The manufacture, use, and significance of shell disc beads from the 9th to 13th century CE in northern South Africa

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ABSTRACT

Shell disc beads (SDB) are some of the earliest ornaments made by humans, and are frequently found in the archaeological record of both hunter-gatherer and farming (Iron Age) societies in South Africa. Despite being one of the most common decorative items found on Iron Age farming settlements, very little is known about who manufactured them, how they were manufactured, or how they were used. This is particularly true for the important archaeological sites of K2 and Mapungubwe on the farm Greefswald 37MS, part of the Mapungubwe National Park in the Shashe-Limpopo Confluence Area (SLCA) of northern South Africa.

This dissertation focuses on the SDB from K2 and Mapungubwe and provides an in-depth analysis of morphological characteristics to identify changes in their manufacture and use. Results suggest several differences in the morphological characteristics between the Greefswald settlements, including diameter, thickness, and drilling direction. These differences are largely a factor of shell type. The sample analysed from K2 consisted predominantly of *Achatina*, while the sample from Mapungubwe almost exclusively consisted of ostrich eggshell. The sample from K2 also presented large quantities of other shell types, suggesting their use of raw materials were more diverse. This finding accentuates the significance of raw materials and the importance of discriminating between different shell types when comparing SDB data between sites.

On a site level, the sample from K2 presented little standardization, both in raw material use and manufacturing techniques, while Mapungubwe Hill presented a greater degree of bead standardization and displayed specific preferences. This, and the increased used of ostrich eggshell to make SDB, is likely due to increased economic specialisation and the intensification of trade that characterises the Mapungubwe period. Increased social complexity allowed Mapungubwe elites to harness new forms of labour and natural resources thereby changing patterns of the SDB usage on the site.

This study is the first research to analyse patterns in style, manufacture, and use of SDB on K2 and Mapungubwe. It lays the foundation for a renewed investigation of SDB on early sites of social complexity in particular, and the Iron Age of southern Africa more generally.

DECLERATION OF ORIGINALITY

I, Michelle Mouton, declare that this dissertation is my own original work. As per departmental requirements, acknowledgement was given and reference was made where someone else's work was used. I understand what plagiarism entails and am aware of the University's policy in this regard.

Signature ______________________________________

ACKNOWLEDGEMENTS

While performing this study and writing my Masters dissertation was an immensely satisfying experience, the process also created a great deal of anxiety. There were occasions where I felt completely lost. I have a tendency to overthink to a point where I get stuck and confuse myself. With too many variables and directions for interpretation, I found myself trapped. Like Alice, I've fallen down a rabbit hole. Unlike Alice's fantasy world, however, I found myself completely overwhelmed by statistical jargon, my own repetitiveness, and the complete inability to put my own thoughts into coherent sentences. Was it not for my supervisor, Xander Antonites, I would surely still be ensnared by my own "what if" thoughts. Your advice, guidance, and enthusiasm is greatly appreciated.

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If anything, I can say this about my Masters, the entire experience was a learning curve, and I am immensely proud of what I achieved. From this dissertation I will take more than simply adding to our understanding of SDB manufacture on the Greefswald sites. Through this project I have grown as a writer, I have learnt the art of time management, and I've experienced the importance of psychological well-being.

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Any opinion, findings, and conclusions or recommendations expressed in this dissertation are those of the author and therefore the NRF do not accept any liability in regard thereto.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

SDB	Shell disc bead
SLCA	Shashe-Limpopo Confluence Area
CE	Common Era
LSS	Land Snail Shell
K2-IP	K2 Indo-Pacific
EC-IP	East Coast Indo-Pacific
CCP	Central Cattle Pattern
ZP	Zimbabwe Pattern
ACH	*Achatina*
OES	Ostrich eggshell
FWB	*Unionid*/Freshwater mussel
A	Angular
VA	Very Angular
R	Rounded
WR	Well rounded
Unk	Unknown
Y	Yes
N	No
MK	Mapungubwe Hill
MST	Mapungubwe Southern Terrace

LIST OF SYMBOLS

CHAPTER 5	S	Standard deviation
	$\bar{x}$	The sample mean
	CI	The 95% Confidence Interval
	$s\,\bar{x}$	The standard error of the mean
	CV1	Coefficient of Variation (Including outliers)
	CV2	Coefficient of Variation (Excluding outliers)
	$\tilde{X}$	The Median or middle value
	r	Correlation coefficient
	p	Significant probability/ statistical significance
	n	Number of observations

CHAPTER 1

INTRODUCTION AND OUTLINE

1.1 Introduction

Shell disc beads (SDB) are some of the earliest ornaments made by humans (Ambrose 1998; McBrearty & Brooks 2000). They can be made from any type of shell, but in southern Africa are typically manufactured from ostrich eggshell, giant African land snail (Achatinidae - termed *Achatina*), and freshwater mussel *(*Unionidae - termed *Unionid*) shells. Beads are typically formed by puncturing and grinding shell fragments into flat, circular discs (Drury 1935: 98-99). SDB can be found over a broad geographic range and can be important indicators of identity, style, and status, and provide archaeologists with a glimpse into how past peoples expressed themselves.

The use of SDB is a long-lived tradition spanning the Stone Age to historic periods with widespread examples from southern to northern Africa, India, northern China, Inner Mongolia, and Siberia (Narr 1966; Wendt 1974; Kumar *et al*. 1990; Bednarik 1993; d'Errico *et al*. 2012; Zwyns *et al*. 2014; Rybin 2014; Yi *et al*. 2017; cf. Bednarik 2015 for summary). Some of the earliest examples were reported from several Middle Stone Age and early Later Stone Age sites from southern and eastern Africa (Ambrose 1998; McBrearty & Brooks 2000; d'Errico *et al*. 2005; Vanhaeren 2005; d'Errico *et al*. 2008; d'Errico *et al*. 2012). Their popularity is evident in their continued use right up to historic times by indigenous groups of southern Africa (Werner 1919; Stayt 1931; Van Warmelo 1932; Tyrrell 1968; Gitywa 1970; Costello 1990; Tapela 2001; Wingfield 2003; Hitchcock 2012). Ostrich eggshell disc beads were often a favoured item; used as decoration to adorn the body, as 'gifts' to strengthen social ties with neighbouring groups, or as trade items. They were not only favoured among the Bushmen groups, but also by Bantu-speaking farmers of the region. Their extended use through time and the diversity of sites from which they are recovered attest to their value and usefulness to past peoples across the Southern African landscape.

Most of our understanding of SDB come from ethnographic and historical studies made of historic Bushmen (San) groups, or from archaeological studies centred around hunter-gatherer contexts in the Later Stone Age. Despite SDB being one of the most common decorative items found on Iron Age farming settlements, little is known about who manufactured them, how they were manufactured, or how they were used. SDB are generally under reported and comparable data concerning their manufacture and use are lacking.

This is particularly true for the Shashe-Limpopo River Confluence Area (SLCA) in northern South Africa. Regarded as the epicentre for the emergence of class distinction and state formation in South Africa between 900 and 1300 CE, the SLCA has been the focus of many research projects (e.g. Fouché 1937; Gardner 1963; Hanisch 1980; Meyer 1998, Calabrese 2000b, 2005; Huffman 2007, 2015). The sites of Schroda, K2, and Mapungubwe, considered the main political and economic centres during their respective occupations, each played a pivotal role in the emergence of class distinction and political centralization which culminated in the development of the Mapungubwe polity. This dissertation specifically focusses on the SDB from K2 and Mapungubwe, collectively referred to here as the Greefswald sites (since both are located on the farm Greefswald) in the northern Limpopo Province of South Africa.

1.2 The Greefswald shell disc beads

The beads included in this study were recovered from Middle Iron Age occupations dating roughly from c. 1000 CE to 1300 CE (cf. Vogel 2000). Reports indicate that copious amounts of SDB have been recovered from K2 and Mapungubwe (e.g. Fouchè 1937; Gardner 1963; Eloff 1979; Wood 2005), yet no data exists on them. Similarly, SDB are often collectively referred to as ostrich eggshell beads, with little reference to the use of other material types (cf. Ward & Maggs 1988; Miller *et al*. 2018), although several other shell types are usually present archaeologically on Iron Age sites (Voigt 1983).

1.3 Research objectives

This dissertation attempts to broaden the approach to SDB studies in South Africa, with specific application to farming communities during the Middle Iron Age in the SLCA. This study will address the aforementioned shortcomings through an in-depth analysis of the changes in the manufacture and use of SDB at K2, Mapungubwe Hill (MK), and the Southern Terrace (MST).

The study will therefore be structured around the following questions:

1. Are there any differences in the manufacturing of SDB between K2 and Mapungubwe?
2. Are there any differences in the use of raw materials between K2 and Mapungubwe?
3. Do any of these differences relate to the social and political changes between 1100 and 1300 CE?

1.4 Dissertation outline

Chapter 2 provides a review of past SDB research, including ethnographical and archaeological studies involving manufacture and use. **Chapter 3** provides background on the occupation of the SLCA and places K2 and Mapungubwe within this setting. This chapter further describes the layout of each site along with their respective research/excavation histories. **Chapter 4** describes the methods used in this study, with particular emphasis on the identification of raw materials and morphological characteristics related to manufacturing activities. **Chapter 5** presents the result from the study. **Chapter 6** provides a discussion on manufacturing differences between the sites drawing on information presented in the previous chapters.

Appendix A presents the spatial (horizontal) and chronological (vertical) distribution of the SDB included in this study. **Appendix B** provides the various summary statistics collected during the course of this study.

CHAPTER 2

SOUTHERN AFRICAN SHELL DISC BEAD STUDIES

Several ethnographic, historical and archaeological studies have dealt with the manufacture and use of SDB in southern African contexts. Although many of these studies focus on the manufacture of beads from ostrich eggshell, they are also applicable to other shell types, such *Achatina* and *Unionid* shells. There are only a few explicitly archaeological studies, and these similarly focus on the use of ostrich eggshell. This chapter provides a review of these sources and discuss the value, use, and manufacture of shell disc beads to provide an actualistic context for this study.

2.1 Ethnographic and historical source material

2.1.1 Bushmen ethnographies

Of all the southern African ethnic groups, ostrich eggshell disc beads are most frequently mentioned in the context of Bushmen communities. Observations of these communities during the 20th century form the bulk of ethnographic literature on the manufacture and use of SDB. During this period, the manufacture and use of ostrich eggshell beads had declined due to the greater availability of cheap modern glass and plastic beads, and other imported jewellery (Wingfield 2003: 58-59).

An early observer of disc bead production was Stow (1905) who studied different Bushmen groups in Southern Africa from the 1840s onward. These included groups from northern and western Namibia, the Kalahari, the Ngami region north of the Kalahari, western Karoo, and the Free State. Although these groups were described primarily in terms of their subsistence and conflict with colonist and Bantu-speaking groups, Stow (Ibid.) briefly described the manufacture and use of ostrich eggshell beads, particularly by the northern Abwata Bushmen from Damaraland near the western coast of modern-day Namibia. His accounts gave clear descriptions on their use to decorate the body and as forming part of a bartering system whereby Bushmen bead makers traded their ostrich eggshell beads for small pieces of iron from neighboring Bantu-speaking groups (Ibid.: 45,139,274).

Similarly, Bleek (1928: 9-10) observed and described the manufacture and use of ostrich eggshell beads by Bushmen groups in the central Kalahari in the 1920s. She (Ibid.) devoted most of her attention to studying the Naron in Sandfontein where she engaged with and meticulously recorded their everyday life and activities. She particularly mentions bead manufacture by women and their use as ornaments by women, children, and younger men.

In the early 1900s, Schapera (1930: 3-5) studied Khoekhoen ('*Hottentots*' in Schapera's publication) and Bushmen groups occupying regions of the southern, central and northern Kalahari Desert of modern-day Namibia. Schapera's account does not provide much detail on manufacture, but does describe how SDB were sewn on to clothing items such as the 'Kaross' (a soft kneaded hide blanket) and their use as jewellery to decorate the waist, arms, and legs (Ibid.: 66,144,145).

Drury (1935) provides a detailed account of the manufacturing process of ostrich eggshell beads (Ibid.: 98-99), as well as their use for decoration by all members of the society (Ibid.: 92-93). These observations were made during an anthropological research expedition to Namibia and Botswana, where he studied various Bushmen groups, with particularly detailed accounts of the Naron and Auen which he encountered in Sandfontein in 1919 and 1921.

From 1958 to 1964, Silberbauer observed the economic life and social organization of the *G/wikhwena* of the central Kalahari Desert in Botswana. Initially, he only briefly described the manufacture and use of ostrich eggshell beads (Silberbauer 1965: 50). In a second publication, Silberbauer (1981: 227) described the manufacturing process in greater detail, commenting on specific techniques and tool use. Silberbauer (Ibid.) expanded on their importance as gifts and how they were considered valuable ornamental objects.

A more recent study on the manufacture of SDB was done by Wingfield in 2001 among the Nharo speakers of D'kar and the Bakgalagadi and !Xõ Bushmen from Ngwatle, Monong and Ncang in the Kgalagadi District, Botswana. Although Wingfield's (2003) publication did not discuss the use or significance of SDB, it did describe in great detail the activities involved in the manufacturing process. By adopting a *chaÎne opératoire* approach to the processes involved in the manufacturing of ostrich eggshell beads, Wingfield set forth to demonstrate the similarities and differences in these regions and how this information would be relevant in interpreting the archaeological record (Ibid.: 55-56).

An important point that many sources touch on is the gender of bead makers. In terms of Bushmen groups, all except Stow (1905) indicates that beads were manufactured exclusively by women (Bleek 1928: 9; Schapera 1930: 66; Drury 1935: 98; Silberbauer 1965: 50; Tapela 2001: 63). In contrast, Stow (1905: 52) explicitly states that "the men were the great manufacturers of beads", but does not mention if this applied only to the Bushmen groups he studied. The fact that Stow is writing close to the start of the 20th century could suggest that female manufacturing is a recent phenomenon and did not necessarily apply to the archaeological record.

2.1.2 Bantu-speaking ethnographies

Ethnographies on Bantu-speaking groups frequently mention the use of beadwork. Although no reference is typically made to shell or glass beads, the assumption is that it's likely the latter. From these accounts it is clear that beaded decoration played an integral part in individual and group identity in these communities. However, only a few authors specifically mention the use of disc beads manufactured from shell by these communities (Werner 1919; Stayt 1931; Van Warmelo 1932; Tyrrell 1968; Gitywa 1970; Costello 1990).

Glass beads were introduced to northern South Africa via Indian Ocean trade networks in the latter half of the first millennium CE. Prior to the introduction of glass beads, beads were manufactured from traditional materials such as shell, seeds, horn, bone, and eggshell (Gitywa 1970: 54; cf. Hammond-Tooke 1974: 103; Costello 1990: 2; Kirsch & Skorge 2001: 55; Bongela 2001: 100). With the eventual introduction of Cape Colony traders, glass beads and the availability of cheap imported beads, became more widespread (Shaw 1974: 103; Wingfield 2003: 58-59), and more traditional materials, such as seeds and shell types, fell out of favour. Costello (1990: 2) indicated that the use of more traditional materials did not disappear completely, but were used together with imported beads. An archaeological example of combined materials is the bead cache found at Sibudu Cave (Wood *et al*. 2009).

2.2 The social life of shell disc beads

The use of disc beads as objects of adornment is often the first thing that comes to mind when thinking about their use and value. We think of them as general accessories worn to embellish or enhance the beauty of the wearer. However, describing beads simply as decoration oversimplifies their potential function, value, and meaning. If the function of an object, or rather, how the object is meant to function in its social environment, gives it meaning, then their functions cannot be interpreted in isolation from their meanings (Hodder 1987: 1). SDB could therefore have served multiple purposes, and thus different meanings depending on the context of its use.

This resonates with Kopytoff's (1986: 170) observation that objects cannot be understood at just one point in time, and that an object, like a person, has a life and carries with it multiple histories. Marshall (1976: 303), for example, stated that Bushman artefacts, like SDB, were durable and may have lasted for generations, "moving in a slow current among the people". It's within this slow moving current that beads accumulate their biographies, moving from person to person, and over time, accumulating meaning along the way. Like people, objects should be interpreted contextually from these histories if we are to understand the value and meanings attached to them.

Stressing the importance of a biographically centred approach, Kopytoff (1986) argues that to understand the value of a thing, we must examine its biography, and not just its production and moments of exchange (cf. Harding 2016). It's for this reason that the use of SDB be approached without limiting it to specific functions and assumed meanings. A discussion on the use of SDB can therefore benefit from an understanding of ethnographic accounts which describes their general everyday use.

In his studies of the Auen and Naron Bushmen groups of Namibia, Drury (1935) described the use of ostrich eggshell beads as jewellery to decorate the arms, legs, and neck. He described a well-dressed woman as having "bangles, and pendants of ostrich eggshell beads tied to the hair and suspended to hang between the eyes", while "thin medallions or short strings of beads are hung all around the head" (Ibid.: 92). Clothing, such as the kaross, were also decorated with ostrich eggshell beads. Schapera (1930: 68) described a string of ostrich eggshell beads around the waist on which a small tortoise-shell box containing "buchu" (a medicinal and fragrant fynbos shrub) is carried. Stow (1905: 139) also observed the use of this girdle and described multiple stings of ostrich eggshell beads worn together, to achieve the desired width.

Marshall (1976: 304) indicated that ostrich eggshell beads were used by all the !Kung people, men, women, and children alike. However, most ethnographic accounts indicate the use of decorative SDB as more common for young women and children, while young unmarried men do wear them, and older married men usually do not (Campbell 1815; Bleek 1928; Schapera 1930; Drury 1935). Photographs taken of Bushmen groups by Dorothea Bleek from 1910 to 1920 (The digital Bleek and Lloyd Collection, University of Cape Town) and Irven DeVore during the 1950's (Lee & DeVore 1976) show that women and children, and not men of prestige, wore the greatest numbers of beads (Fiedel 1986: 192).

However, several accounts on the use of similar ornamentation by Bantu-speaking groups, paints a different picture, one of rank (cf. Campbell 1815). In his studies of Venda-speaking groups in South Africa, Stayt (1931) described a headband decorated with ostrich eggshell beads worn by royal women to distinguish themselves from commoners (Ibid.: 26; cf. Schapera 1937). Van Warmelo (1932: 114-115) similarly described a string of ostrich eggshell beads called a *Tshiala* which was exclusively worn by the wives of chiefs in Venda-speaking communities. A wife received this string of beads through a ritual of initiation into the headman's clan. Once the headman dies, she will remove the string and boil it in a medicine made from the root of a specific tree, until it is spoiled so it can never be worn again. These accounts therefore describe ostrich eggshell beads as a symbol of rank and prestige within these particular communities.

However, these beads were also used more widely within Bantu-speaking communities. Stayt (1931) described an ostrich eggshell bead waistband, or girdle, presented to many children at their first naming ceremonies (Ibid.: 25, 88). Tyrrell (1968: 6, 76) described an apron decorated with ostrich eggshell beads worn by Ntwana women and young girls from the then eastern Transvaal, now Mpumalanga. Werner (1919: 255) described a string of ostrich eggshell beads called *omitombe*. A collection of these strings were worn together, hanging downwards from a belt (*otjimbakutu*), forming a skirt. She adds that shell beads were highly valued because their manufacture was tedious and time consuming. Rather significantly, Werner (Ibid.) described an *ombongora* which was similar to the above mentioned *omitombe* except that it consisted of disc beads manufactured from snail shell or other shelled molluscs. However, Werner did not elaborate on the distinction between bead materials. Nevertheless, this is one of only a few accounts where specific mention is made of mollusc SDB and their specific distinction from ostrich beads.

Going beyond decoration, several accounts described the medicinal uses of ostrich eggshell. Low (2011), for example, noted that in Bushmen communities, "ostrich eggshell is used in healing contexts, either as beads or as a burnt and ground powder…. All groups ascribed healing benefit to wearing ostrich eggshell" (Ibid.: 302). Tapela (2001: 64) described a similar belief among the Bushmen of D'Kar that children grow faster when they wear strings of ostrich eggshell beads around their waists or neck (cf. Low 2011: 302).

Ostrich eggshell beads were also an important gift/trade item. These beads were not only gifted across vast distances, but were also passed from person to person for many years (Hitchcock 2012: 98). Lee (1984: 99) noted that valued gift items - such as ostrich eggshell beads - could travel as far as 200 kilometres, being gifted and regifted along the way. Wiessner (1977, 1982, 1984, 1997, 2002; cf. Wadley 1986, 1987, 1989, 1993; Mitchell 1996) described one such gifting system among Bushmen groups from Botswana and Namibia, called *hxaro*. This system was a form of delayed reciprocal gifting, based on a partnership of reciprocal exchange among the Kalahari San and involved the exchange of gifts among different groups across the larger population to build ties between different groups.

