20	43	5	48
K-padlas	11	10	7	28	24	52
%	Poor	Moderate	Good	Total		
Szaz	6%	43%	51%	100%		
Duna	21%	33%	46%	100%		
K-padlas	39%	36%	25%	100%		

Handle Symmetry - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	13	30	46	89	51	140
Duna	6	16	17	39	9	48
K-padlas	3	8	16	27	25	52
%	Poor	Moderate	Good	Total		
Szaz	14.5%	34%	51.5%	100%		
Duna	15%	41%	44%	100%		
K-padlas	11%	30%	59%	100%		

Profile Symmetry - cups

count	Poor	Moderate	Good	Total	NA	Total
Szaz	27	43	45	115	25	140
Duna	6	24	17	47	1	48
K-padlas	17	14	15	46	6	52
%	Poor	Moderate	Good	Total		
Szaz	23%	38%	39%	100%		
Duna	13%	51%	36%	100%		
K-padlas	37%	30%	33%	100%		

Firing - cups

count	High	Normal	Soft	Total
Szaz	6	131	3	140
Duna	0	24	24	48
K-padlas	1	51	0	52
%	High	Normal	Soft	Total
Szaz	4%	94%	2%	100%
Duna	0%	50%	50%	100%
K-padlas	2%	98%	0%	100%

Clay preparation - domestic pots

count	Poor	Moderate	Good	Total
Szaz	5	14	36	55
Duna	17	18	7	42
K-padlas	10	11	21	42
%	Poor	Moderate	Good	Total
Szaz	9%	25.5%	65.5%	100%
Duna	40%	43%	17%	100%
K-padlas	24%	26%	50%	100%

Manufacturing - domestic pots

count	Poor	Moderate	Good	Total
Szaz	1	20	34	55
Duna	9	23	10	42
K-padlas	2	14	26	42
%	Poor	Moderate	Good	Total
Szaz	2%	36%	62%	100%
Duna	21%	55%	24%	100%
K-padlas	5%	33%	62%	100%

Additions - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	2	7	14	23	32	55
Duna	8	11	5	24	18	42
K-padlas	3	3	5	11	31	42
%	Poor	Moderate	Good	Total		
Szaz	9%	30%	61%	100%		
Duna	33%	46%	21%	100%		
K-padlas	27%	27%	46%	100%		

Interior surface treatment - domestic pots

count	Poor	Moderate	Good	Total
Szaz	4	21	30	55
Duna	11	24	7	42
K-padlas	5	15	22	42
%	Poor	Moderate	Good	Total
Szaz	7%	38%	55%	100%
Duna	26%	57%	17%	100%
K-padlas	12%	36%	52%	100%

Exterior surface treatment - domestic pots

count	Poor	Moderate	Good	Total
Szaz	5	23	27	55
Duna	16	16	10	42
K-padlas	7	15	20	42
%	Poor	Moderate	Good	Total
Szaz	9%	42%	49%	100%
Duna	38%	38%	24%	100%
K-padlas	17%	35%	48%	100%

Decoration - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	7	14	13	34	21	55
Duna	10	11	8	29	13	42
K-padlas	5	6	14	25	17	42
%	Poor	Moderate	Good	Total		
Szaz	21%	41%	38%	100%		
Duna	34%	38%	28%	100%		
K-padlas	20%	24%	56%	100%		

Rim deviation on the horizontal plane - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	4	32	10	46	9	55
Duna	9	22	1	32	10	42
K-padlas	3	24	9	36	6	42
%	Poor	Moderate	Good	Total		
Szaz	9%	69%	22%	100%		
Duna	28%	69%	3%	100%		
K-padlas	8%	67%	25%	100%		

Wall thickness - domestic pots

count	Poor	Moderate	Good	Total
Szaz	10	19	26	55
Duna	22	7	13	42
K-padlas	19	13	10	42
%	Poor	Moderate	Good	Total
Szaz	18%	35%	47%	100%
Duna	52%	17%	31%	100%
K-padlas	45%	31%	24%	100%

Rim Symmetry - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	6	17	25	48	7	55
Duna	13	13	9	35	7	42
K-padlas	4	9	17	30	12	42
%	Poor	Moderate	Good	Total		
Szaz	12.5%	35.5%	52%	100%		
Duna	37%	37%	26%	100%		
K-padlas	13.3%	30.0%	57.0%	100%		

Handle Symmetry - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	1	4	20	25	30	55
Duna	2	12	10	24	18	42
K-padlas	0	2	8	10	32	42
%	Poor	Moderate	Good	Total		
Szaz	4%	16%	80%	100%		
Duna	8%	50%	42%	100%		
K-padlas	0%	20%	80%	100%		