Wiessner (1982: 64) described the Kalahari environment as highly variable from year to year, with droughts and other seasonal fluctuations making many resources inaccessible at times. *Hxaro* therefore represented a structured system of social relations designed to pool these risks between groups in different regions. It was therefore a means to create, maintain, and strengthen friendships. In times of hardship a family can call upon these friendship ties for support or to gain access to areas in which to forage or hunt based on the links in their *hxaro* network (Ibid.: 66). Ostrich eggshell beads were historically a favoured gift item amongst Bushmen groups (Marshall 1976: 304, 308; Lee 1979: 98; Wiessner 1982: 70, 72; Smith & Lee 1997; Mitchell 2003: 157) and evidently played an important role in *hxaro* exchanges.

Wadley (1986, 1987) identified the *hxaro* system in the archaeological record in the Magaliesberg Range north of Johannesburg in South Africa. Wadley (1986) argued that the temporal variability in some Later Stone Age assemblages could be explained by aggregation and *hxaro* models. The manufacture of *hxaro* gifts, such as ostrich eggshell beads, would largely occur on aggregation camps where kin-related households congregate for marriages, feasts, and rituals (Wadley 1986, 1987, 1989; cf. Lee 1979; Silberbauer 1981; Wiessner 1982; Jacobson 1987a). Here, the manufacture of bead ornaments and gift exchange would form part of a 'public' phase where friends and kin socialize in large aggregation camps.

SDB were also traded with neighbouring agriculturalist groups by Bushman hunter-gatherers. Schapera (1930: 66) indicated that shell beads were a standard article of barter between Bushmen groups and their Bantu-speaking neighbours. Stow (1905: 139) described similar transactions where nomadic Bushmen bead makers traded their ostrich eggshell beads for small pieces of iron. Forde (1934: 31) indicates that ostrich eggshell beads were some of the most sought-after Bushman trade items and was exchanged for goods such as iron, knives, spearheads, millet grain, and tobacco to neighboring Bantu-speaking groups (cf. Marshall 1998: 79).

2.3 Archaeological studies of shell disc beads

2.3.1 Shell disc bead variability and identity

Archaeological and experimental studies of SDB have primarily focussed on their manufacture and use as markers of identity. One of the earliest archaeological studies that specifically looked at SDB manufacture in the southern African past was by Plug (1982). Her analysis of the ostrich eggshell beads from the upper Pleistocene and early Holocene deposits at Bushman Rock Shelter showed a greater degree of variability in the manufacturing stages of beads when compared to the stages observed from modern day Bushmen beadmakers (Ibid.: 60). However, she did not compare her findings to other archaeological assemblages.

Jacobson's (1987a, 1987b) publications were the first comparative study on the size variability of ostrich eggshell beads. His study was prompted by a suggestion by W. E. Wendt that ostrich eggshell beads recovered from older assemblages were smaller when compared to the beads recovered from more recent assemblages (Jacobson 1987a: 55). If this observation held true, ostrich eggshell bead variability could therefore be the result of changes through time, or be interpreted as a variable related to style. Ostrich eggshell beads could therefore potentially be used as a possible relative dating method to distinguish between early and later assemblages - or, as a function of style, beads size offered a possible way to distinguish between different socio-economic groups (hunter-gatherer vs. herder) in the archaeological record (Ibid.). This was especially appealing since distinguishing between hunter-gatherer and herder groups in the archaeological record of the last 2000 years has proved to be problematic (Ibid.; cf. Smith 1998).

Similar to Wadley's (1986, 1987) aggregation and *hxaro* models, Jacobson (1987a: 57) also proposed that specific manufacturing stages could potentially distinguish between short-term task specific sites and long-term aggregation camps. He hypothesised that short term camps would not have beads belonging to a variety of manufacturing stages as women, the primary bead producers, are often absent at these camps. Aggregation camps would therefore provide the greatest variability of SDB (complete, incomplete, broken), as well as a greater range of sizes (Ibid.).

Jacobson (1987a: 55-56) compared the ostrich eggshell disc bead size distributions of 18 archaeological assemblages from Central Namibia. Sites were classified into three types based on their assemblages. Type I sites were characterised by hunter-gatherer subsistence strategies and were accompanied by microlithic tool kits, but with a lack of pottery. Type II also represents assemblages with microlithic tool kits, but with the addition of a small quantity of pottery, and date to periods after the introduction of herding. Type III, on the other hand, describes assemblages belonging to herding communities which consist of abundant quantities of pottery and few lithics.

Observations indicated an increase in mean bead size from the earlier Type I assemblages, to the later Type II and III assemblages that postdate the arrival of domestic animals (1987a: 57). From this, Jacobson (Ibid.) concluded that there is a bead size difference between hunter-gatherer (smaller beads) and herder (larger beads) sites. From this study, a number of complimentary studies have emerged (Jacobson 1987b; Smith *et al.* 1991; Smith *et al*. 1995; Smith *et al*. 2001; Tapela 2001; Sadr *et al*. 2003), and also a number of critiques (Kandel & Conard 2005; Orton 2008; Wilmsen 2015).

One of the most prominent of these follow-up studies was conducted to assess whether hunter-gatherer and herding groups were separate social identities (as opposed to a single economic group 'cycling' between economic systems) in the southwestern Cape. Smith *et al*.

(1991) correlated ostrich eggshell bead sizes, faunal remains, and pottery, from the sites of Witklip and Kasteelberg. The results indicated that assemblages with ceramic and domestic stock remains tended to have larger SDB diameters. This was taken to suggest that hunter-gatherers and herders were likely separate socio-economic groups (Ibid.: 75). This study was later expanded to include the sites Bloeddrift 23 and Jakkalsberg which seemingly confirmed the previous results of SDB as cultural markers (Smith *et al*. 2001).

In a subsequent study, Smith and Jacobson (1995) re-assessed the appearance of early domestic stock at Geduld, Namibia, a site previously studied by Jacobson (1987a). Published as an appendix within this larger study, Yates (1995: 17) identified the same bead size pattern as Jacobson (1987a) and concluded that "the first changes in ostrich eggshell bead sizes throughout southern Africa can definitely be associated with the appearance of pottery". Yates indicated a statistically significant increase in mean bead diameter. However, he suggested a mean of ≤ 5mm for pre-pottery assemblages as opposed to the ≤ 7,5mm suggested by Jacobson (Yates 1995: 17; cf. Jacobson 1987a: 57). Nevertheless, Yates (1995: 17) cautioned that the nature of these changes may differ between regions.

In an extensive study on ostrich eggshell beads, Kandel and Conard's (2005) study presented a methodological approach to analyse the steps and activities involved in the manufacture of SDB from open-air sites in the Geelbek Dunes of the Western Cape, South Africa. The study firstly set forth to assess Jacobson's (1987a) premise that bead production stages are indicative of the duration of site occupation and accompanying activities, and secondly to possibly identify the cultural affinities of the bead makers (Kandel & Conard 2005: 1711).

They introduced the concept of "production value" (*pv*) to evaluate the degree of completion reflected by an assemblage. The *pv* represents all the steps and activities involved in the manufacture of an ostrich eggshell bead. They (Kandel & Conard 2005: 1720) found that the small beads from their study did relate to pre-pottery hunter-gatherers, while the identity of the makers of the large beads is less clear. Orton (2008) set forth to further refine Kandel and Conard's (2005) disc bead production stages to gain a greater understanding of the decisions and activities involved in the production sequence. Orton applied his refined production sequence to five sites in the Northern Cape, South Africa.

Based on his study, Orton (2008: 1770-1771) made several observations and interpretations. He observed that the sites included in his study focussed on the manufacture of small and medium beads. Larger beads were therefore likely traded in, as there was a lack of manufacturing debris for them from the sites. He further argued that larger beads are generally associated with herders (cf. Jacobson 1987a; Smith *et al*. 1995), and that the lack of sheep remains and large SDB from the archaeological record at all coastal or near-coastal

Namaqualand sites, could suggest these herders were infrequent visitors to the coast. Sites in his study varied between short- and long-term occupation sites, yet all produced evidence for the manufacture of ostrich eggshell beads (Orton 2008: 1771). Similar to Kandel and Conard (2005: 1713), this is in opposition to Jacobson's (1987a) suggestion that beads would not have been manufactured on short term settlements. Orton therefore argued that the manufacturing of SDB took place on sites with both short- and long-term occupations.

Tapela (2001) extended the approach of linking SDB size and identity to Iron Age assemblages from Botswana. He (Ibid.: 60) compared the external diameters and perforations of 819 ostrich eggshell beads from a range of herder and hunter-gatherer sites. Tapela (Ibid.: 67) identified manufacturing debris on both site types, establishing that SDB were produced by both groups. He also found that there was a clear size difference in bead sizes between hunter-gatherer and herder assemblages (Ibid.: 66).

The study identified three patterns: pattern 1 are hunter-gatherer sites with bead diameters between 3.3mm and 7.4mm; pattern 2 were small herder sites with bead diameters between 6.1mm and 13.6mm; and pattern 3 are large herder sites with a bead diameter size distribution between 1.5mm and 13.5mm. Pattern 3 was taken to indicate that either hunter-gatherer and herders occupied the same sites, each producing their own preferred SDB sizes, or alternatively, that greater interaction existed between these groups and smaller beads were exchanged with herders.

Sadr *et al*. (2003: 28-29) re-examined the model proposed by the earlier studies by examining six contemporary neighbouring sites on the hill of Kasteelberg. They concluded that there were "no clear stylistic differences between the ceramics or ostrich eggshell beads in these two sets of sites" and that the bead sizes thus "reflect change through time rather than representing emblems of different but contemporary cultures" (Ibid.: 31). This echoes Smith's (2001: 30) earlier caution that the interpretation of bead sizes for hunter-gatherer sites dating to later periods are more complicated since these assemblages also contained larger beads.

It becomes clear that caution should be exercised when using beads (and other forms of material culture) to distinguish between sometimes fluid social identities. In an extensive study on ostrich eggshell bead variability, Wilmsen (2015) investigated the morphology of ostrich eggshells, together with pre- and post-depositional factors that could affect the relative size and thickness of an ostrich eggshell bead. This included the environment in which the egg was produced, influences such as soil acidity, and wear patterns for beads manufactured for different purposes.

Wilmsen (2015: 89) argued that the relative size of a bead is the result of a complex interplay between multiple variables, such as "an eggshell's original chemical structure, environmental influences pre- and post-bead fabrication, and a bead maker's original intent for the use to which the bead was to be put". Variability in bead dimensions can therefore be the result of many factors other than those that relate to identity. From his archaeological and ethnographic evidence, Wilmsen (2015: 99) concludes that "bead size, however measured, cannot serve as a criterion for relative dating nor as a stylistic marker for distinguishing herder and pre-herder or hunter-gatherer archaeological sites".

2.3.2 Archaeological studies of raw material

In contrast to the ethnographic record which almost exclusively mentions the use of ostrich eggshell to make disc beads, archaeologists have long known of the use of other shell types (e.g. Hanisch 1980; Plug 1982). The presence of *Achatina* and *Unionid* disc beads has been identified on several Iron Age sites in the Limpopo region (Fouchè 1937; Gardner 1963; Hanisch 1980; Calabrese 2005; Antonites 2012; Raath 2014; Lippert 2015; Mouton 2018; Hopf 2018). Similarly, the use of mollusc shells for ornamentation have been recorded in historic African communities. Willcox (2018: 178) notes on "snail shell beads", while Rudner and Rudner (1957: 14) described "earrings of snail shell". Werner (1919: 225) similarly described the use of snail shell in the manufacture of beads among Bantu groups.

Ward and Maggs (1988) set out to establish and improve on the methods for identifying the raw material of SDB. This was done after they identified several cases of misidentification in earlier studies. Their analysis included descriptions of ostrich eggshell, Achatinidae, and Unionidae shell, as well as ivory, and was accompanied by detailed imagery (optical microscopy and scanning electron microscopy) of each material type. Their approach described both superficial surface and microscopic internal characteristics unique to each material type (Ibid.: 408-411).

This study also re-examined SDB from several Later Stone Age sites with the aim of accurately identifying raw materials. The misidentification of raw materials was attributed to insufficient magnification, encrustations on the outer surfaces, and inadequate samples of comparable raw materials (Ward & Maggs 1988: 407). This publication not only added to the understanding of the varied use of raw materials in the manufacturing of SDB, but also emphasized the need for greater accuracy in identifying SDB manufactured from Achatinidae, and Unionidae*,* as these were often misidentified.

Miller *et al*. (2018) was the first SDB study to exclusively focus on the use of *Achatina* shells (Land Snail Shell (LSS) in the publication). Like Ward and Maggs (1988), Miller *et al*. (2018: 361) suggested that, where possible, morphological traits (e.g. colouration and irregular ridging on outer surfaces) and microstructures could be used to identify archaeological Achatinidae beads. However, from their case study of SDB from Magubike rockshelter in Tanzania, Miller *et al*. (2018: 360), concluded that it's nearly impossible to identify shell to the species level from archaeological beads (cf. Ward and Maggs 1988: 409). As a result, identifying the raw material will in most cases only be to the general category of land snail (Achatinidae). Key features used to identify species in live specimens are lost during the manufacturing process, although unmodified shells within a site's deposits might indicate which species were available. This, however, should be used with caution as living species burrow themselves into soil and often die, an may therefore not be contemporary with site occupation ((Ibid.: 361; cf. Raath 2014: 206). Similarly, not all species might have been suitable for the manufacture of SDB, and land snail shell beads could have been imported from areas with a different level of species diversity (Miller *et al*. 2018: 361).

In their study, Miller *et al*. (2018: 347) observed that LSS beads only appear in the late Holocene, and almost exclusively within Iron Age (farmer) contexts. While SDB are present in many Iron Age archaeological assemblages, few past studies discuss the use of other shell types such as *Achatina* and *Unionid*. Notable exceptions are Pont Drift (9th- 12th CE) and Schroda (9th- 11th CE) in the Limpopo Valley where *Achatina* discs dominated the assemblages (Hanisch 1980: 290). Hall and Smith (2000: 36) speculated that this could indicate a difference in the value between beads manufactured from ostrich eggshell and *Achatina*, with the former being more highly valued. This topic will be expanded on in Chapter 6.

2.4 Shell disc bead manufacturing activities

Several ethnographic and historical studies have provided accounts on the manufacture of SDB (Stow 1905; Bleek 1928; Schapera 1930; Forde 1934; Drury 1935; Silberbauer 1965, 1981; Tapela 2001; Wingfield 2003; Hitchcock 2012). In addition to these, there are archaeological (Plug 1982; Jacobson 1987a; Vuruku 1997; Tapela 2001; Kandel & Conard 2005; Orton 2008) and experimental studies (Bednarik 1997; Kandel & Conard 2005; Orton 2008) as a compliment.

From these studies, the bead manufacturing process can broadly be divided into four main activities: blank preparation, drilling/reaming, trimming, and grinding. The sequence of these tasks varied along at least two different pathways (Orton 2008). Pathway 1 consists of a blank that was drilled and perforated before being trimmed into a disk, while Pathway 2 was trimmed into a disc before being perforated.

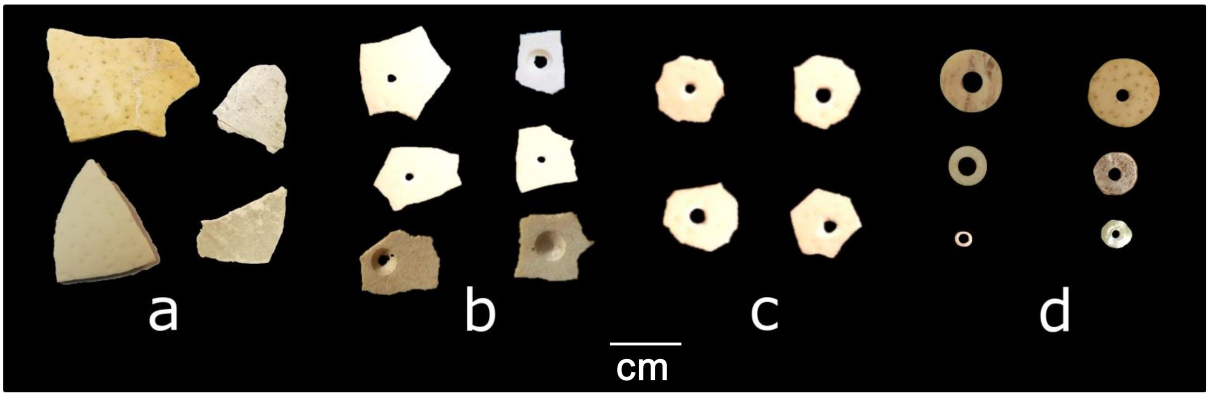


Figure 2.1: Examples of the four manufacturing activities. a-Blank preparation; b-Drilling; c-trimming; d-grinding. Photos: adapted from Kandel & Conard (2005); Orton (2008).

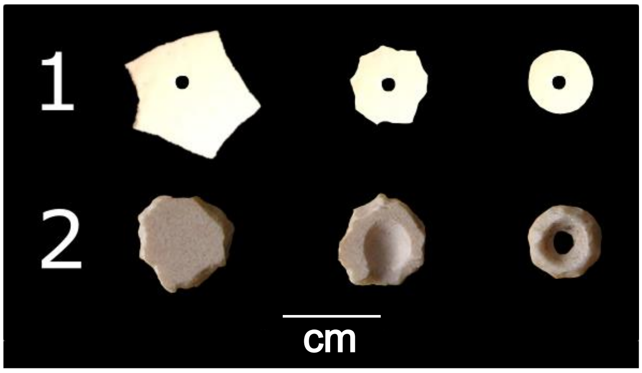


Figure 2.2: Examples of the manufacturing pathways: pathway 1 and pathway 2. Photos: adapted from Orton (2008: 1768).

2.4.1 Blank preparation

This step entail breaking the shell into appropriate sizes in preparation of further manufacture. Apart from this, these fragments were otherwise unmodified with no evidence of alteration (Kandel & Conard 2005: 1712). Bleek (1928: 9) observed the use of a stone to chip off fragments, while Drury (1935: 98) mentioned the crafters' use of their teeth to bite off smaller pieces.

2.4.2 Drilling and perforation

This involved drilling the hole by rapidly rubbing a drill between the hands. The drill could have been made from various materials, although stone and iron are among the most popular reported ethnographically. Stow (1905: 139) briefly described "a little flint or agate drill" which was used to drill a hole into the shell fragment. Similarly, Schapera (1930: 144) described the use of small drills manufactured from stone. Bleek (1928: 9), on the other hand, observed the use of an “iron awl” (obtained from Bantu-speaking groups through barter), while Drury (1935: 98) similarly reported the use of an iron tip fastened to the end of a stick.

Drilling could take place from either the inner or outer shell surface. Following his experimental work, Bednarik (1997: 157) noted that both methods took an equal amount of time to complete, but that it was simply easier to drill from the inner surface due to the concave shape (cf. Wingfield 2003: 57). The blank can also be drilled from both surfaces until the two holes meet. Drury reported that shell fragments were drilled to near completion, before the fragment was reversed and drilling continued from the opposite surface (Drury 1935: 98). Plug (1982: 60) observed a similar pattern in SDB recovered from the archaeological deposits at Bushman’s Rock Shelter (cf. Bednarik 1997: 157; Tapela 2001: 63). Conversely, Bednarik (1997: 157) argued that bead blanks were unlikely to have been drilled from both surfaces as he found it very difficult to get the two holes to meet.

After drilling, blanks can be considered beads. Kandel and Conard (2005: 1712) distinguished between a bead and a finished bead when discussing manufacturing activities, whereby a bead referred to a perforated piece of shell in any stage of production, while a finished bead specifically represented the final product. This definition requires a clear description of what can be considered as complete. Some beads were worn despite the fact that they were only partially ground smooth. From his observations of the bead makers at the D’kar settlement in the Ghanzi District, western Botswana, Tapela (2001: 64) noted the use of ostrich eggshell with rougher edges on clothing, while jewellery such as necklaces tended to consist of smooth and well-rounded beads. Similarly, Plug (1982: 61) noted a string of 145 trimmed, but not ground, ostrich eggshell beads recovered from a child’s grave from Bushman Rock Shelter. Plug suggested that “trimmed but unground beads were also regarded as ornaments in their own right” (Ibid.).

2.4.3 Trimming

This involved the removal of small fragments from the bead until a roughly circular shape with some jagged edges was achieved. Bleek (1928: 9) reported the use of an animal horn to chip off rough edges (cf. Schapera 1930: 66; Tapela 2001: 63), while Drury (1935: 98) described the use of two stones, acting as a hammer and anvil to chip away at rough edges.

2.4.4 Grinding

This involved the rubbing of rough edges with a stone, until a round smooth surface was achieved. There are also accounts where beads were rubbed against a stationary stone. Drury (1935: 98) described a string of disc beads being placed on a hard surface and ground with a rough grained stone, presumably by rubbing the stone over the beads (cf. Schapera 1930; Wingfield 2003).

A similar lack of consensus exists in descriptions of tool use. Schapera (1930: 66) reported the use of a soft stone, while Bednarik (1997, 2015) noted the use of rough grained stones. Orton (2008: 1769), on the other hand, described the possible use of grooved stones (cf. Stow 1905; Bleek 1928; Forde 1934; Goodwin 1945; Silberbauer 1965; Wingfield 2003). According to Orton (2008: 1769), “one might either pull a string of beads through a groove or, perhaps more likely, rest the string on something and rub it longitudinally with the grooved stone while it is held taut”.

2.5 Trade and production relations with foragers during the Middle Iron Age, northern South Africa

Because Bushmen groups have been ethnographically recorded manufacturing and trading ostrich eggshell beads with neighbouring groups (see p.4, 9), it has been suggested that the beads found on Iron Age sites were manufactured by, and obtained from, neighbouring hunter-gatherer groups (e.g. Silberbauer 1981; Jacobson 1987a; Mazel 1987: 279). Mazel (1987: 279) for example states that when an object that’s historically associated with one group is found on a site associated with another group, that object signifies the relationship between them. However, determining who manufactured the object without definitive evidence is problematic.

In describing the political landscape from the 9th to 13th CE in Botswana, Denbow (1983) proposed a settlement hierarchy whereby hunter-gatherers lived in small cattle posts where they served as clients to farmers. Here, hunter-gatherers would produce craft items, such as SDB, for trade with larger farming communities. The expectation is therefore that evidence of disc bead manufacture would be restricted to hunter-gatherer sites while contemporary farming settlements would present no manufacturing debris.

However, evidence presented by Tapela (2001) suggested that hunter-gatherers and Iron Age peoples each produced their own beads. Hall and Smith (2000) made a similar suggestion for the northern Limpopo region in South Africa. Here, hunter-gatherer shelters like Little Muck and Balerno (Figure 3.1, p.19), both in close proximity to contemporary farmer settlements, produced no evidence of shell bead production that would support the requirements necessary for trade (Ibid.: 36). At Little Muck, there is an increase in shell fragments, but low densities of finished beads.

Hall and Smith (2000: 36) suggested that foragers could have supplied farmers with raw materials (ostrich eggshell) instead of complete beads and that the production of beads took place on the farmer settlements. Ethnographically, Schapera (1937: 143-144) observed that ostrich eggshell beads were both traded from Bushmen and produced locally by Bantu-speaking groups. In addition, Forssman (2017: 4) pointed out that the presence of items historically produced by hunter-gatherers for trade does not necessarily indicate that they were specifically manufactured for exchange purposes, and that they were also produced for personal consumption. As Mazel (1987: 276) indicates, without manufacturing debris, determining whether items historically associated with one group, but found on the site of another was not manufactured by the occupants on whose site they were found, will be archaeologically irretrievable.

The Iron Age archaeological sites of Schroda, Castle Rock, Edmondsburg, Skutwater, Pont Drift, Leokwe Hill, and Mutamba all produced debris related to the manufacturing of SDB in the greater Limpopo region (Hansich 1980; Van Ewyk 1987; Calabrese 2005; Wood 2005; Antonites 2012; Raath 2014). The manufacturing debris included drilled or undrilled trimmed discs, drilled rough blanks, partially ground discs, and grooved stones. Leokwe Hill (Calabrese 2005) and Castle Rock (Calabrese 2005; Wood 2005), produced evidence for low intensity manufacture while Schroda (Hall & Smith 2000) appeared to have produced SDB on a much larger scale. A large cache of ostrich eggshell manufacturing debris, consisting of thousands of rough drilled discs and strung roughouts ready for grinding, was recovered from Schroda indicating manufacturing took place on a large scale within the settlement (Cited in Raath 2014; cf. Hall & Smith 2000: 36). Elsewhere, from the Msuluzi Confluence, Maggs (1980: 138) argued that *Metachatina* was locally abundant and readily available, whereas ostrich eggshell, and/or their disc beads, were obtained through trade as the areas where Early Iron Age farmers settled did not overlap with known distributions of ostriches. The presence of ostrich eggshell therefore suggest interaction might have taken place between farmers and neighbouring hunter-gatherers. In terms of northern South Africa, it is certainly possible that farmers traded SDB from foraging communities. However, the archaeological evidence suggests that SDB were also produced by Iron Age farmers themselves.

CHAPTER 3

RESEARCH AREA

This chapter describes the natural environment and the excavation histories of K2 and Mapungubwe located in the Shashe-Limpopo Confluence Area (SLCA) in northern South Africa (Figure 3.1). The sites will be discussed within a regional chronology, individual excavation histories, and sequence of occupation.

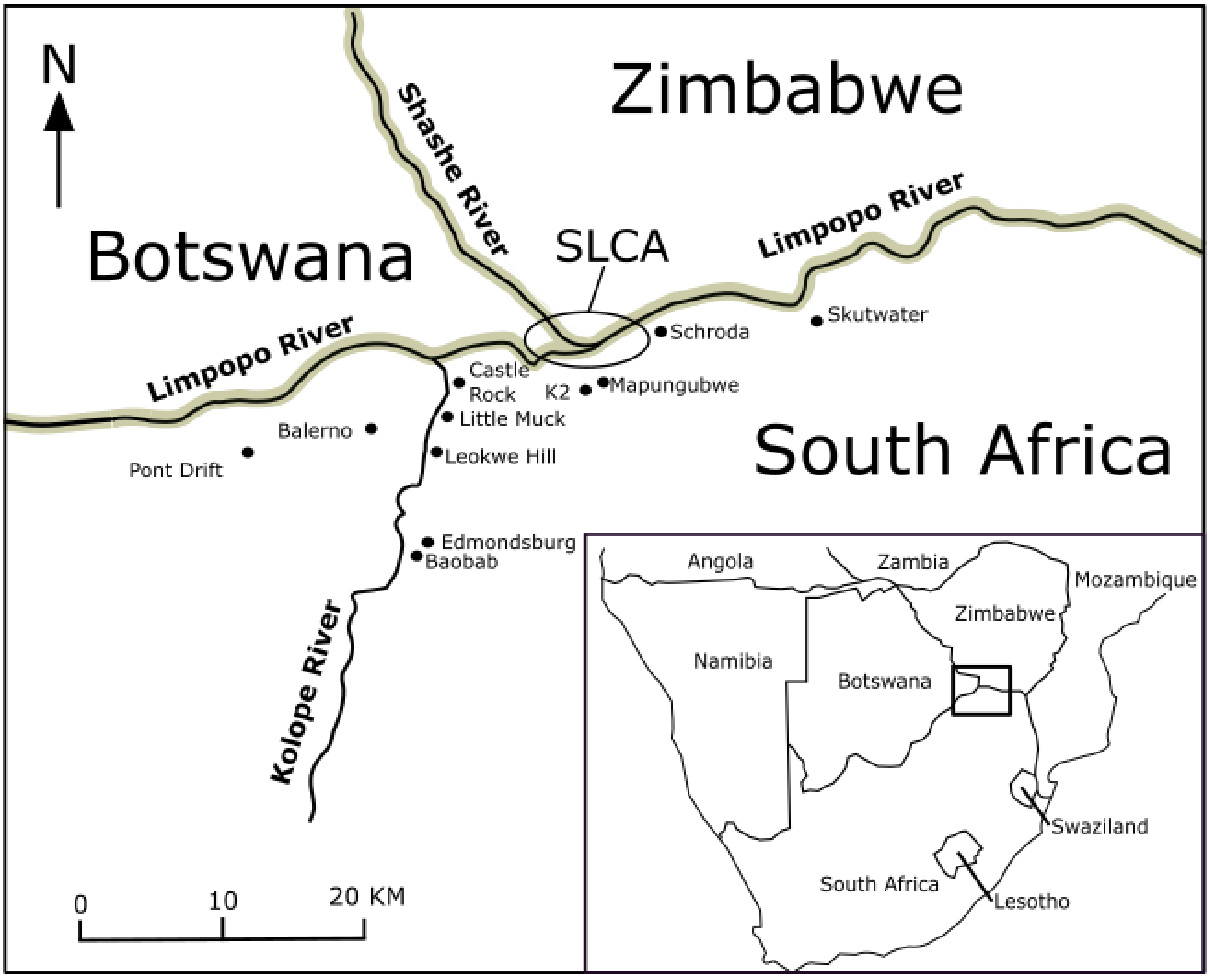


Figure 3.1: Location of K2 and Mapungubwe in the SLCA along with other sites mentioned in the text.

3.1 Occupation history of the Shashe-Limpopo Confluence Area

Occupation of the SLCA dates back to the Early Stone Age, approximately 1 mya (Kuman *et al*. 2005a; Kuman *et al*. 2005b). This area, however, is better known for its Iron Age occupation. The term Iron Age generally refers to the time period associated with the expansion and settlement of Bantu-speaking communities in southern Africa from 200 - 1900 CE. These communities practised metallurgy (iron, copper, and gold), agriculture (sorghum, millet, legumes, and cucurbits), and pastoralism (cattle, sheep, and goats), and lived in permanent and/or semi-permanent settlements.

During the Iron Age, worldview, cattle, and social structures greatly influenced the way settlements were organized. This world view was initially expressed in a Central Cattle Pattern (CCP) settlement layout (Huffman 1982, 2000, 2001). In short, the CCP is characterised by a cattle kraal and assembly area (the court) in the centre, which is surrounded by residential zones (Huffman 2001 Figure 1). Within this settlement structure, the central area is public but considered the domain of men, while the residential zones are private and linked to women (cf. Huffman 2000, 2001). Huffman (1982:140) highlighted the importance cattle played in these early communities, noting their role in acquiring wives and children, and argued that cattle ownership was therefore directly linked to status and power.

Based on changes in settlement layout and ceramic facies, the Iron Age in the SLCA can broadly be divided into Early (200 – 900 CE), Middle (900 – 1300 CE), and Late (1300 – 1840 CE) (Huffman 2007a). The broader Limpopo Valley contains numerous archaeological sites spanning the Iron Age.

During the early part of the Iron Age, the first Bantu-speaking farming communities settled in the Limpopo Valley, around 350 and 450 CE (Huffman 2000: 16, 2007a: 366). These groups are associated with the Happy Rest ceramic facies. The presence of Happy Rest ceramics on Mapungubwe Hill indicates that the early farmers were present in the area. However, these groups did not settle permanently in the SLCA, likely due to poor climatic conditions between 600 and 1030 CE (Holmgren *et al.* 2001; Smith *et al*. 2007).

This period was followed by the Middle Iron Age, a term used by archaeologists to demarcate the period associated with the development of social complexity in northern South Africa, southern Zimbabwe, and eastern Botswana. It was during this time that the agriculturalist presence became abundantly apparent in the archaeological record of the southern Limpopo Valley. The distribution of ceramic facies, stratigraphic records, settlement features, and radiocarbon dates establishes a 400-year Middle Iron Age chronology divided into four periods: Zhizo (900 - 1000 CE), K2 (1000 - 1220 CE), Transitional K2 or TK2 (1200 - 1250

CE), and Mapungubwe (1250 - 1300 CE) (Meyer 1998; Vogel 1998, 2000; Huffman 2007a; Van der Walt 2012). Collectively, the periods encompass the social, economic, and political development of the Mapungubwe polity.

Around 850-900 CE, groups producing Zhizo ceramics entered the area (Huffman 2007a: 366). The semi-arid climate was still unsuitable for agriculture (Smith *et al*. 2007) and occupation of the area likely relates to broader economic factors such as hunting and trading between the interior of northern South Africa and the Eastern Coast (Huffman 2000, 2007a, 2008; Smith 2005; Forssman *et al*. 2014). Large quantities of exotic glass beads and ivory objects recovered at the settlement of Schroda provide the earliest archaeological evidence connecting the SLCA with Indian Ocean trade networks (Wood 2000, 2011; Hanisch 2002). The wide distribution of these Zhizo-period glass beads could indicate that Zhizo groups traded them for grain with groups outside the basin (Huffman 2007b: 165). Due to Schroda's large size and links with the Indian Ocean trade networks, Schroda has been interpreted as the main economic and political centre of the Zhizo-period (900 – 1000 CE) within the valley (Huffman 2000, 2007a; Hanisch 2002).

From about 1000 CE, a noticeably different ceramic facies - Leopards Kopje - appeared in the region, which is linked to the arrival of new groups of people (Huffman 2007a: 371). During this time, the settlement of K2 (Bambandyanalo) was established as the regional capital. Huffman (2004, 2005) argued that the increase in wealth from the Zhizo communities precipitated the arrival of Leopards Kopje groups into the region where they soon took control of trade networks. Some Zhizo communities were displaced from the Limpopo River Valley, while others remained in the area, continuing alongside the Leopard's Kopje communities (Calabrese 2000a: 206; Raath 2014: 13). The close interaction between Zhizo and Leopards Kopje (K2) communities is seen in the development of the Leokwe ceramic facies which incorporates both Zhizo and K2 stylistic elements. These ceramics were seemingly used by the descendants of Zhizo communities who remained in the Limpopo Valley for two centuries and had effectively become a subordinate class in SLCA society (Calabrese 2000a; Huffman 2007b).

Improved climatic conditions around 1030 CE (Smith *et al*. 2007) allowed for the cultivation of the fertile Limpopo floodplain by K2 groups resulting in increased agricultural production and growing population numbers. Based on the size of K2 and the significant amount of exotic and local trade goods such as glass beads, shell disc beads, ivory, and metal jewellery recovered, it seems that the settlement served as an important economic and political centre in the region.

During K2's occupation, important social changes was taking place and these changes were reflected in settlement layout. The K2 settlement was originally organised according to the CCP (p.20). Within this settlement layout, the K2 central midden would have been related to the men's assembly area where political activities took place (Huffman 1982: 143). The size of this midden is therefore directly related to the number of assemblies held there. The midden became so large the cattle kraal was moved further south. By 1150 CE, the second cattle kraal was abandoned and the midden eventually engulfed the area. This was a direct result of the settlement's political importance. The court activities were so extensive, the adjacent midden eventually engulfed the cattle kraal and the cattle were moved away (Huffman 2007a: 373).

The change in settlement layout was the result of important social changes taking place within K2 society. The central cattle kraal represented an assembly area for all people, irrespective of rank, while cattle bound people together because cattle were exchanged for people. Moving the second kraal at K2 represented a change in social-organization; fragmenting the common ground between the ruling elite and commoners. The court was no longer associated with the cattle kraal and became a place for common people. According to Huffman (2007a: 373) this change in court function indicate the manifestation of social ranking and represents the beginning of class distinction between commoners and their ruling elite. Huffman (1982, 2007a, 2007b) argued that as class distinction was evolving within K2 society, the traditional CCP settlement layout was no longer suitable.

Around 1220 CE the K2 settlement complex was abandoned in favour of Mapungubwe Hill, a rainmaking hill approximately 2km away (Meyer 2000: 10; Huffman 2009: 7). During the occupation of K2, small communities had occupied areas at the base of Mapungubwe Hill (Southern Terrace). However, with the eventual abandonment of K2, occupation around the Hill intensified, while the elite segments of society relocated to the summit of Mapungubwe. This shift marks the first time where the leadership physically separating themselves from the rest of the community, marking the full materialization of class distinction (Huffman 2000, 2007a, 2009). Furthermore, by establishing themselves on a rainmaking hill (cf. Schoeman 2006), the leader acquired the 'power of the place' (cf. Huffman 2007a; Scarre 2011) and established the beginning of sacred leadership.

Although Mapungubwe Hill was only occupied for roughly 70 years, from 1220 to 1290 CE, the site demonstrated the effects of significant changes in social organization that took place in the society. The spatial changes that occurred, first at K2 and then with the shift to Mapungubwe, represent the evolution of a new elite settlement pattern – the Zimbabwe Pattern (ZP) (Huffman 2007a: 373). Mapungubwe was abandoned around 1300 CE. Reasons for its decline is unclear. It was previously thought to be linked to less rainfall limiting successful food production (Tyson & Lindesay 1992; Huffman 1996, 2000), but Smith *et al*. (2007) showed that drier conditions only became more common after 1450 CE. Others stress the importance of broader economic and political factors, or a combination of environmental factors and changing trade patterns as an explanation for the decline of the Mapungubwe state (Hall 1987; Pikirayi 2001; Mitchell 2002; Kim & Kusimba 2008).

The period between the 9th and 13th century CE in northern South Africa saw significant changes in worldview, an increase in social complexity, and the rise of Southern Africa's first state-level society. Within this time period, settlements such as K2 and Mapungubwe showed significant changes in social and political structures. It has been argued coastal trade items enhanced the status of the elite, resulting in increased social stratification (Hall 1987; Huffman 1982, 2007a). This process developed at K2 and fully materialised itself at Mapungubwe. These subsistence practices and the participation in trade with Indian Ocean trade communities helped to support a growing Iron Age population and the development of increasingly complex social structures (Hall 1987; Meyer 1998; Huffman 2009).

3.2 Chronology and occupation phases

3.2.1 Ceramic facies and exotic glass bead series

Investigating the spatial and temporal distribution of material culture, particularly ceramic styles, is a useful way to reconstruct the past. Schofield, who first provided a report on the ceramic assemblage, created a typology based on vessel shape, rim shape, decoration, colour, and surface finish. From this, the Greefswald ceramic assemblage was divided into classes: Class M2 from K2 (K2 ceramic facies), M1 from Mapungubwe (Mapungubwe facies), and M3 which consisted of imported wares (Schofield 1937: 40-41; Meyer 1998: 196).

Meyer (1980) defined a typological sequence for the Greefswald sequence and distinguished the K2 ceramic series and the Mapungubwe ceramic series. Meyer also confirmed that the K2 and Mapungubwe ceramics formed part of the Leopard's Kopje branch and represented the southern variation of Leopard's Kopje A (K2) and Leopard's Kopje B (Mapungubwe) (Meyer 1980; cf. Robinson 1965, 1966, 1967, 1968; Huffman 1974, 1978).

Based on the distribution of ceramic facies, Meyer (1980: 49-50) divided the occupation of the main Greefswald sites of K2 and Mapungubwe into "main layers" or Strata, each representing possible occupation periods. Occupation on K2 was divided into three Strata, while Mapungubwe Hill and the Southern Terrace into four Strata. According to Meyer (1980: 159) the vertical distribution of ceramics on K2 presented no statistically significant changes and were therefore considered to represent a homogenous assemblage belonging to a single occupation period. Ceramics from the different Strata can therefore be regarded as a single Strata represented by the K2 facies. The vertical distribution of ceramics on Mapungubwe presented significant differences in ceramic form and decoration between its Strata. Meyer (1980: 159) therefore suggested each Strata represents a separate occupation phase: Strata 4 (the K2 facies), Strata 3 (mainly K2 / few Mapungubwe ceramics), Strata 2 (mainly Mapungubwe / few K2 ceramics), and Strata 1 (the Mapungubwe facies). Meyer (1998: 181-182) formalised this sequence and divided the occupation of K2 and Mapungubwe into four occupation phases: Phase I (Early Iron Age Happy rest ceramics), Phase II (K2 facies, 1030 - 1220 CE), Phase III (K2 / Mapungubwe ceramics, 1220 - 1250 CE), and Phase IV (the Mapungubwe facies, 1250 - 1290 CE).

Meyer (1980) and Eloff and Meyer (1981) recognised several changes in ceramic style, particularly during Phase III, but attributed these changes to an influx of people. More recently Huffman (2007a, 2007b) identified the changes as a transitional phase between K2 and Mapungubwe – Transitional K2 (TK2) (cf. Van der Walt 2012). This phase dates roughly to around 1200 and 1250 CE.

Wood’s (2005, 2011) analyses of morphological changes in exotic glass beads further refined this chronology and identified six “temporally-sensitive” bead Series. These helped refine the chronology for K2 and Mapungubwe and place them within the larger regional setting (Wood 2005: 2).

The **Zhizo** bead series is dated to around the 8th to mid-10th century CE (Wood 2011: 73). The series is characterised by small to medium untreated drawn beads with blue being the most common colour. The brownish-red, black, and white glass beads did not occur within this series. The second series, the **K2 Indo-Pacific (K2-IP)** bead series, previously termed K2 series (Ibid.: 71), first appear around the mid-10th century CE and was exported roughly until the end of the 12th century CE. The series is characterised by minute to small drawn beads that have been lightly rounded by heat treatment. Various shades of blue-green dominates this series (Ibid.: 75).

The third series, the **East Coast Indo-Pacific (EC-IP)** bead series, previously termed Indo-Pacific series (Wood 2011: 71), appeared shortly after the K2-IP series. The series consisted of a wide range of colours but is well known for the opaque brownish-red beads. These specific beads arrived later in the series and dominated the EC-IP series by the time the K2 capital was relocated to Mapungubwe. The fourth series, the **Mapungubwe Oblate** bead series, arrived in the SLCA from the mid-13th century CE and completely replaced imports of the East Coast-IP series (Ibid.: 76). The series is characterised by small, drawn oblate beads of uniform shape and consisted of a wide range of colours with black being the most popular.