Profile Symmetry - domestic pots

count	Poor	Moderate	Good	Total	NA	Total
Szaz	5	10	9	24	31	55
Duna	12	15	5	32	10	42
K-padlas	3	6	6	15	27	42
%	Poor	Moderate	Good	Total		
Szaz	21%	42%	37%	100%		
Duna	37%	47%	16%	100%		
K-padlas	20%	40%	40%	100%		

Firing - domestic pots

count	High	Normal	Soft	Total
Szaz	0	55	0	55
Duna	0	16	26	42
K-padlas	1	40	1	42
%	High	Normal	Soft	Total
Szaz	0%	100%	0%	100%
Duna	0%	63%	37%	100%
K-padlas	2.3%	95.3%	2.3%	100%

Clay preparation - urns

count	Poor	Moderate	Good	**Total**
Szaz	5	11	47	63
Duna	11	30	15	56
K-padlas	4	10	16	30
%	Poor	Moderate	Good	**Total**
Szaz	8%	17%	75%	100%
Duna	20%	54%	26%	100%
K-padlas	13.3%	33.3%	53.3%	100%

Manufacturing - urns

count	Poor	Moderate	Good	**Total**
Szaz	2	14	47	63
Duna	6	22	28	56
K-padlas	0	10	20	30
%	Poor	Moderate	Good	**Total**
Szaz	3%	22%	75%	100%
Duna	11%	39%	50%	100%
K-padlas	0%	33%	67%	100%

Additions - urns

count	Poor	Moderate	Good	**Total**	NA	**Total**
Szaz	1	7	15	23	40	63
Duna	3	9	21	33	23	56
K-padlas	0	3	13	16	14	30
%	Poor	Moderate	Good	**Total**		
Szaz	4%	31%	65%	100%		
Duna	9%	27%	64%	100%		
K-padlas	0%	19%	81%	100%		

Interior surface treatment - urns

count	Poor	Moderate	Good	Total
Szaz	3	26	34	63
Duna	1	22	33	56
K-padlas	3	10	17	30
%	Poor	Moderate	Good	**Total**
Szaz	5%	41%	54%	100%
Duna	2%	39%	59%	100%
K-padlas	10%	33%	57%	100%

Exterior surface treatment - urns

count	Poor	Moderate	Good	Total
Szaz	8	11	44	63
Duna	1	22	33	56
K-padlas	0	9	21	30
%	Poor	Moderate	Good	**Total**
Szaz	13%	17%	70%	100%
Duna	2%	39%	59%	100%
K-padlas	0%	30%	70%	100%

Decoration - urns

count	Poor	Moderate	Good	**Total**	NA	**Total**
Szaz	1	10	20	31	32	63
Duna	6	13	23	42	14	56
K-padlas	1	3	15	19	11	30
%	Poor	Moderate	Good	**Total**		
Szaz	3%	32%	65%	100%		
Duna	14%	31%	55%	100%		
K-padlas	5%	16%	79%	100%		

Rim deviation on the horizontal plane - urns

count	Poor	Moderate	Good	**Total**	NA	**Total**
Szaz	2	18	14	34	29	63
Duna	4	24	7	35	21	56
K-padlas	0	10	10	20	10	30
%	Poor	Moderate	Good	**Total**		
Szaz	6%	53%	41%	100%		
Duna	11%	69%	20%	100%		
K-padlas	0%	50%	50%	100%		

Wall thickness - urns

count	Poor	Moderate	Good	**Total**	NA	**Total**
Szaz	9	14	40	63	na	na
Duna	12	14	28	54	2	56
K-padlas	4	4	22	30		
%	Poor	Moderate	Good	**Total**		
Szaz	14%	22%	64%	100%		
Duna	22%	26%	52%	100%		
K-padlas	13.3%	13.3%	73.3%	100%		

Rim Symmetry - urns

count	Poor	Moderate	Good	**Total**	NA	**Total**
Szaz	3	12	25	40	23	63
Duna	4	14	23	41	15	56
K-padlas	0	7	9	16	14	30
%	Poor	Moderate	Good	**Total**		
Szaz	7.5%	30%	62.5%	100%		
Duna	10%	34%	56%	100%		
K-padlas	0%	44%	56%	100%		

Handle Symmetry - urns

count	Poor	Moderate	Good	Total	NA	Total
Szaz	1	3	18	22	41	63
Duna	4	8	24	36	20	56
K-padlas	0	1	15	16	14	30
%	Poor	Moderate	Good	Total		
Szaz	4%	14%	82%	100%		
Duna	11%	22%	67%	100%		
K-padlas	0%	6%	94%	100%		

Profile Symmetry - urns

count	Poor	Moderate	Good	Total	NA	Total
Szaz	4	5	17	26	37	63
Duna	2	24	25	51	5	56
K-padlas	0	1	8	9	21	30
%	Poor	Moderate	Good	Total		
Szaz	16%	19%	65%	100%		
Duna	4%	47%	49%	100%		
K-padlas	0%	11%	89%	100%		