3.2.2 The Greefswald settlement chronology

Phase I represents the oldest Iron Age materials found on Greefswald. This consist of a small number of Early Iron Age potsherds recovered from the base of the sequence in layer 17 of Square K8 on the Southern Terrace and layer 11 from MK1 on Mapungubwe Hill (Meyer 1998: 181). The material remains from this early phase are assumed to represent Mapungubwe's use as a traditional rainmaking site (cf. Meyer 1980; Nienaber & Hutten 2006; Huffman 2007b; Van der Walt 2012).

Phase II, dating between 1030 and 1220 CE, represents the main occupation phase at K2, and the bottom layers on Mapungubwe Hill and the Southern Terrace. This phase is associated with the K2 ceramic facies and the accumulation of thick deposits on K2. Here, intensive occupation resulted in a prominent vertical succession of gravel floors and hut remains, and the accumulation of thick midden deposits in, and around, the central homestead. During the early to mid-Phase II, the K2-IP bead series dominates with fewer Zhizo and EC-IP beads (Wood 2005). Phase II deposits from Mapungubwe are sparse. These deposits consist of similar hut remains observed at K2 and are restricted to bottom layers on the Southern Terrace in square F4, H5, K8, and MST1, and MK1 on Mapungubwe Hill (Meyer 1998: 181). Material culture relating to this phase is relatively denser on the Southern Terrace than the Hill. The low-density distribution of material likely indicates that occupation of the Hill only commenced toward the latter part of Phase II or early TK2 period (Meyer's Phase III) (Meyer 1998: 181; cf. Huffman 2007b: 170).

Phase III of the settlement sequence dates from 1200 to 1250 CE. Meyer (1998: 182) separated this occupation phase from preceding and succeeding deposits based on several layers of burnt hut rubble and settlement features. He therefore subdivided the phase into two parts; Phase III (a) for the older deposits and Phase III (b) for the more recent.

During phase III (a), settlement was discontinued on K2 and intensified on the Southern Terrace as the K2 community relocated to Mapungubwe. Changes in ceramics style at the end of Phase II suggests the occupants of K2 started making TK2 ceramics before the site was abandoned for Mapungubwe (Huffman 2007b: 170). Wood (2005, 2011) similarly identified the EC-IP bead series as a transitional phase between K2 and Mapungubwe, where it dominates top layers at K2, but the bottom layers at Mapungubwe.

Deposits dating to this phase consisted of a thick accumulation of household structures on the Southern Terrace, such as red and light-yellow mudstone gravel floors, hut remains, and midden materials. The phase is associated with TK2 ceramics (Huffman 2007b; Van der Walt 2012) and a glass bead assemblage dominated by EC-IP beads (Wood 2005, 2011). By this time the K2-IP glass beads were no longer being imported and their continued presence within the deposit suggest they were passed down from generation to generation (Wood 2005: 144).

The first housing structures on Mapungubwe Hill appeared during the early part of Phase III but were restricted to the western end. Here, Gardner (1963) described the remains of large hut structure, which Huffman (2009: 7) interpreted as the first king's house. Material and structural remains in the centre of the Hill suggests that rainmaking activities still took place there (Ibid.: 10).

Occupation intensified on Mapungubwe during Phase III (b) with deposits on the Southern Terrace containing the remains of large double-walled huts and a succession of floors of red mudstone and mustard yellow dolerite gravel. According to Wood (2005: 135-137), the EC-IP glass beads start to decrease while the Mapungubwe Oblates make their first appearance between 1230 and 1240 CE. During the latter part of Phase III (b), free-standing stonewalls and stone terrace walls were constructed on the Southern Terrace and Mapungubwe Hill (Meyer 1998: 182, 2010).

A stonewalled palace was also constructed on top of the old rainmaking area towards the centre of Mapungubwe Hill around 1250 CE (Meyer 1998: 182). Here, the palace provided ritual seclusion for the leader and signified the beginning of sacred leadership as its location - and the leader - was directly associated with rainmaking (p.22; cf. Huffman 2007b).

Settlement Phase IV dated from 1250 to 1290 CE (Meyer 1998: 182). By this time, the TK2 facies changed into the Mapungubwe facies (Van der Walt 2012: 24), and Mapungubwe Oblates dominate the glass bead assemblages (Wood 2005, 2011). The deposits dating to this phase predominantly consisted of thin, uneven dolerite gravel floors with scattered remains of circular stone structures on the eastern section of Mapungubwe Hill. Meyer (Meyer 1998: 182, 2010: 253-254) described these structures as possible grain storage huts constructed towards the end of Phase IV. The stone walls constructed during Phase III (b) were initially used by the occupant during the early part of Phase IV but were eventually covered by soil deposits on Mapungubwe Hill and the Southern Terrace. Both Eloff (1979 Vol II) and Meyer (1998) describe a distinct lack of significant structures constructed during Phase IV. Eloff (1979 Vol II: 377) went so far as to describe Phase IV as less prosperous compared to previous phases. He describes a decline in agricultural production and the discontinued use of stone structures and stone walls (Ibid.).

3.3 Site background

Since the discovery of Mapungubwe in 1932, the farm Greefswald 37 MS has been excavated and researched extensively. This extensive research history took place over four phases (cf. Meyer 1998: 17 and Table 2.1). The early research phase (phase one) consists of excavations from 1933 to 1935 carried out by I. Fouchè, B.D. Malan, F.J. Tromp, and C. Van Riet Lowe. These excavations were mostly trial pits and test trenches concentrating on the grave area on Mapungubwe Hill and the western ascent to the hilltop from the Southern Terrace (Fouchè 1937: 5). During the 1934 investigations, the site of K2 was discovered approximately 2km to the south-west of Mapungubwe with small-scale test excavation carried out. From 1935-1940, G.A. Gardner continued excavations on Mapungubwe and K2. The goal of these excavations was to establish a chronology for the site to better understand the cultural development of its occupants (Ibid.).

Research phase two took place from 1953 to 1954 by P.J. Coertze and H.F. Sentker who focussed on the Southern Terrace in an attempt to establish a detailed stratigraphy (Meyer 1998: 24). Scant research was conducted on the Greefswald sites during the 1940's and 50's due to economic constraints (cf. Eloff 1979 Vol 1: 66).

Thereafter, excavations continued on Mapungubwe Hill and the Southern Terrace during research phase three between 1970 and 1995 by A. Meyer and J.F. Eloff (Meyer 1998: 26). Between 1970 and 1984, excavations continued on K2, and consisted of Rn1, Rn2, and test trenches TS1-TS6, while on Mapungubwe Hill, MK1 and MK3 was excavated in 1973. On the Southern Terrace, squares E2, F4, H5, and K8 was excavated. Between 1991 and 1995 the Greefswald sites were surveyed and mapped, while the University of Pretoria's Department of Anatomy conducted supplementary test excavations to recover and record additional human skeletons (Ibid.: 34). On K2, the excavation of TS2 was extended and Rn3 was excavated.

Research phase four took place between 1996 and 2000 during which excavation continued on Rn3 on K2 and MK4 on Mapungubwe Hill. Between 2002 and 2003, a preservation project was initiated on Mapungubwe Hill and the Southern Terrace to stabilize old open excavations and implement conservation measures to protect the remaining archaeological deposits (Nienaber & Hutten 2006).

3.3.1 The K2 complex

The K2 complex lies at the base of Bambandyanalo Hill, approximately 2km south-west of Mapungubwe (Figure 3.1, p.19). The site lies in a sheltered valley surrounded by sandstone cliffs and covers an area of approximately five hectares. Since its discovery, K2 has undergone extensive excavation until the early 2000's. These included multiple test trenches (TS), test pits (TG), and large excavation units (Figure 3.2, p.29). However, due to a lack of context for many of these early assemblages (see p.54 for sampling methods), only specific excavation units were selected for analysis in this study - TS1 to TS6, and Rn2.

The K2 site complex can be divided into several components: a large central midden, a central cattle kraal, a large central homestead with smaller adjacent middens, a north-eastern settlements area on the slope of Bambandyanalo Hill with adjacent middens at the base of the slope, a Western settlement area, a Northern homestead, and an Eastern peripheral midden (K1) (Meyer 1994, 1998). The units included in this study date to Meyer's (1998) Phase II of the Greefswald settlement chronology (p.25). The excavation methods and contextual information for these units were retrieved from Eloff (1979 Vol 1) and Meyer (1994, 1998).

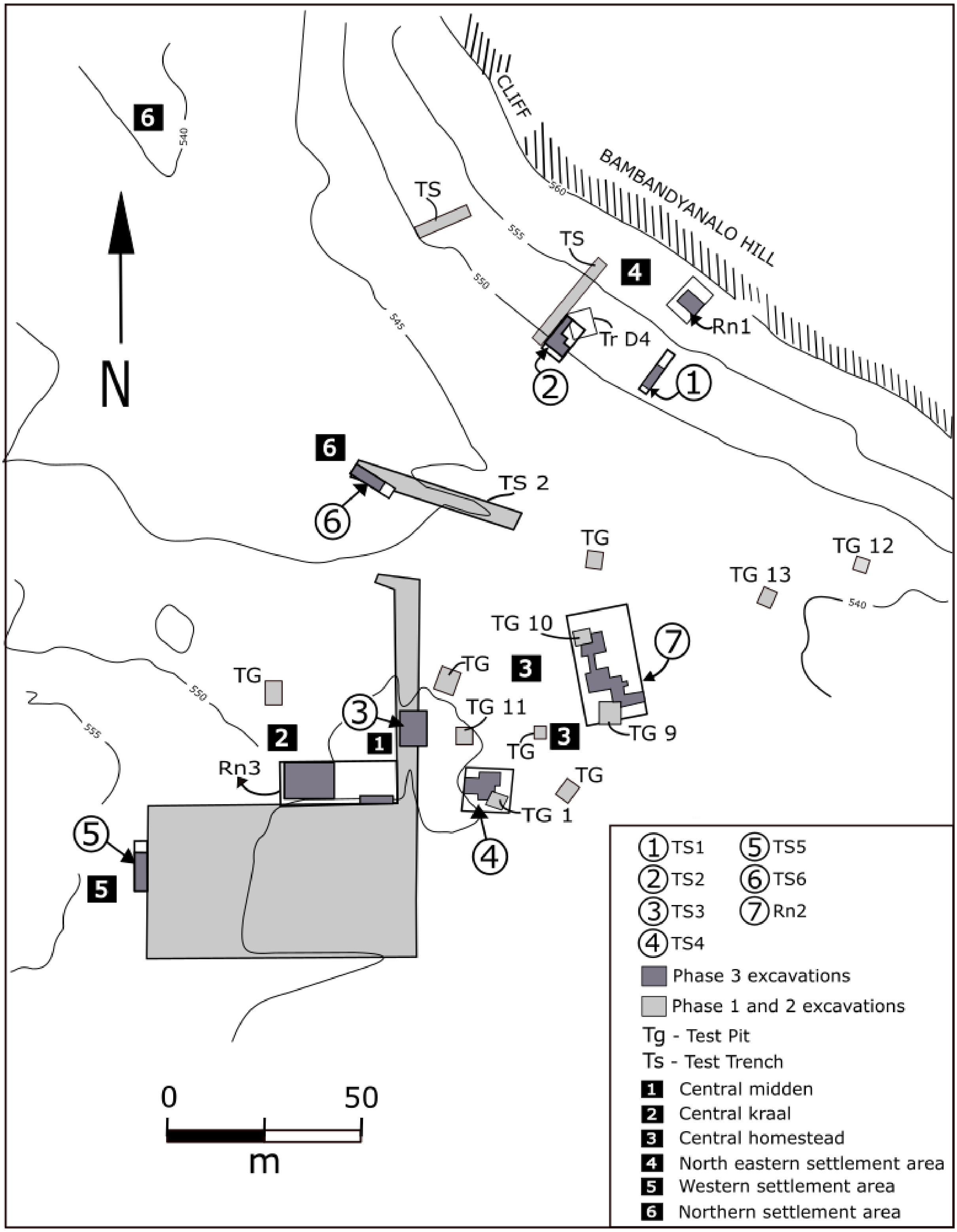


Figure 3.2: K2 site map showing layout of excavated areas. Map: adapted from Meyer (1998: 61).

Units in the central midden and kraal area

TS3, located in the collapsed eastern wall of Gardner's TS1 trench from 1935 (Figure 3.2, p.29), was initiated to obtain detailed information on the midden deposits exposed in Gardner's trench. Excavated during the research phase three by A. Meyer, it initially consisted of a 9m x 3m trench, subdivided into squares of 3m x 3m labelled square 01, 02, A1, and A2 (Figure 3.3). Damage caused by spring hares in square A1 was so severe, the excavation was discontinued after layer 3. After removing 10 layers from the adjacent squares, it was decided to restrict the remainder of the excavation to a test pit (2m x 1.50m) in Square 02. Here, layers 11 to 24 were removed. Two profile drawings were recorded for TS3: profile 1 (B1-B2-B3-A3) for the first 10 layers, and profile 2 (02/A-02/B-02/C-03(02/D)) for layer 12 to 24. SDB were likely recovered from all the excavated layers, but beads for layer 4, 16, 18, 21, 22, 23, and 24 could not be located. Similarly, SDB were only present for square 01 and 02. No beads were located for square A1 and A2 within the assemblages. It is highly unlikely that these squares contained no SDB.

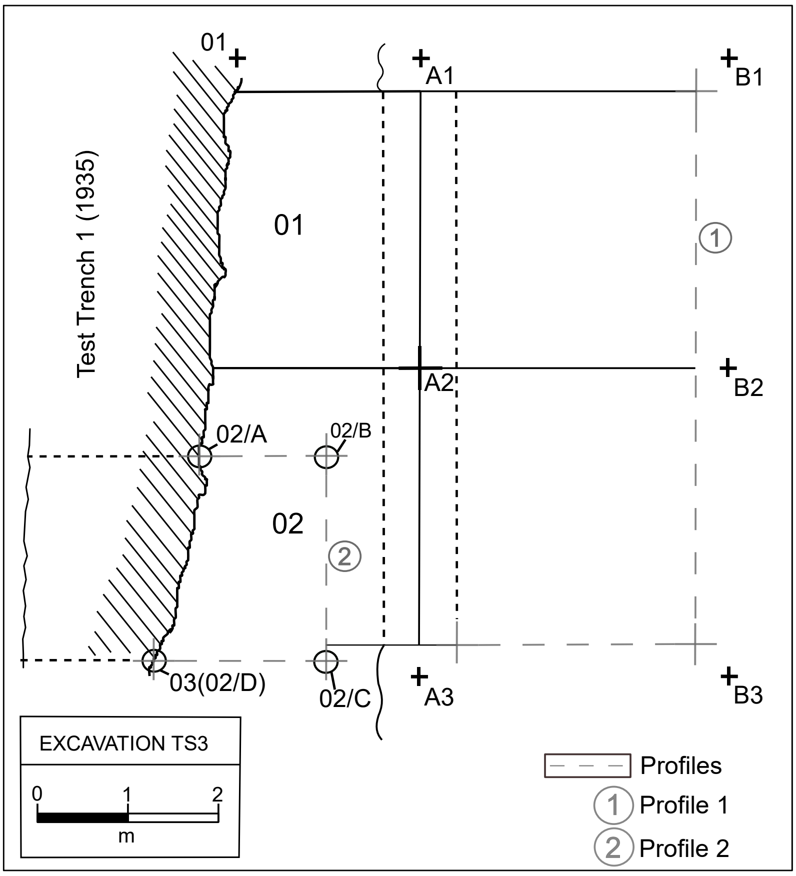


Figure 3.3: Layout of excavation grid TS3. Schematic: adapted from Meyer (1998: 66, 68).

Units in the central homestead area

Rn2 was excavated during research phase three by J.F. Eloff to investigate and record the stratigraphic contexts still visible in the profile of Gardner's previous test pit (TG 10) excavated in 1935 (Figure 3.2, p.29). It was initially limited to the excavation of a single square with the express aim to expose and record household structures. This excavation was subsequently expanded by creating a 33m x 15m gridded area called Rn2. The grid was subdivided into 3m x 3m squares with Gardner's earlier excavation, TG 10, located more or less within square B3 of Rn2 (Figure 3.4, p.32). To locate structures, several small test trenches were excavated. Once a structure was found, the excavation was extended into the surrounding grid units to expose the rest of the remains. As a result, many of the squares were only partially excavated, both in terms of surface area and layers. Only the first three layers were removed. Older layers 4 and 5 were only exposed in the small test trenches, and were never excavated beyond these. Several profile drawings were recorded for Rn2: profile 1 (B9/C9-B10/C10), profile 2 (A8/A9-B8/B9), profile 3 (A9/A10-A9/B9), profile 4 (C5-C6-C7-C8-C9), and profile 5 (D7/E7-D8/E8-D9/E9).

TS4 was excavated during research phase three by A. Meyer in 1972 and again in 1976 to expose gravel floors still visible in the profile of Gardner's 1935 test pit TG 1. Excavations initially consisted of a 15m x 12m grid subdivided into 3m x 3m squares (Figure 3.5, p.32). Squares A2 and A3 were fully excavated to a sterile base, while Square B2 and B3 was only partially excavated up to layer 4. The grid was eventually extended in 1976 to a 15m x 12m grid. Squares A1, B1 and part of squares A0, B0, C0, and C1 were fully excavated to a sterile base. Square 01 and 02 were only excavated up to layer 3.

The layer numbering from excavations performed in 1976 did not fully correspond with the initial excavations from 1972. The only SDB related to TS4 came from the 1972 excavation of squares A2, A3, and B2. No SDB from the 1976 excavations were located. Reference made to layering of TS4 will therefore exclusively refer to the layers of squares A2, A3, and B2. For further information on layers see Meyer (1998: 81).

Several profile drawings were recorded: profile 1 (A1-B1-C1-D1), profile 2 (A2-A1-A0), profile 3 (A4-A3-A2), and profile 4 (D1/D2-C1/C2-B1/B2-A1/A2). The excavation also uncovered a single grave. TS4.G1 was the grave of a small child and was likely dug during the occupation of layers 1 or 2 (Meyer 1998: 82). Meyer (Ibid.) described ostrich eggshell disc beads decorating the knees and pelvic area. Observation of the photos taken (Ibid.: 92) shows numerous disc beads still stuck together. However, only four ostrich eggshell discs were labelled for this grave. No exotic glass beads were found in association with the skeleton.

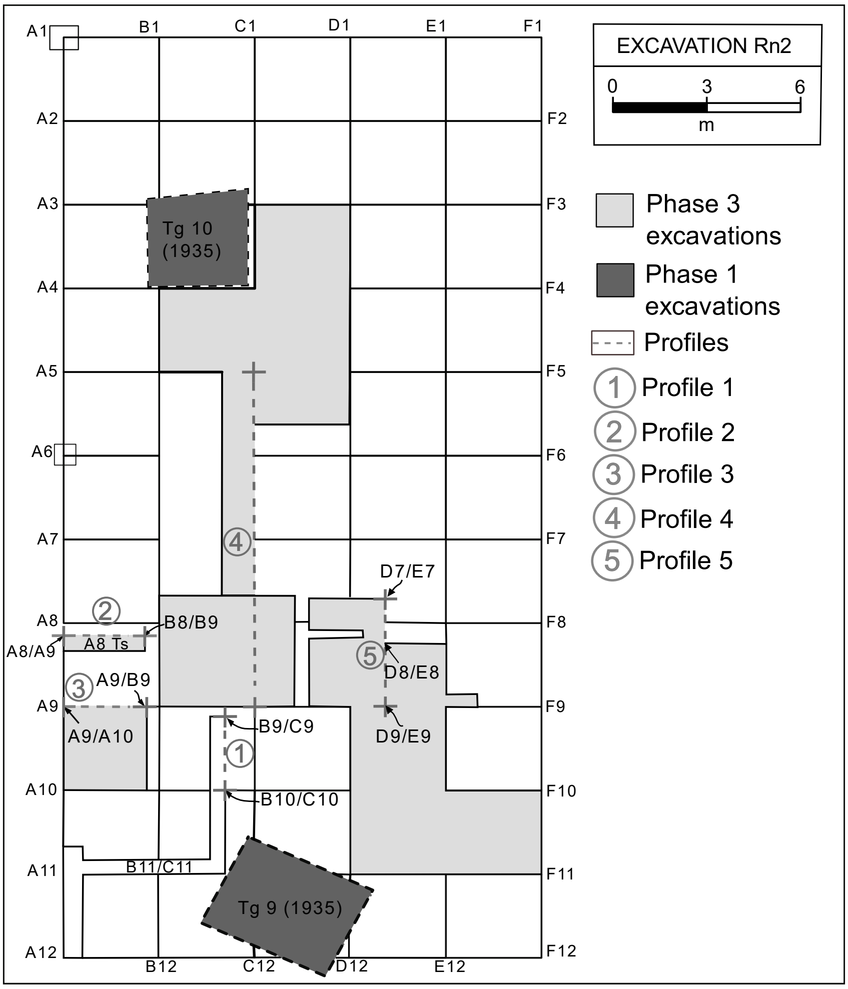


Figure 3.4: Layout of excavation grid Rn2. Schematic: adapted from Meyer (1998:75).

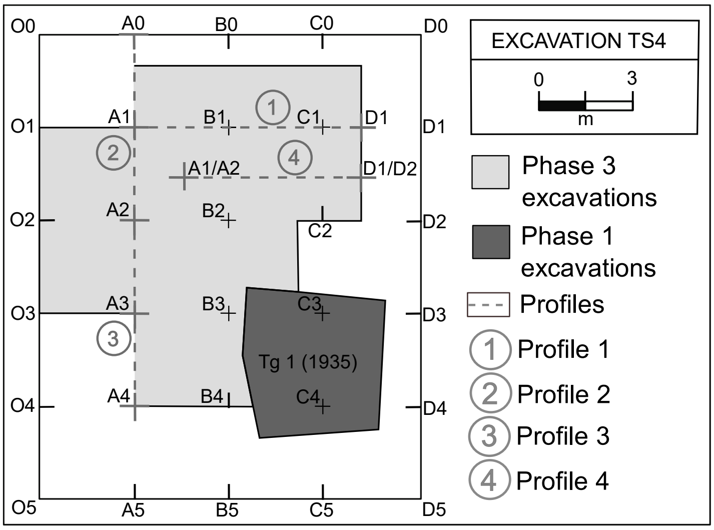


Figure 3.5: Layout of excavation grid TS4. Schematic: adapted from Meyer (1998: 84).

Units in the north-eastern settlement area

TS1 is located on the lower slopes of Bambandyanalo Hill. It was excavated in 1972 to investigate the midden deposits in the eastern part of the north-eastern settlement area (Figure 3.2, p.29). The excavation consisted of a 2m x 14m trench subdivided into blocks of 2m x 2m, of which only squares A4, A5, and A6 were fully excavated (Figure 3.6, p.34). From here, 5 layers were excavated until a sterile deposit on bedrock was reached. SDB were recovered from each of the excavated layers. Two profile drawings were recorded: profile 1 (A7-A6-A5-A4) and profile 2 (B4-B5-B6-B7).

TS2 is located on the lower slopes of Bambandyanalo Hill. It was excavated 1972 by A. Meyer to recover information from an older 1934 trench. TS2 initially consisted of a 2m x 12m trench subdivided into 2m x 2m grids of which squares A1, A2, and A3 were fully excavated. During 1974-1975, the trench was extended into a 6m x 13m grid of which squares A4, B4, A5, B5, C5, A6, B6, and C6 were excavated (Figure 3.7). The excavation uncovered 4 layers in most of the squares. Two profile drawings were recorded: profile 1 (B1-B2-B3-B4) and profile 2 (A4-A3).

Three graves were uncovered in excavation TS2: TS2.G1, TS2.G2, and TS2.G3. All three graves were of small children. TS2.G1 was recovered from the base of the old test trench of 1934 adjacent to square A1. The grave was likely dug during the occupation of layer 3. Wood (2005: 118) described the grave as a typical K2 burial containing many (*n*=606) blue-green glass beads. Meyer (1998: 102) noted a single ceramic bowl included in the grave. Only three SDB were located for this grave - one *Achatina* discs, one ostrich eggshell disc, and a *Unionid* disc.

TS2.G2 was recovered next to profile A3-A4 in the midden deposits from the old 1934 test trench. It was likely dug some time during the occupation of layer 3 (Meyer 1998: 102). Wood (2005: 120-121) dated TS2.G2 towards the end of K2's occupation since the grave contained many (*n*=363) brownish-red glass beads from the EC-IP bead series. The material culture included K2 ceramic vessels and a SDB necklace around the cervical vertebrae (Meyer 1998: 102). The SDB retrieved from the K2 assemblage consisted of *Achatina* (*n*=24) discs, ostrich eggshell discs (*n*=21), and a *Unionid* disc (*n*=1).

The TS2.G3 skeleton was retrieved from profile B4-B5. The child was buried with ceramic vessels, numerous glass beads (*n*=314), a garden roller bead, several cowrie shells, and copper anklets (*n*=5 around each ankle) (Saitowitz 1996: 101; Meyer 1998: 102). Wood (2005: 120-121) described the grave as dating to the last part K2's occupation as the glass beads were dominated by brownish-red glass beads from the EC-IP bead series. In terms of SDB, only a single *Achatina* bead was located for this grave.

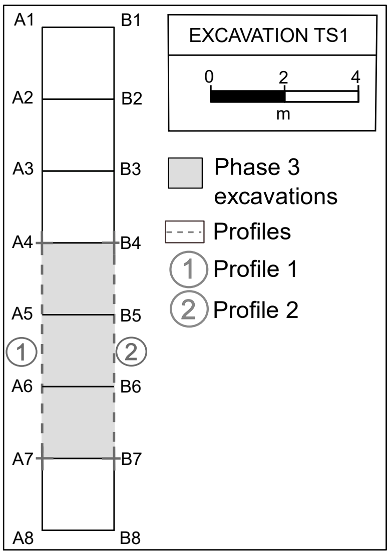


Figure 3.6: Layout of excavation grid TS1. Schematic: adapted from Meyer (1998: 98).

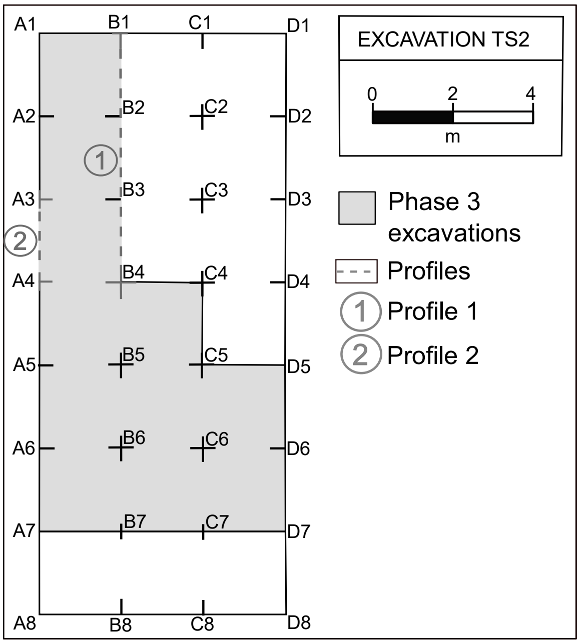


Figure 3.7: Layout of excavation grid TS2. Schematic: adapted from Meyer (1998: 110).

Units in the western settlement area

TS5 was excavated in 1972 by A. Meyer to investigate the stratification in the western peripheral areas of the K2 complex. It was located along the western wall of Gardner's 1936 to 1940 large excavation blocks (Figure 3.2, p.29). The excavation was a 10m x 2m trench subdivided into 2m x 2m squares (Figure 3.8). Squares A2, A3, and A4, were fully excavated during 1972 and removed three layers. Square A5 was excavated in 1993 to locate more skeletal remains (Meyer 1998: 109). Three profile drawings were recorded for TS5: profile 1 (A2-B2), profile 2 (B5-A5), and profile 3 (A5-A4-A3-A2).

Within the assemblage, SDB were recovered from every layer for square A2, A3, and A4. No SDB were located for square A5. It's doubtful that it contained no SDB as Saitowitz (1996: 228) notes glass beads from this square.

The excavation uncovered two graves. TS5.G1 was the grave of a small child in the collapsed wall of Gardner's large excavation block. Only the skull was recovered as the rest of the skeleton was likely removed by Gardner or lost during the collapse of the wall. As a result, no material culture was found in association with the grave save for the fragments of a ceramic vessel around the head (Meyer 1998: 111). The second grave, TS5.G2, was the grave of a small child. The grave was likely dug during the development of layer 1. The child was buried with numerous brownish-red EC-IP glass beads indicating it dates to a later part of K2's occupation (Ibid.). Only two ostrich eggshell disc beads were located for this grave.

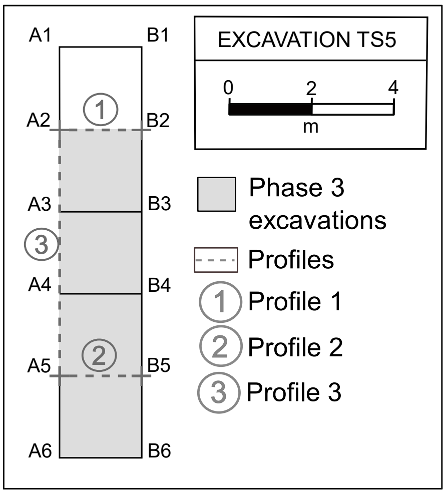


Figure 3.8: Layout of excavation grid TS5. Schematic: adapted from Meyer (1998: 110).

Units in the northern settlement area

TS6 was excavated in 1972 and is located in the south-western wall of Gardner's 1935 Test Trench 2 (Figure 3.2, p.29). It consisted of a 12m x 3m grid subdivided into squares of 3m x3m (Figure 3.9). Here, square A2 was fully excavated to bedrock, uncovering 13 layers, while only the surface deposit was removed in squares A1 and A3. Two profile drawings were recorded: profile 1 (B2-B3) and profile 2 (B3-A3). SDB were recovered from every excavated layer, except layer 9.

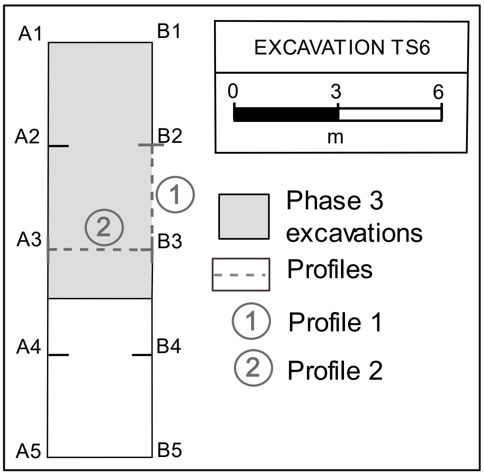


Figure 3.9: Layout of excavation grid TS6. Schematic: adapted from Meyer (1998: 115).

3.3.2 Contextual and chronological description of the K2 site components

The excavation unit Rn2 and TS4 represent the remains of a residential area that formed part of the central homestead area (Meyer 1994: 72, 81). Rn2 revealed two large hut structures with some midden build-up on the outside. TS4 consist of a succession of hut structures and gravel floors. No radiocarbon dates were obtained for Rn2. A bone sample from TS4 layer 4 gave a radiocarbon date of 920±50, 1152-1226 or 1052-1087 CE at 1-sigma (Pta-6073; Vogel 1998: 298).

Since the radiocarbon dates from K2 are often inconclusive (Vogel 1998: 296), Wood (2005) compared the glass bead assemblages from K2 with known glass bead series (p.24) to refine K2's dates and occupation phases. Wood (Ibid.: 122) described the glass beads for Rn2 as "the beginning of a trend that becomes more evident at Mapungubwe: blue-green beads from the K2-IP series decline in numbers while brownish-red and then black from the EC-IP series predominates". Brownish-red beads were recovered from all the excavated layers indicating that the deposits dates to the later part of the K2 occupation (Ibid.: 106). Based on the tables provided by Saitowitz (1996: 227), TS4 likely dates to a similar phase.

TS3 formed part of the large midden area to the west of the central homestead and presents the longest chronological sequence for K2 (Meyer 1998: 63). The deposits consist predominantly of household refuse and ash. Remains of the adjacent cattle kraal were observed in layers 22 and 23. Wood (2005: 122) described the glass beads from TS3 as typical of the overall K2 pattern, dominated by blue-green K2-IP beads. TS3 layer 24 gave a radiocarbon date of 950±50, 1037-1205 CE at 1-sigma (Pta-1226); layer 15 to 970±50, 1029-1180 CE at 1-sigma (Pta-1215); and layer 6 to 970±40, 1033-1173 CE at 1-sigma (Pta-2051; Vogel 1889:298).

TS1 and TS2 formed part of the middens at the base of Bambandyanalo Hill adjacent to the north-eastern settlement area. Both excavations consisted of midden materials with household refuse (Meyer 1998: 95, 99). Wood (2005: 122) described the glass beads for TS2 as typical of the overall K2 pattern whereby the dominant colour profile consists of K2-IP blue-green beads. The colour profile for TS1 is similarly dominated by typical blue-green beads, with a significant percentage of yellow beads (Ibid.: 102, 108). Although the EC-IP brownish-red beads are present in all the layers for TS1 and TS2, they represent a small percentage of the overall colour profile. They generally occur in small numbers concentrated in the top three layers. TS1 layer 2 provided a radiocarbon date of 980±40, 1029-1167 CE at 1-sigma (Pta-1214) and 880±50, 1173-1260 CE at 1-sigma (Pta-6064; Vogel 1998: 298). The only radiocarbon date for TS2 was obtained from excavation TR D4 adjacent to TS2 (cf. Meyer 1998: 107) and dated to 1010±50, 1015-1063 or 1074-1157 CE at 1-sigma (Pta-6576; Vogel 1998: 298).

TS5 consisted of midden materials similar to TS1 and TS2. This unit can be described as an area used to dispose of household refuse and ash. The unit did not produce much in terms of material culture (Meyer 1994: 146). Based on Saitowitz's (1996: 228-229) description of the glass beads, the deposits likely date to a later part of K2's occupation as brownish-red beads occur in all the layers, albeit in low counts, while black beads only appear in layer 1. Overall, the colour profile for TS5 is similar to TS2, one typical of the overall K2 pattern with the dominant colour profile consisted of blue-green beads. A radiocarbon date of 760±50, 1269-1299 CE at 1-sigma (Pta-6570) was obtained from TS5 layer 3. However, Vogel (2000: 56) argued this date be treated as an outlier.

TS6 similarly consists of midden deposits with the possible remains of an old cattle kraal. No structures or hut floors were present (Meyer 1994: 146). According to Saitowitz (1996: 229-230), the EC-IP brownish-red beads first appear in small quantities from layer 7. While the overall colour profile is dominated by the typical K2 blue-green beads, these too occur in small quantities compared to other areas on the site. TS6 layer 7 provided a radiocarbon date of 940±50, 1041-1213 CE at 1-sigma (Pta-6080; Vogel 1998: 298).

Unfortunately, K2's initial occupation falls into a period where the calibration curve is flat and provides indistinct dates (Vogel 1998: 296). Determining the beginning of K2's occupation is therefore difficult. Vogel (Ibid.: 297) places this date around 1030 CE, while the end of K2's occupation, and therefore the end of Meyer's (1998) Phase II occupation phase, can be placed around 1220 CE.

3.3.3 The Mapungubwe complex

The Mapungubwe complex consists of Mapungubwe Hill (MK), the Southern Terrace (MST), the Mahobe site, a southern settlement area, and a settlement on the northern slope of the Hill (Figure 3.10, p.39). Mapungubwe Hill is a sandstone hill with vertical cliffs and a flat summit. This area can only be accessed with specific routes. At the base of the so-called western ascent lies a group of large boulders and the remains of stone walling, marking one of these routes between the Hill and the Southern Terrace (Eloff & Meyer 1981: 10). The route itself consisted of a narrow rock cleft with hollowed out footholds. In his excavation on the summit of Mapungubwe Hill, Jones (1937) described free standing stone walls, terrace walls, gravel floors, and 'cement' pavements. Similar stonewalling and gravel floors were present on the Southern Terrace.

During the early excavations on Mapungubwe Hill in 1932 and 1933, multiple graves were discovered of which three contained objects made of gold (Fouchè 1937; Galloway 1937; Gardner 1963; Meyer 1998; Woodborne *et al*. 2009). Since no gold objects were discovered anywhere else in the Mapungubwe complex, the graves were assumed to contain high-status individuals. It was therefore posited that the Hill complex was inhabited by an elite group, while the rest of the community occupied the surrounding valley floor and neighbouring settlements (Meyer 1998: 116; Huffman 2000: 21; 2007a: 373).

The units included in this study are MK1 and MK3 for the Hill, and squares E2, F4, K8, I9, I10, I11, and J10 for the Southern Terrace. The excavation methods and contextual information for these units were retrieved from Jones (1937), Eloff (1979 Vol 1, 1978, 1980), Meyer (1994, 1998), and Meyer and Cloete (2010).

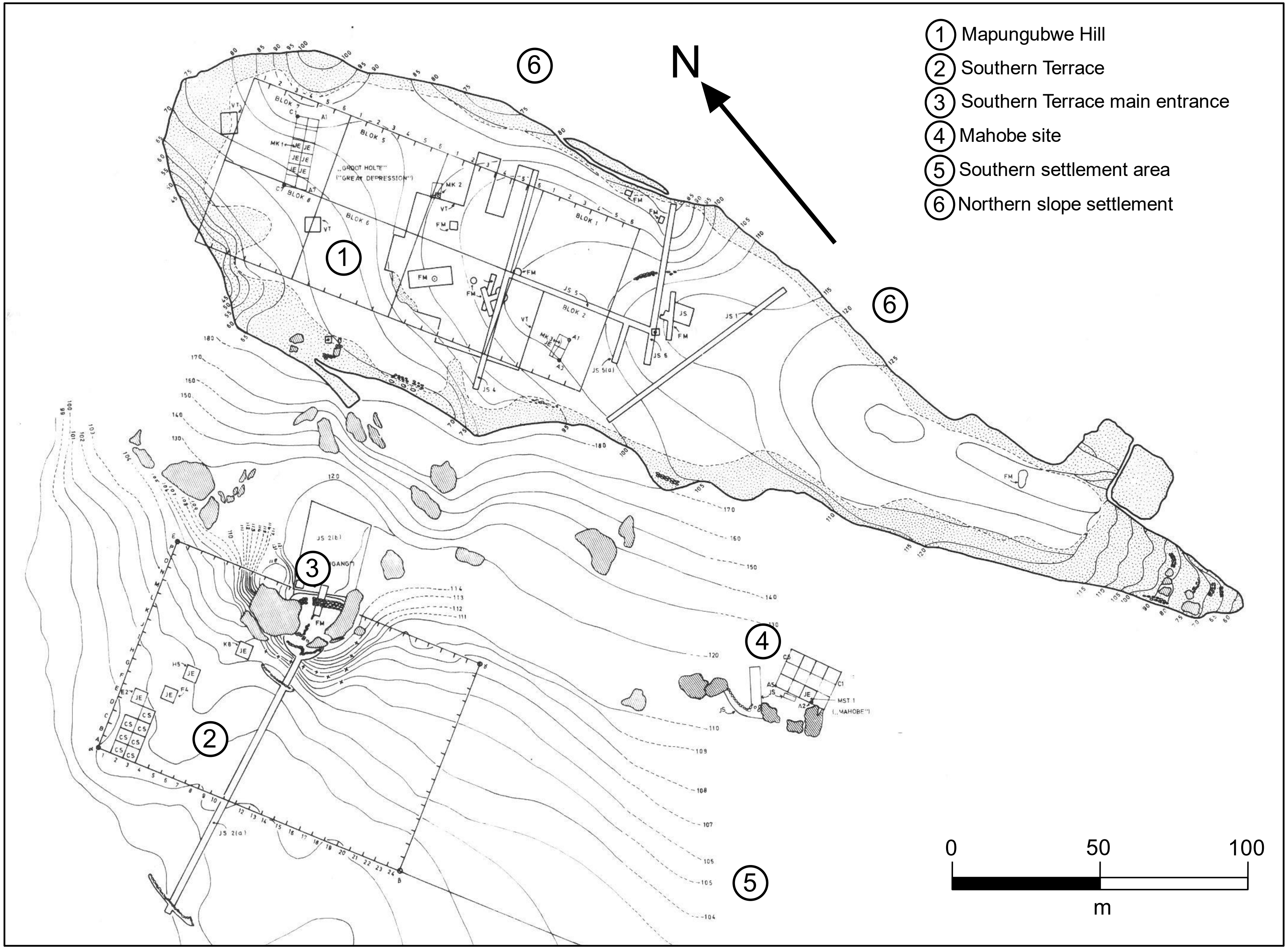


Figure 3.10: Mapungubwe site map with settlement areas. Map: adapted from Eloff (1983).