Firing - urns

count	High	Normal	Soft	Total
Szaz	2	60	1	63
Duna	0	42	14	56
K-padlas	0	30	0	30
%	High	Normal	Soft	Total
Szaz	3.5%	95%	1.5%	100%
Duna	0%	75%	25%	100%
K-padlas	0%	100%	0%	100%

Clay preparation - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total
Szaz	3	12	82	97
Duna	12	31	11	54
K-padlas	3	5	30	38
%	Poor	Moderate	Good	Total
Szaz	3%	12%	85%	100%
Duna	22%	58%	20%	100%
K-padlas	8%	13%	79%	100%

Manufacturing - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total
Szaz	3	28	66	97
Duna	18	24	12	54
K-padlas	2	7	29	38
%	Poor	Moderate	Good	Total
Szaz	3%	29%	68%	100%
Duna	33%	45%	22%	100%
K-padlas	5%	19%	76%	100%

Additions - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	5	14	42	61	36	97
Duna	9	11	9	29	25	54
K-padlas	0	3	17	20	18	38
%	Poor	Moderate	Good	Total		
Szaz	8%	23%	69%	100%		
Duna	31%	38%	31%	100%		
K-padlas	0%	15%	85%	100%		

Interior surface treatment - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total
Szaz	7	17	73	97
Duna	12	21	21	54
K-padlas	3	9	26	38
%	Poor	Moderate	Good	Total
Szaz	7%	18%	75%	100%
Duna	22%	39%	39%	100%
K-padlas	8%	24%	68%	100%

Exterior surface treatment - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	6	11	79	96	1	97
Duna	9	23	22	54		
K-padlas	2	4	32	38		
%	Poor	Moderate	Good	Total		
Szaz	6.5%	11.5%	82%	100%		
Duna	17%	42%	41%	100%		
K-padlas	5%	11%	84%	100%		

Decoration - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	4	15	44	63	34	97
Duna	6	13	18	37	17	54
K-padlas	2	4	18	24	14	38
%	Poor	Moderate	Good	Total		
Szaz	6%	24%	70%	100%		
Duna	16%	35%	49%	100%		
K-padlas	8%	17%	75%	100%		

Rim deviation on the horizontal plane - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	7	28	35	70	27	97
Duna	13	29	5	47	7	54
K-padlas	1	6	20	27	11	38
%	Poor	Moderate	Good	Total		
Szaz	10%	40%	50%	100%		
Duna	28%	62%	10%	100%		
K-padlas	4%	22%	74%	100%		

Wall thickness - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	7	25	63	95	2	97
Duna	21	16	15	52	2	54
K-padlas	2	4	32	38		
%	Poor	Moderate	Good	Total		
Szaz	7.3%	26.3%	66.3%	100%		
Duna	40%	31%	29%	100%		
K-padlas	5%	11%	84%	100%		

Rim Symmetry - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	5	16	59	80	17	97
Duna	13	16	19	48	6	54
K-padlas	2	7	15	24	14	38
%	Poor	Moderate	Good	Total		
Szaz	6%	20%	74%	100%		
Duna	27%	33%	40%	100%		
K-padlas	8%	29%	63%	100%		

Handle Symmetry - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	4	7	47	58	39	97
Duna	2	6	21	29	25	54
K-padlas	0	2	15	17	21	38
%	Poor	Moderate	Good	Total		
Szaz	7%	12%	81%	100%		
Duna	7%	21%	72%	100%		
K-padlas	0%	12%	88%	100%		

Profile Symmetry - 'fineware' bowls & jugs

count	Poor	Moderate	Good	Total	NA	Total
Szaz	4	9	45	58	39	97
Duna	11	18	18	47	7	54
K-padlas	1	0	11	12	26	38
%	Poor	Moderate	Good	Total		
Szaz	7%	15%	78%	100%		
Duna	24%	38%	38%	100%		
K-padlas	8%	0%	92%	100%		

Firing - 'fineware' bowls & jugs

count	High	Normal	Soft	Total
Szaz	3	93	1	97
Duna	0	23	31	54
K-padlas	0	38	0	38
%	High	Normal	Soft	Total
Szaz	3%	96%	1%	100%
Duna	0%	44%	56%	100%
K-padlas	0%	100%	0%	100%

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Personal Communications

Dr Ildiko Poroszlai: The quote cited at the start of Chapter 2 was to form part of a paper *Life on Bronze Age Tells* to be presented in Cambridge. Unfortunately Dr Poroszlai passed away prior to completion of the manuscript. Dr Poroszlai was director of the Matrica Museum, Százhalombatta and highly regarded as a Bronze Age scholar.

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