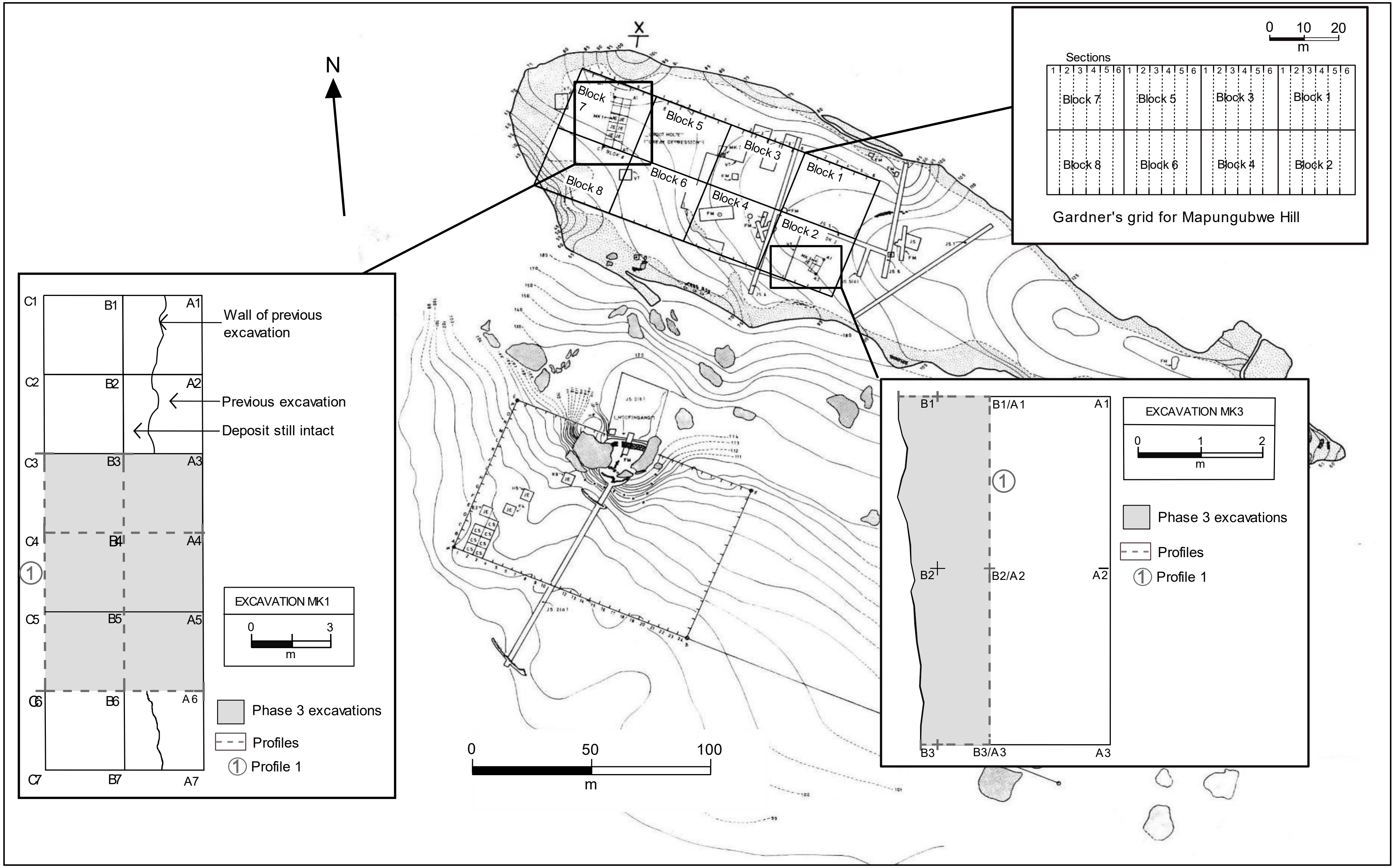


Figure 3.11: Mapungubwe Hill site map with location and layout of the excavations MK1 and MK3. Map: adapted from Eloff (1983). Schematics: adapted from Meyer (1998).

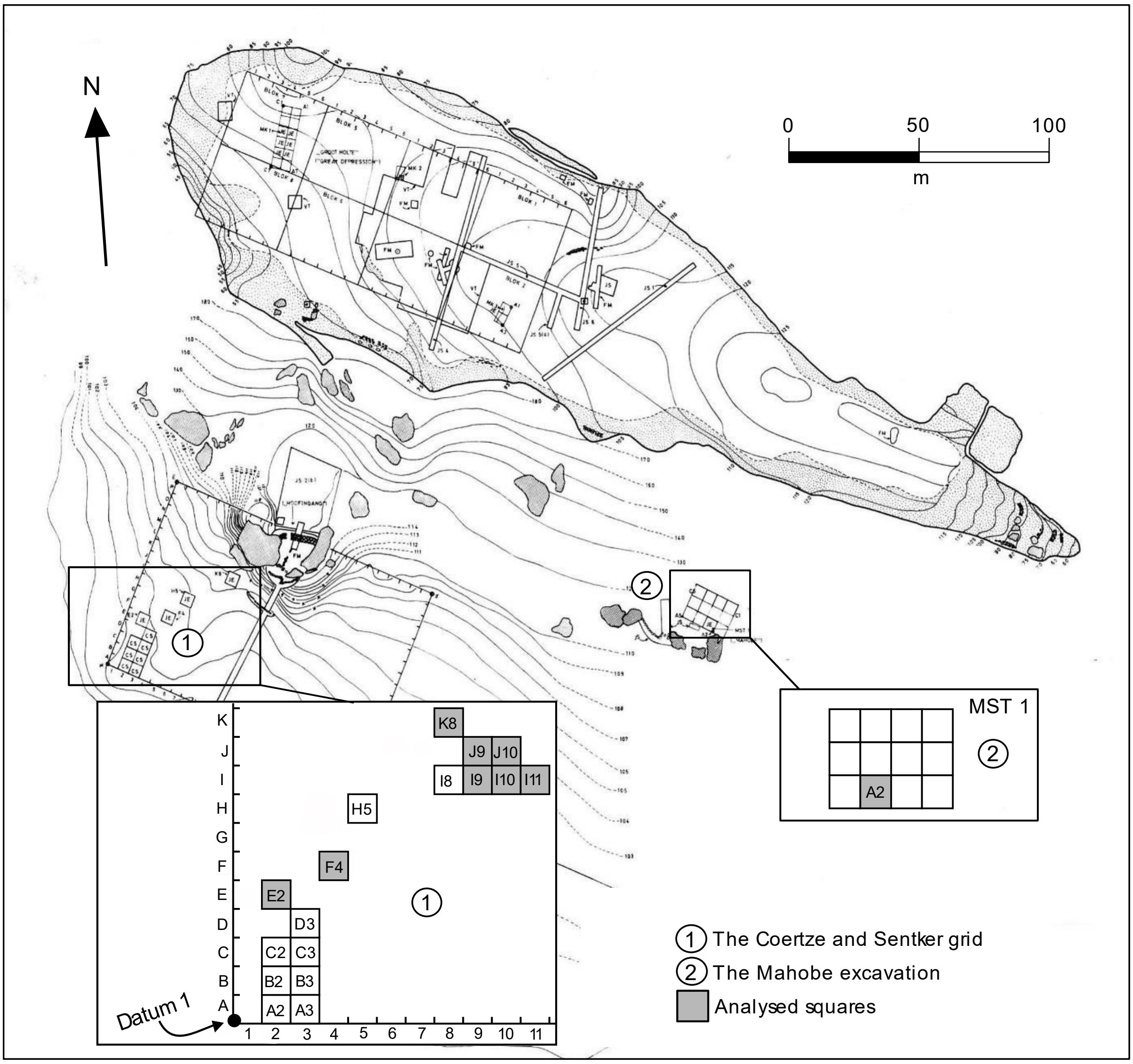


Figure 3.12: Southern Terrace site map showing the location of Coertze and Sentker's (1953) excavation grid and the Mahobe area. Map: adapted from Eloff (1983: 10).

Units on Mapungubwe Hill

MK1, located in the collapsed north-western wall of Gardner's 1935-1940 grid (Figure 3.11, p.40), was excavated in 1973 in order to study and record the remaining intact stratigraphy. Gardner's grid consisted of 8 blocks from where deposits were removed up to section 5 in block 7 (Gardner 1963: 10). MK1 is located in the unexcavated sections (4 and 5) of Gardner's block 7. It consisted of a 18m x 6m grid subdivided into 3m x 3m squares. Of these, squares B3, B4, B5, A3, A4, and A5 were excavated during research phase three. The squares were dug until a sterile base (sandstone rock) was reached, uncovering 11 layers of deposit.

Several profile drawings were recorded throughout the excavation. SDB were recovered from each of the squares and from all of the excavated layers.

MK3 was excavated in 1973 in an attempt to recover part of the eastern wall of Gardner's 1935-1940 excavation. It was a 6m x 3m test trench subdivided into two 3m x 3m squares and placed so as to include the wall of Gardner's old trench. A 1m strip was excavated (indicated in grey) to study the remaining stratified deposits and gravel floors. The excavation uncovered 7 layers (Eloff 1979 Vol 1: 309; Meyer 1998: 139). A profile drawing was recorded from the edge of Gardner's excavation to the edge of the 1m strip. SDB were recovered from every excavated layer from both square A1 and A2.

Units on the Southern Terrace

Coertze and Sentker laid out a large grid on the Southern Terrace between 1953 and 1954 to recover, and record, all cultural material within their exact stratified contexts (Sentker 1953) (Figure 3.12, p.41). The grid was divided into 6ft. x 6ft. (3.66m x 3.66m) squares, with each square excavated as three adjacent strips called L (left), M (middle), and R (right) (Figure 3.13, p.43). Eloff and Meyer continued excavations within the existing grid system using the metric system. They discontinued the L-M-R system and renamed the corners to P-Q-R-S.

Several reference points were used throughout the grid for horizontal and vertical measurements. The fixed point from where all depth measurements were taken consists of Datum 1 (o-vlak in Eloff 1979) in the south-west corner of Coertze and Sentker's grid (Figure 3.12 Datum 1). Measurements above Datum 1 were indicated with a plus sign (+), while those below with a minus sign (-) (cf. Eloff 1979 Vol I: 69). From here, the surface and base of each layer was then measured in relation to Datum 1 on the south-west corner of the grid.

F4 was initially excavated by Sentker in 1953 using the L, M, R system. However, he only excavated the upper layers of the L section to a depth of approximately -87cm and left the rest of the deposits intact (Sentker 1953: 104-117; Eloff 1979 Vol I: 85) (Figure 3.13, p.43). In 1971, Eloff continued excavations in square F4. The collapsed wall of Sentker's previous excavation (now termed profile Y-Z) was removed while the rest of the intact deposit (now termed profile YZ-PS) was removed according to the natural stratigraphy (Eloff 1979 Vol I: 85-86). Subsequently, the remainder of F4 was removed in its entirety to a sterile base, uncovering 10 layers. A profile drawing was recorded for Profile 1 (S-P-Q).

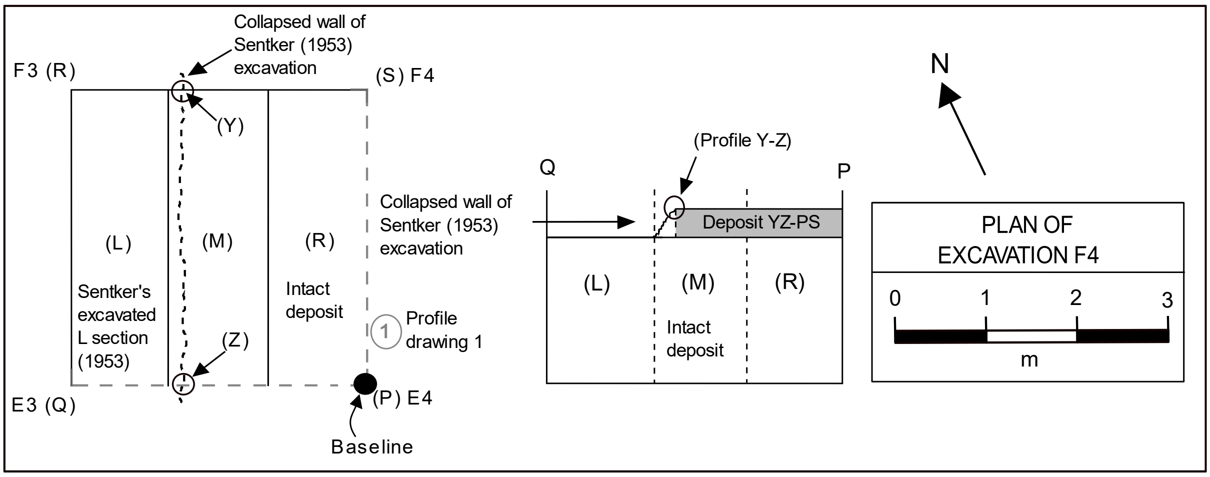


Figure 3.13: Layout of square F4. Schematic: adapted from Meyer (1998: 151).

K8 was excavated in 1971 by A. Meyer (Eloff 1971). The unit was excavated following the natural stratified layers until a sterile base was reached, uncovering 17 layers (Figure 3.14, p.44). A profile drawing was recorded for Profile 1 (Q-R-S). SDB (*n*=194) were recovered from most of the excavated layers for square K8 except for layer 2, 13, and 16. It's doubtful that layer 2 contained no beads and these are therefore likely missing. Layers adjacent to layer 13 and 16 contained very few beads so it is possible that these layers did not contain any disc beads.

Squares ***J10, I9, I10, and I11*** were excavated from 1977 to 1980 by J.F. Eloff (Eloff 1978, 1980). Each square was excavated according to the natural stratigraphy, while arbitrary layers were only used where layers could not be distinguished or where natural layers were too thick. 50cm baulks were left to compare stratigraphy between different units. The stratigraphy of squares J9, J10, I9, I10, and I11 were chronologically linked back to the layers of K8 to better understand the occupation sequence of the Southern Terrace (Table 3.2, p.50). Two profile drawings were recorded linking these stratigraphic units: Profile 2 (I9-J9-X-P-S) and Profile 3 (S-P-X-Y-Z-K10-K11).

A large quantity of SDB (*n*=1606) were recovered from these squares. However, beads from several layers are missing. For squares J10, I9, and I10, beads are missing from layer 4, while the layer 1 beads are missing from squares I9 and I11.

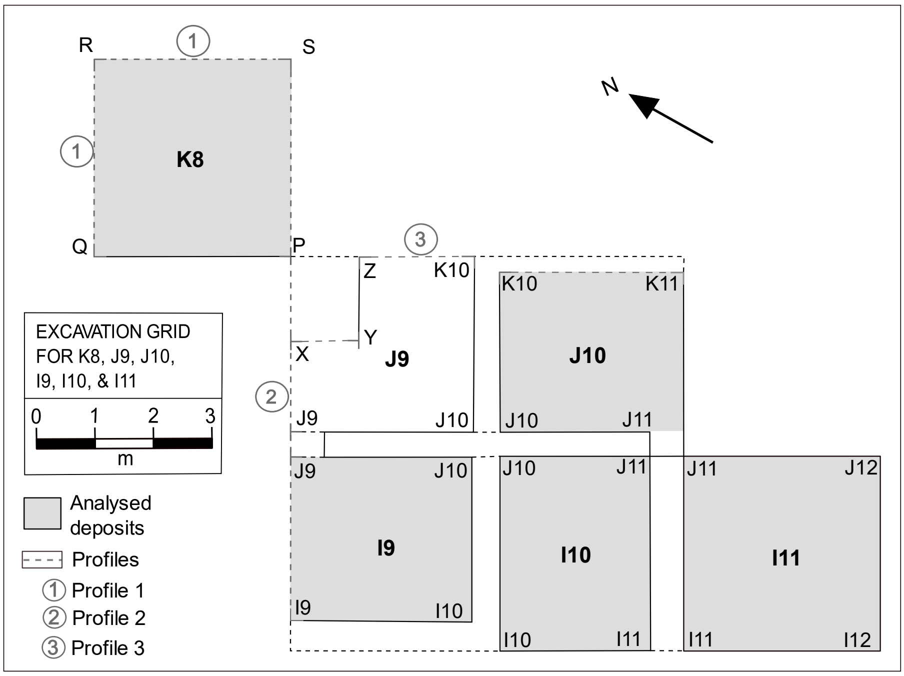


Figure 3.14: Layout of square K8, J9, J10, I9, I10, and I11. Schematic: adapted from Eloff (1980).

E2 was fully excavated to bedrock by J.F. Eloff and students from 1968 to 1970 (Meyer 1998: 26). However, reports documenting the excavation is missing. The only contextual information available consists of the written labels for the materials excavated.

Based on these labels, square E2 was excavated using the old Imperial system in mostly 6” (15,24cm) arbitrary spits. Layers were labelled after the layer’s depth measurements from Datum 1 (e.g. -12”/-18” indicated the top of the layer measured -12” from Datum 1 while the base of the layer measured -18”) (cf. Eloff 1979 Vol I: 69; Sentker 1953). The cultural materials were then sorted and labelled according to these layer labels (Figure 3.18, p.53). Letters were added to layer numbering when referencing specific contexts within the layer (e.g. E2: V1). Many of the square E2 labels contained the letter ‘V’. Eloff (1979 Vol I: 75) indicate that these make reference to floors, where V1, V2, V3 indicates the sequential order (from top to bottom) in which floors were excavated.

From these labels it can be inferred that 13 layers were removed from square E2 to a depth of -66” (-167,64cm) (Table 3.1). From here, SDB (*n*=363) were recovered from each of the levels, except from layer -6”/-12”. The SDB for this layer are likely missing.

Table 3.1: Excavated layers for square E2.

Assigned layer	Phase	Original layer	Top of deposit	Base of deposit	Depth removed
1	IV	+6”/0”	+15,24cm	0”	15,24cm
2	IV	0”/-6”	0”	-15,24cm	15,24cm
3	IV	-6”/-12” missing	-15,24cm	-30,48cm	15,24cm
4	IV	-12”/-18”	-30,48cm	-45,72cm	15,24cm
5	IV	-18”/-20”	-45,72cm	-50,8cm	5,08cm
6	III (b)	-20”/-30”	-50,8cm	-76,2cm	25,4cm
7	III (b)	-30”/-33”	-76,2cm	-83,82cm	7,62cm
8	III (b)	-30”/-34”	-83,82cm	-86,36cm	10,16cm
9	III (b)	-34”/-42”	-86,36cm	-106,68cm	20,32cm
10	III (b)	-42”/-48”	-106,68cm	-121,92cm	15,24cm
11	III (b)	-48”/-54”	-121,92cm	-137,16cm	15,24cm
12	III (a)	-54”/-60”	-137,16cm	-152,4cm	15,24cm
13	III (a)	-60”/-66”	-152,4cm	-167,64cm	15,24cm

MST1 is located on the Mahobe area and was originally excavated in 1934 by Fouchè (1937). Here, a large test pit and two test trenches were excavated (cf. Fouchè 1937 Diagram 4). Eloff continued excavating the area between 1971 and 1973 with MST1 just northeast of the JS3 test trench of 1934 (Figure 3.12, p.41). It consists of a 12m x 9m grid, subdivided into 3m x 3m squares. In this gird, only square A2 (indicated in grey) was excavated (Figure 3.15). The excavation recovered 15 layers. Two profile drawings were recorded: Profile 1 (A2-B2-B3) and Profile 2 (B3-A3-A2). Few (*n*=64) SDB could be securely associated with MST1. These were recovered from layer 1, 2, and 3. Beads from the rest of the layers are likely missing.

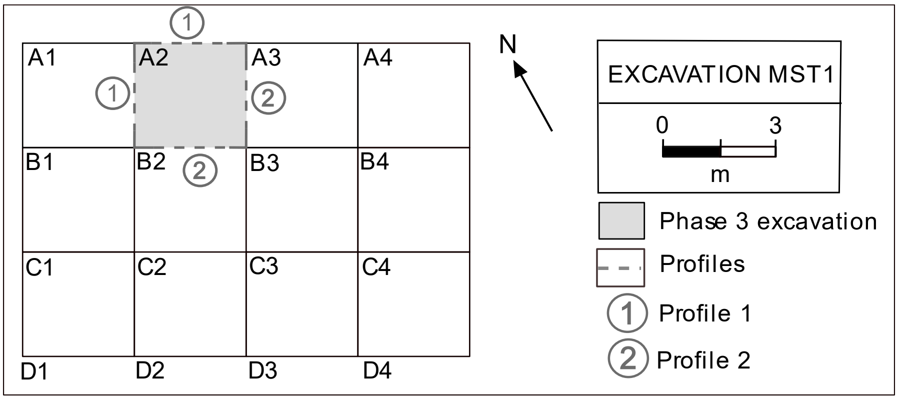


Figure 3.15: Layout of excavation MST1. Schematic: adapted from Meyer (1998: 172).

3.3.4 Contextual and chronological description of the Mapungubwe site components

Based on a detailed stratigraphic study (Meyer 1994, 1998), MK1 can be described as a residential zone consisting of a succession of gravel floors, stone features, stonewalls, and household refuse. These deposits developed from the later part of Meyer's (1998) Phase II to the end of Phase IV (Table 3.3, p.53). MK1 layer 11 was radiocarbon dated to 850±50, 1205-1274 CE at 1-sigma (Pta-1158) and to 840±40, 1220-1274 CE at 1-sigma (Pta-1159; Vogel 1998: 298).

Initial use of the Hill was limited to rainmaking activities during Phase I and Phase II. These activities are represented by Happy Rest and succeeding K2 ceramics found at the base (layer 11) of MK1's occupation sequence. Material culture belonging to these early phases are sparse. While these early ceramics document the first use of Mapungubwe Hill, Huffman (2007b: 170) argues that the transitional phase - Phase III - represents the earliest true occupation. Within a broader settlement chronology for Mapungubwe Hill, several changes in ceramics and glass beads during Phase III accompany key moments throughout Mapungubwe's occupation.

During the early part of the transitional period - early Phase III (a), the material culture was still sparse compared to later phases as represented by MK1's sequence. During this early stage of Mapungubwe Hill's occupation, the first housing structures appeared on the western end. This area likely consisted of the first king's housing complex (Huffman 2007b: 176; cf. Huffman 2009) and represented the first time the elite segments of society so physically separated themselves from the rest of the community. This spatial arrangement provides the earliest evidence for class distinction in southern Africa (Huffman 2000, 2009).

Similar to the younger deposits on K2, these early deposits from MK1 on Mapungubwe Hill contained predominantly brownish-red EC-IP glass beads with considerably less K2-IP blue-green beads (Wood 2005: 136). Here, the TK2 facies predominate Phase III deposits on the Hill (Van der Walt 2012). Collectively, these changes in ceramics and glass beads represent a transitional phase between K2 and classic Mapungubwe between 1200 to 1250 CE on Mapungubwe Hill (Wood 2005: 136; cf. Van der Walt 2012: 21-22).

From mid-Phase III (MK1's layer 9 and upward) the glass bead sequence changes again as we see an increase in uniform minute oblate black beads (Wood 2005: 136). The new glass beads represent changes in trade patterns in the Indian Ocean during the early 13th century and saw the introduction of the Mapungubwe Oblate bead series which quickly predominate later Phase III and Phase IV deposits on the Hill (Wood 2005, 2011). Wood (2005: 137) places their arrival between 1230 and 1240 CE. By this time, occupation of the Hill intensifies around

1250 CE as the large stonewalled palace is built on top of the old rainmaking area towards the centre of the Hill. Here, the palace provided ritual seclusion for the leader and signified the beginning of sacred leadership (Huffman 2007b). By this time, the TK2 facies changed into the Mapungubwe facies (Van der Walt 2012: 24), and Mapungubwe Oblates dominate the glass bead assemblages (Wood 2005, 2011). From 1250 to 1290 CE, or Phase IV, classic Mapungubwe material culture dominates Mapungubwe Hill.

The unit MK3, on the other hand, dates from the later part of Phase III (b) to Phase IV (Meyer 1998: 183). The excavation presented little in terms of materials culture or residential structures and predominantly consisted of a succession of thin yellow-brown gravel floors. No hut structures were observed. MK3 layer 3 was radiocarbon dated to 880±40, 1180-1252 CE at 1-sigma (Pta-1145; Vogel 1998: 298). Unfortunately, Wood (2005: 130) could not locate enough glass beads to refine the social context or chronology of MK3.

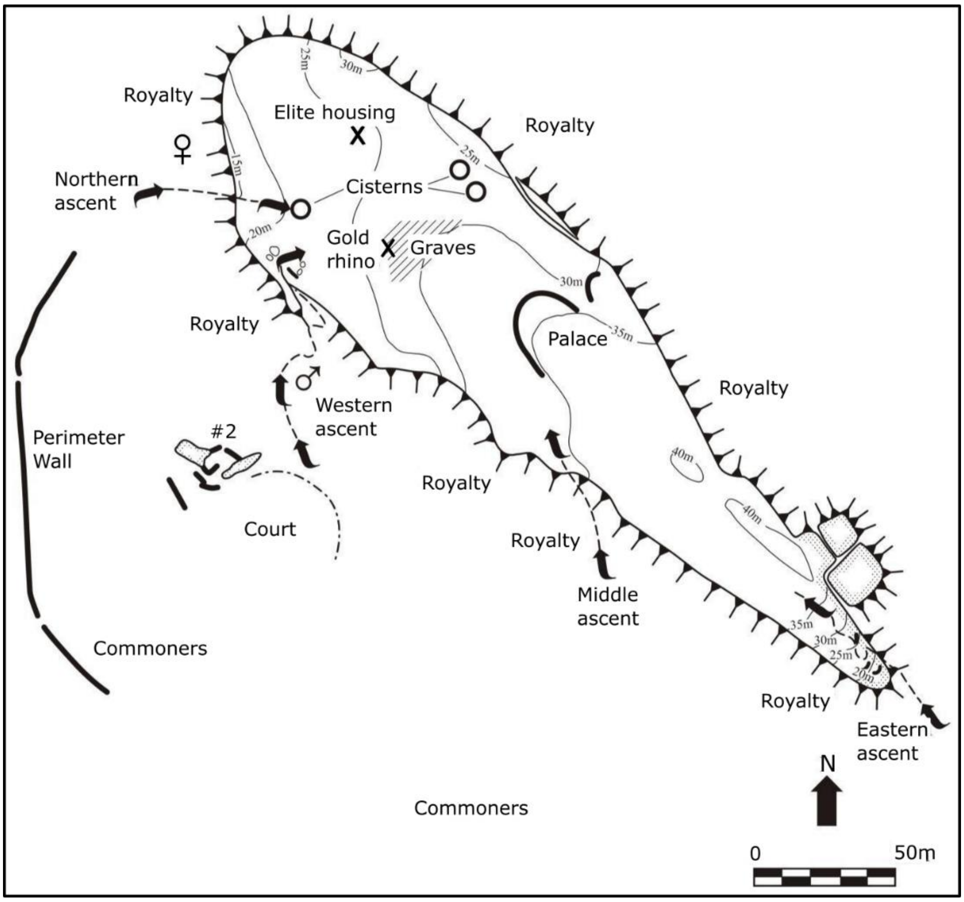


Figure 3.16: Mapungubwe settlement layout. Map: adapted from Huffman (2009b).

For the Southern Terrace excavations, square K8 consisted of a succession of gravel floors, ash, and burnt hut rubble (Meyer 1998: 161-164). Several calibrated dates were obtained from charcoal samples for K8. Layer 16 provided a calibrated date of 1000 to 1040 CE, layer 15 a date of 1190 to 1260 CE, layer 3 a date of 1190 to1260 CE, layer 2 a date of 1250 to 1290 CE and Layer 1 a date of 1260 to 1290 CE (Vogel 2000: 56). Based on the radiocarbon dates, square K8 was occupied throughout the Greefswald settlement chronology, from Phase II until Phase IV (Meyer 1998: 183).

The Phase II material culture and settlement deposits were limited suggesting the Southern Terrace was sparsely occupied during the early occupation phases (Meyer 1998: 181).

Phase III, on the other hand, presented thick settlement deposits. Here, a succession of red mudstone and mustard yellow dolerite floors characterise the transitional period between K2 and Mapungubwe (Meyer 1998: 161-164; Huffman 2007b: 180).

The early part of the transitional period - layer 15 to layer 8 of Phase III (a) – consists of a succession of red mudstone floors (Meyer 1998: 163) and a predominance of brownish-red EC-IP glass beads (Wood 2005: 141). Here, settlement intensifies on the Southern Terrace as thick deposits accumulate during the transitional period. Wood's (Ibid.) analysis of the glass beads suggests the residents of K8 had little access to glass beads up to the later part of the transitional period, supporting the notion that commoners resided on the Southern Terrace (cf. Huffman 2000, 2007a, 2009). From layer 8 upward, the gravel floors were largely replaced by mustard yellow dolerite floors. From layer 4 upwards, Mapungubwe ceramics dominate the deposits (Van der Walt 2012: 54), while the Mapungubwe black beads first appear during the latter part of the transitional period in layer 5 (Wood 2005: 141). Together, the changes in ceramics and glass beads characterise the final period of Mapungubwe's occupation during Phase IV.

The transitional period – layer 15 to layer 4 presented intensive settlement on the Southern Terrace. From square K8 it can be seen the transitional period was dominated by TK2 ceramics (Van der Walt 2012: 54) and EC-IP beads (Wood 2005: 141), while the classic Mapungubwe material culture proliferate deposits above layer 4. This sequence of events was similarly observed in square F4.

Square F4 also represented a residential area with deposits consisting of a succession of gravel floors and burnt hut structures (Meyer 1998: 142). These deposits developed from a period spanning Phase II to Phase IV (Table 3.3, p.53) (Ibid.: 183; cf. Meyer 1980). Calibrated dates of 1005 to 1035 CE were obtained from a charcoal sample from layer 10 (Vogel 2000: 56).

Like the Phase II deposits from K8, the deposits from F4 (layer 9 and lower) indicate less intensive settlement during the initial occupation of the Southern Terrace (Meyer 1998: 145).

The early part of the transitional period – layer 8 to layer 7 (iii) of Phase III (a) – was characterised by a succession of predominantly red mudstone floors (Meyer 1998; Huffman 2007b: 180). However, contrary to square K8, the brownish-red EC-IP beads only dominate the oldest deposits of the transitional period in square F4 (Wood 2005: 139). Black glass beads increase in number throughout the transitional period and quickly dominate the assemblage.

By the mid-transitional phase - layer 7 (ii) of Phase III (b) - the red mudstone floors were replaced by mustard yellow floors as occupation of the area intensifies. Contrasting square K8, is the continued presence of large quantities of black glass beads. Overall, square F4 contained 20% more black beads compared to square K8. Based on this, and the overall distribution of brownish-red beads, Wood (2005: 141) argued that K8 likely predates F4 and was probably no longer used as a residential area by the time the last layers were deposited on F4.

Square J10, I9, I10, and I11 were excavated adjacent to square K8. Interpreting these squares contextually, however, presented significant problems. The squares were not included in either Eloff's (1979) or Meyer's (1998) publications on the Greefswald excavations. The only available information consists of incomplete excavation reports (Eloff 1978, 1980) stored in the Mapungubwe Museum archives at the University of Pretoria. Here, pages related to the description of layers 1 to 4 for J10 and I9 in Eloff's (1978) are missing from the archive. Only descriptions for layer 5 and 6 are present. Any stratigraphic interpretations are therefore based on profile drawings for J10 and I9 presented in Eloff's (1980: 15-16) report. The excavated layers for square I10 and I11 were discussed by Eloff (1978) but were not stratigraphically linked to adjacent squares or to the broader Greefswald settlement chronology. There were also no profile drawings recorded for I10 and I11 making a stratigraphic connection between them and adjacent squares extremely difficult. Eloff (1980: 5) did relate the excavated layers from square J10 and I9 to that of the known stratigraphic sequence and occupation phases identified for square K8 (Table 3.2, p.50). This was done by comparing soil textures, colours, and the sequence of gravel floors between the squares. As a result, the description of I10 and I11 will be based on the layer descriptions of adjacent units in Eloff's (1978) report.

The excavation of I10 consisted of ashy soils with a succession of weathered irregular yellow mustard gravel floors in the base of the sequence, followed by red mudstone floors in the top layers (Eloff 1978). The former is similar to the gravel floors noted for layer 2 (ii) in K8 (Eloff 1979 Vol I: 156), layer 4 in J9 and I9 (Eloff 1978), and layer 3 in I8 (Eloff 1981).

The layers excavated for square I11 represented similar soil conditions described for I10 (cf. Eloff 1978). Irregular and weathered yellow gravel floors were noted in layer 3 and 4. The excavated layers from I10 and I11 likely represent a continuation of the top two layers of K8 and therefore similarly date to Phase IV of the Greefswald sequence (Table 3.2 and 3.3).

Table 3.2: Stratigraphic correlation between the layers of square K8 and adjacent squares. Adapted from Eloff (1980: 5).

	K8	**J9**	**J10**	**I9**	**I10**	**I11**
Layer	1(i)	1	1	1	1	1
	1(ii)	2	2	2	2	2
	1(iii)	3	3	3	3	3
	2(i)	4	4	4	4	4
	2(ii)	5	5	5	-	-
	3	6	6	6	-	-
	4	-	-	-	-	-

Square E2 was more difficult to place within the Greefswald chronology as no information is available on its excavation or stratigraphic sequence. A handful of authors did reference square E2, but the information they provided was limited. Eloff (1979 Vol I: 5) and Meyer (1998: 26) simply mention that E2 was excavated but make no other reference to it. Vogel (1998 Table 8.9.1; 2000: 56) provides radiocarbon dates for a square E2 on the Southern Terrace. However, the layers, and the depths from which samples were collected, do not match the layers for E2 used in this study (p.45). The calibrated dates presented by Vogel (Ibid.) are as follows: layer 5 gave a calibrated date of 1270 CE, layer 7 (iii) a date of 1265 CE, and layer 10 a date of 1252 CE. Huffman (2007b Table 4) and Van der Walt (2012 Table 2) similarly reference Vogel's radiocarbon dates and layers for square E2.

Saitowitz (1996) made several references to soapstone objects and glass beads recovered from square E2. She initially lists the objects provenance as block E2 on the Southern Terrace (Saitowitz 1996 Figure 6.2.1 d & g). Thereafter she lists E2 as a separate site although the year of excavation along with the excavator remains the same (Ibid.: 131 & Appendix IIa). Here, she also adds block numbers (B70/10 or B11) to E2. These alphanumeric codes were present on the original labels (Figure 3.18, p.52), but do not refer to provenance information. Instead, they served as accession numbers (B13 – Bottle 13), as beads were originally stored in small glass bottles. This numbering system was also used for the excavations on K2, Mapungubwe Hill, and other squares on the Southern Terrace (Figure 3.18). Why some of the accession numbers were followed by an encircled lowercase alphabet number is unclear, but Saitowitz (Ibid.: 239) similarly used these to demarcate blocks. The layers she provided for E2 in the glass bead tables, however, was the same as the labels used in this study and will be used to refine the chronology for E2.

Seeing that no further contextual information could be linked to E2, its chronology will be based off of adjacent squares. Since E2 is located on the southern slope in close proximity to F4 (Figure 3.12, p.41), the known stratigraphic sequence of F4 can be used to extrapolate a broad chronology for E2. Data from square H5 and K8 further upslope will be used to refine the sequence (Figure 3.17). This method is not ideal but remains the easiest way to place the excavated materials within the broader settlement chronology for the Southern Terrace.

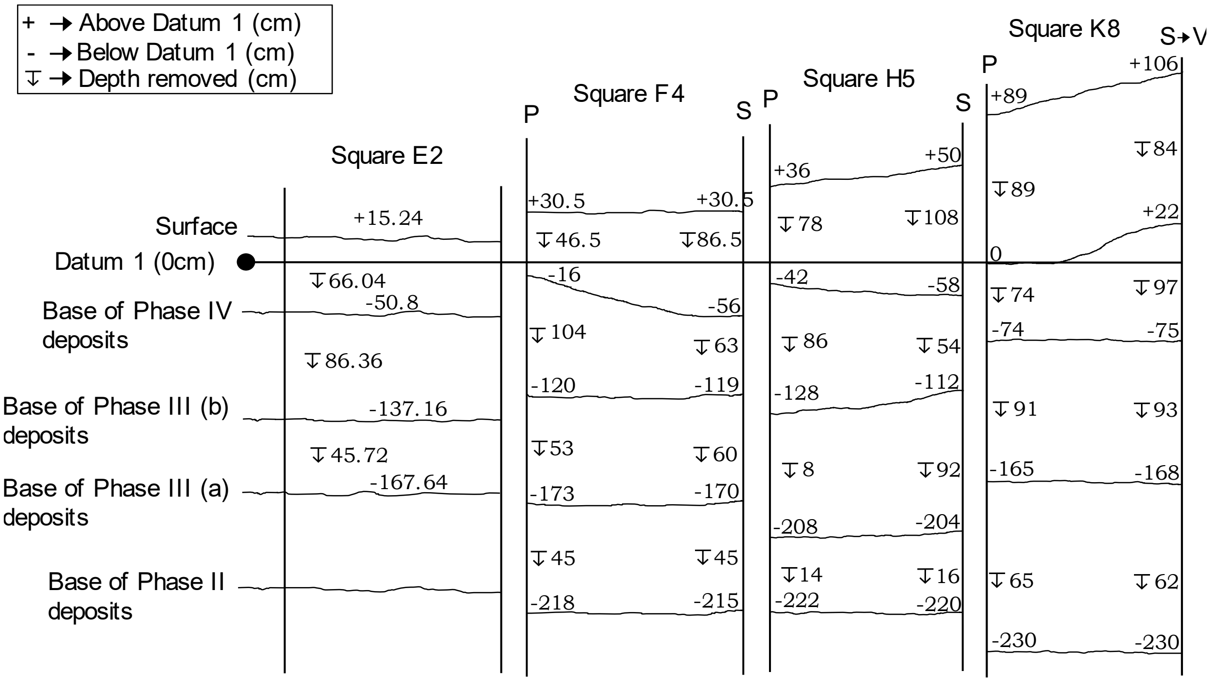


Figure 3.17: Stratigraphic correlation between square E2, F4, H5, and K8.

The fixed point from where all depth measurements were taken consists of Datum 1 (0-vlak in Eloff 1979 Vol I: 69) which was located on the south-west corner of Coertze and Sentker's grid (Figure 3.12 Datum 1). Since the Southern Terrace settlement area is a slope (p.39), the deposits lower down the slope will be closer to zero, as represented by Datum 1, (cf. Eloff 1979 Vol I: 69) compared to deposits higher up the slope. This can be seen in the measurement of each squares surface deposits from Datum 1. Square F4 corner P and S measured +30.5cm, H5 corner P measured +36cm and corner S +50cm, while K8 corner P measured +120cm and S/V +106cm above Datum 1 (cf. Ibid: 85, 125, 153).

From the known chronological sequence of F4, H5, and K8, the Phase IV deposits are thinner lower down the slope and gets progressively thicker as one moves upslope towards K8. Since E2 is downslope from K8, the expectation is that its Phase IV deposits will likewise be thinner than in F4 and K8. Therefore, stratigraphic information from adjacent squares suggests that

Phase IV deposits from E2 are likely represented by the layers above -18”/-20” (Figure 3.17 and Table 3.3).

Deposits belonging to Phase III is more problematic as it presents extensive settlement on the Southern Terrace and varies greatly between different occupation areas. Establishing whether Phase II deposits were removed from E2 provides an easy starting point. Phase II deposits are fairly deep, but thin throughout the Southern Terrace. The total depth removed from E2 was 167,64cm, which is more or less the depth at which Phase II deposits start in adjacent squares. Similarly, F4, H5, and K8 were all excavated to a depth greater that 200cm. Considering the depth at which E2’s excavation was stopped, it’s unlikely that Phase II deposits were removed.

The deposits below E2’s layer -18”/-20” therefore belong to Phase III. Subdividing Phase III deposits correctly between Meyer’s (1998) Phase III (a) and III (b) is of minor importance as these deposits all belong to the transitional phase. Nevertheless, the division was based on contemporaneous deposits from F4 and H5. As a result, the base of the Phase III (b) is at a depth of 137,16cm below Datum 1, which would include the layers above layer -48”/-54”. The remainder of the E2 deposits were assigned to Phase III (a), the base of which is represented by layer -60”/-66”.

Saitowitz’s (1996: 239-240) analysis of the E2 glass beads presented a colour profile for Phase IV consisting of 56% black, 23% brownish-red, 13% blue-green, and 3% yellow. For Phase III (b), the profile changed to 27% black, 52% brownish-red, and 18% blue-green. This is similar to the profile described for F4 by Wood (2005: 139) where black beads dominated Phase IV, while EC-IP brownish-red beads characterise the transitional period of Phase III.

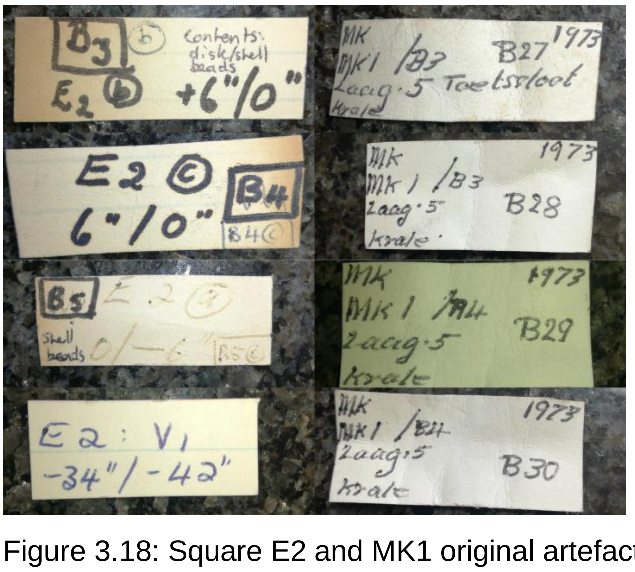


Figure 3.18: Square E2 and MK1 original artefact labels.

The excavation of MST1 represented a residential zone forming part of the Mahobe settlement area (Meyer 1998: 169). The deposits were formed over a period spanning from Phase II to Phase IV (Ibid: 183). The only SDB that could be located from this area came from layer 1, 2, and 3 which all date to Meyer's (1998) Phase IV. At present, there are no radiocarbon results or glass bead data for the MST1 excavation to help refine its chronology. In its entirety, MST1 consisted of a succession of red mudstone floors, followed by mustard yellow dolerite floors, household refuse, and ashy soils representing a residential zone (Meyer 1998: 169). Layer 1 to 3, however, consisted of mustard yellow dolerite floors and stone structures. Material culture described from these layers (cf. Eloff 1979 Vol I: 182-184; Meyer 1998: 169; Nienaber & Hutten 2006 Table 11) are similar to Phase IV materials described for the rest of Mapungubwe.

Table 3.3: Division of excavated layers into the broader Greefswald settlement chronology. Adapted from Meyer (1998: 183).

Site	Phase	Rn2	TS1	TS2	TS3	TS4	TS5	TS6	
K2	IV	-	-	-	-	-	-	-	
	III (b)	-	-	-	-	-	-	-	
	III (a)	-	-	-	-	-	-	-	
	II	1-7	1-5	1-6	1-20	1-7	1-3	1-13	
	I	-	-	-	-	-	-	-	
MK	**Phase**	MK1	MK3						
	IV	1-3	1-5						
	III (b)	4-8	6-7						
	III (a)	9-10	-						
	II	11	-						
	I	11 base	-						
MST	**Phase**	F4	MST1	K8	J10	I9	I10	I11	E2
	IV	1-2	1-3	1-3	1-6	1-6	1-5	1-4	+6"/0" to -18"/-20"
	III (b)	3-7(ii)		4-8	-	-	-	-	-20"/-30" to -48"/-54"
	III (a)	7(iii)-8		9-14	-	-	-	-	-54"/-60" to -60"/-66"
	II	9-10		15-17	-	-	-	-	
	I	-		17 base	-	-	-	-	

CHAPTER 4

METHODS

This chapter will outline the methods and processes used in the analysis. The methods applied here are developed from those published by Ward and Maggs (1988), Plug (1982), Kandel and Conard (2005), Orton (2008), and Miller *et al*. (2018). The aim of this approach is to develop fine-grained standardised methods which will allow for greater comparative analyses between assemblages and analysts in the future.

4.1 Sampling

The manner in which the early excavations of Mapungubwe and K2 were conducted pose significant sampling difficulties (cf. Meyer 1998: 23). Many of these early excavations were not conducted by trained archaeologists and deposits were frequently removed and stratigraphic sequences destroyed without proper recording. In many cases, poor contextual information means that SDB collected during early excavations cannot be placed to either K2 or Mapungubwe, or to specific excavation units or stratigraphic layers on either site. This created a lack of accurate documentation and scientific data for fieldwork done prior to 1970.

For this reason, sampling was limited to collections which retained some contextual information relating to site of origin, context, or any other information relating to provenience. These samples were mostly excavated during research phase three of excavations on the Greefswald sites (p.27). From K2, these included samples from the excavations of TS1 – TS6 and Rn2. From Mapungubwe Hill, these were MK1 and MK3, and for the Southern Terrance square F4, E2, K8, J10, I9, I10, and I11. Analysis of the Southern Terrace also included a small sample of beads from the Mahobe (MST1) excavation.

All the beads from the selected excavations were analysed and measured except for some layers in square I10 and I11 where a sub-sample was selected due to time constraints. The sub sampled layers were from square I10 layer 2 (33%; *n*=63) and 3 (33%; *n*=12) and square I11 layer 3 from (55%; *n*=464). The total sample size was *n*=832 for I11 layer 3 and *n*=186 for I10 layer 2 and *n*=36 for I10 layer 3.

4.2 Identification of raw materials

Identification of raw materials was conducted through a direct comparison of archaeological materials with modern reference samples. The reference material consisted of ostrich eggshell (OES), giant African land snail (ACH), and large freshwater mussel (FWB) samples. The analysis was conducted with a stereo microscope with a magnification range from X0.65 to X4.5 and with lighting from above. Both magnification and lighting were dependent on samples and varied between different beads.

4.2.1 Ostrich eggshell

Ostrich (*Struthio camelus)* eggshell beads are characterized by a smooth, glossy finish (cuticle) on the outer surface (Figures 4.1 and 4.3 A), while the inner surface (mammillary layer) appears grainy and rough (4.3 B). The 'dimples' on the outer surface are a characteristic unique to ostrich eggshell and is usually easily identified on both large and small beads. In large beads, the convex (outer surface)-concave (inner surface) shape of the eggshell is often well-preserved.

Ostrich eggshell beads are slightly more difficult to identify when delaminated. Delamination occurs when the outer layers are removed, exposing the inner (spongy) palisade layers (Figures 4.1 nr.3 and 4.3). This can be the result of either the manufacturing process or from damage. A similar process occurs with *Achatina* and *Unionid* beads where the outer periostracum and prismatic surface layers are removed. However, the delaminated ostrich eggshell beads can be distinguished from mollusc beads when the molluscs' nacre layers are absent (p.58).

Ostrich eggshell that has been exposed to heat is easily identified as the outer and inner surface burns differently, with the inner surface often being lighter in colour (Figure 4.2 A). Additionally, when sufficiently exposed to heat (identified by a dark grey to black colouration), the inner mammillary layer often separates (delaminates), leaving a rough, broken surface (Figure 4.2 B) (Janssen *et al*. 2011: 660; Craig *et al*. 2020: 3). Depending on the temperature it is exposed to, heated ostrich eggshell can be various shades of brown, grey, black, or white (Figures 4.2 C and 4.17, p.67).

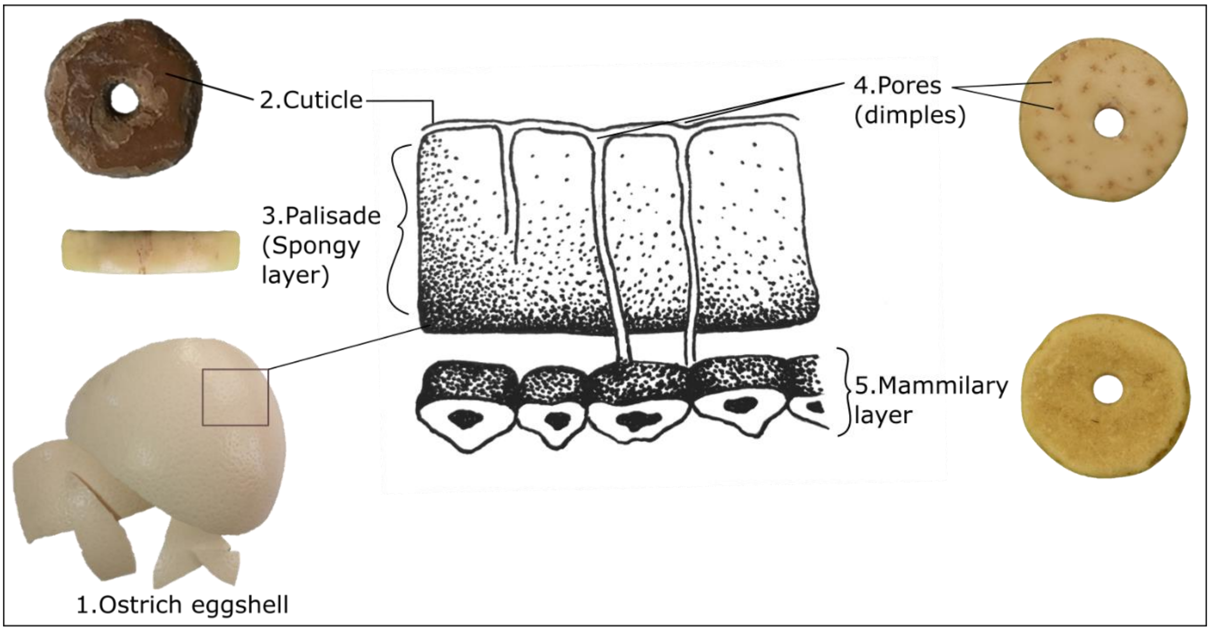


Figure 4.1: Schematic of ostrich eggshell structure. 1-Ostrich eggshell; 2-Cuticle visible on outer surface; 3-Palisade layer; 4-Characteristic pores/dimples on outer surface; 5-Mammillary layer (inner surface). Schematic: adapted from Sultana (2013).

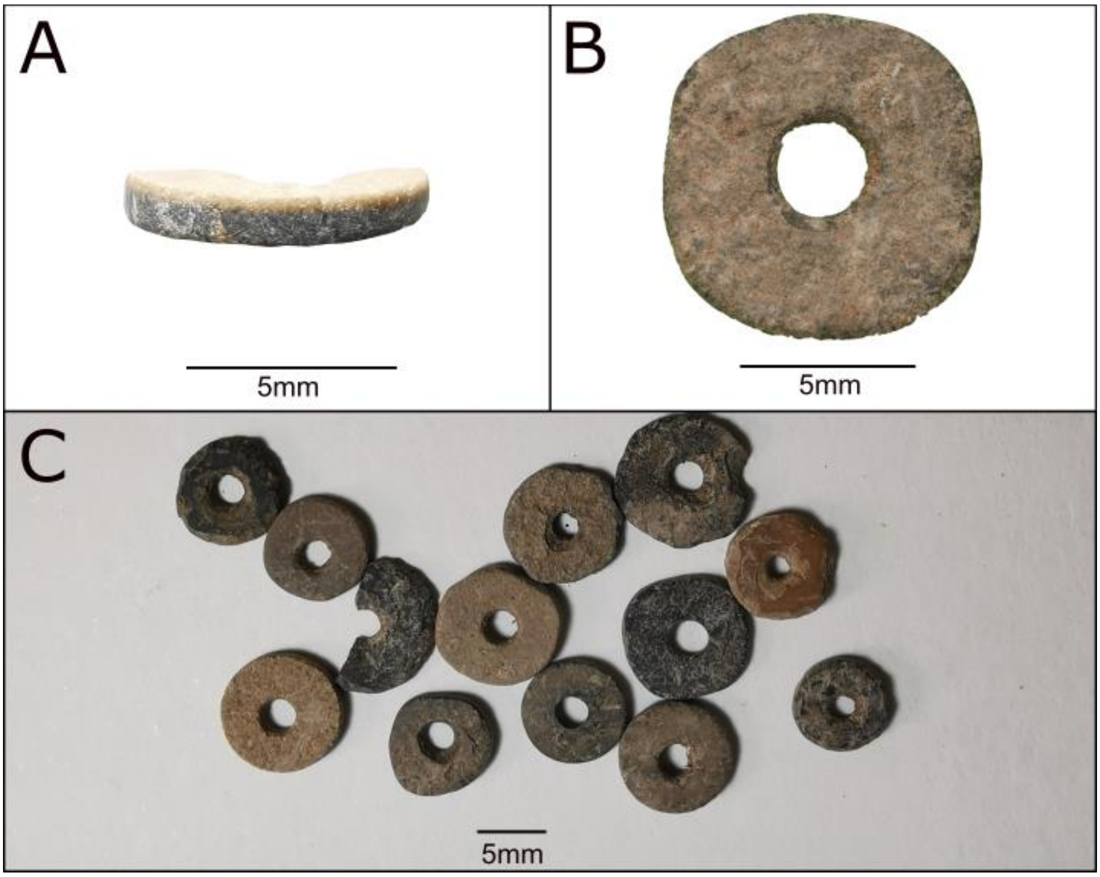


Figure 4.2: Heated ostrich eggshell beads. A-Heated ostrich eggshell disc bead with a light brown inner mammillary layer and a dark brown outer layer; B-Damaged inner surface of a heated ostrich eggshell bead; C-Collection of heated ostrich eggshell beads.

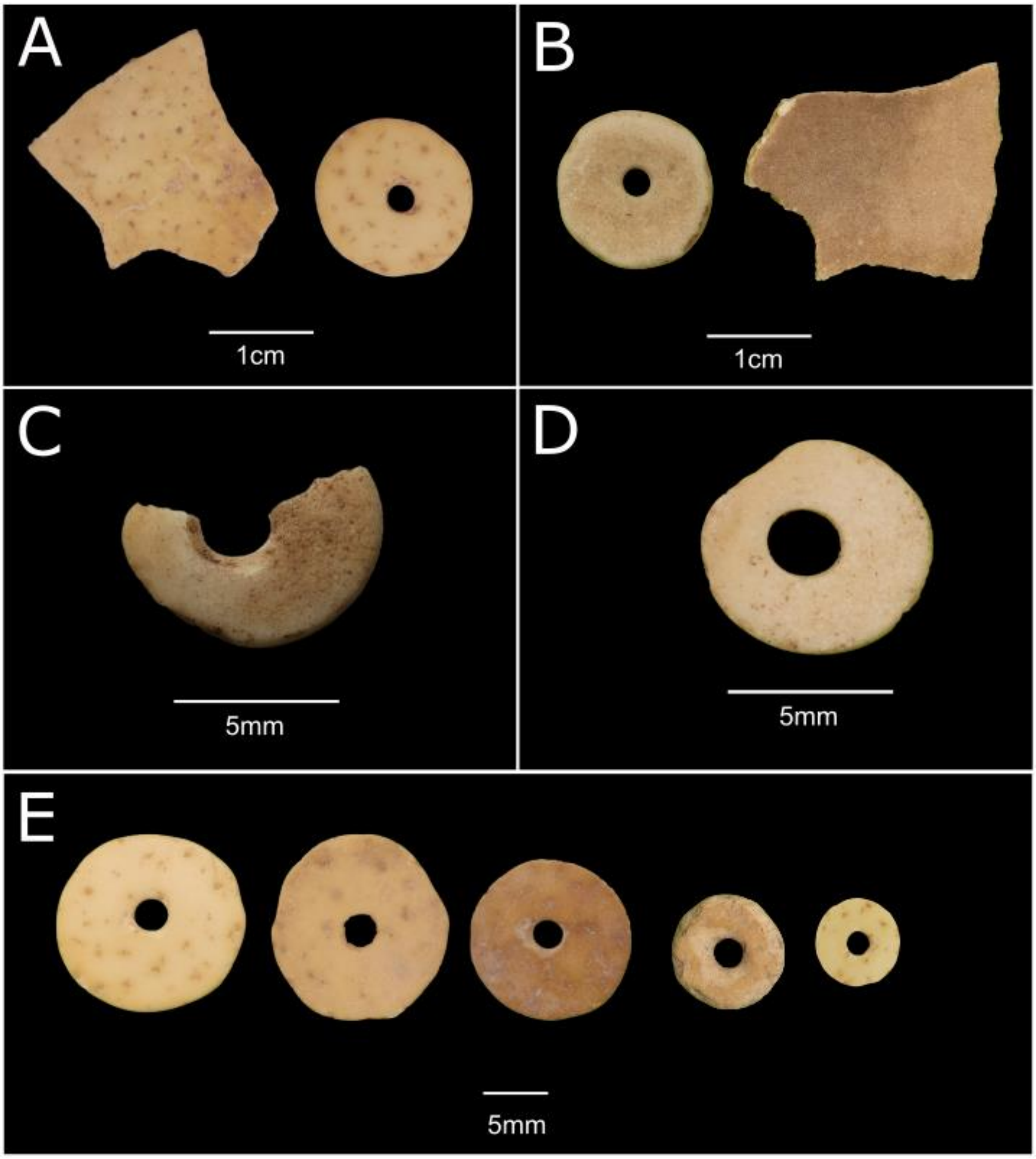


Figure 4.3: Ostrich eggshell bead characteristics. A-Outer surface on ostrich eggshell with characteristic smooth finish and “dimples”; B-Rough inner mammillary surface of ostrich eggshell; C&D-Partially delaminated inner mammillary surface exposing spongy palisade centre; E-Ostrich eggshell disc beads of various sizes.

4.2.2 Achatinidae

Achatinidae is a family of giant African land snails (gastropod). Several Achatinidae genera have shells large and thick enough for the manufacture of SDB (cf. Miller *et al*. 2018: 358). Beads manufactured from different genera and species belonging to this family was collectively referred to as *Achatina*. Non-heated *Achatina* beads have a clear white colouration, often appearing semi translucent (Figure 4.5), while heated *Achatina* beads are usually a light grey colour and retain characteristics unique to the shell type (Figure 4.6).

Achatina, like other gastropod shell, consists of several types of foliated layers - the periostracum, prismatic, and nacreous layers (Figure 4.4) (Taylor *et al*. 1969; Checa & Rodriquez-Navarro 2001; Lawfield *et al*. 2014). These layers are similar in most shelled mollusca, but the nacre structure can differ between gastropods and bivalves (see Unionidae below) in the way organic and inorganic compounds are secreted for shell development and growth (Jacob *et al*. 2008: 5402).

The periostracum is a very thin organic layer that covers the outer surface of the shell, while the prismatic layer consists of aragonite crystals composing approximately 10% of the total shell mass (Lawfield *et al*. 2014). The periostracum gives the shell its colour and patterns observed in living or recently deceased specimens. The majority of the shells' thickness, however, is composed of thick nacre layers. Together, these nacre layers create a crossed-lamellar structure.

Distinguishing between *Achatina* and ostrich eggshell beads with the naked eye can be difficult, especially with worn, delaminated, or small beads (cf. Miller *et al.* 2018: 349). However, when viewed under a microscope with sufficient magnification, characteristics unique to *Achatina* become clear. For one, the foliated nacre layers of *Achatina* shells are easily observed when viewing a bead from its side profile (Figure 4.5 C). Similarly, the crossed-lamellar nature of the nacre layers are visible from the bead shaft, or on the surface once the prismatic layer was removed (Figure 4.7). In some samples, the outer surface is partially preserved, in which case distinctive ridges can still be observed in parallel rows (Figure 4.5 B) (cf. Ward & Maggs 1988: 410; Miller *et al*. 2018: 361).

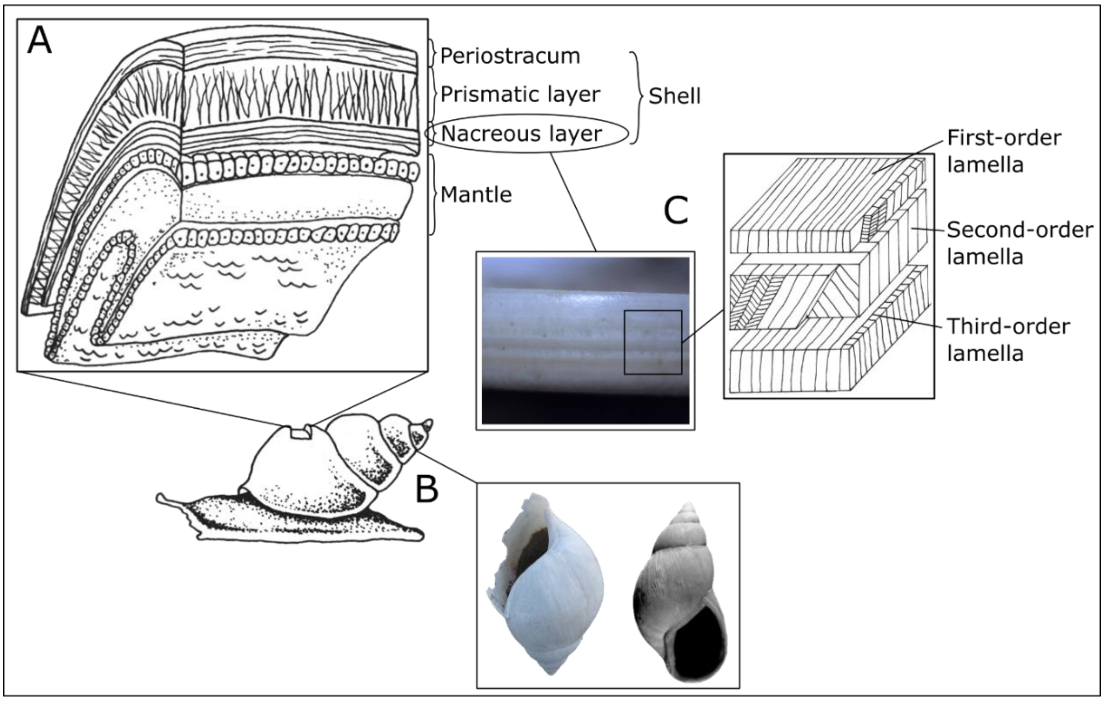


Figure 4.4: Schematic of *Achatina* shell structure. A-Scheme of *Achatina* shell structure; B-*Achatina* shell; C-Nacre layers visible in a side view of a disc bead. Schematic adapted from Fall (2014) and Li *et al*. (2017).

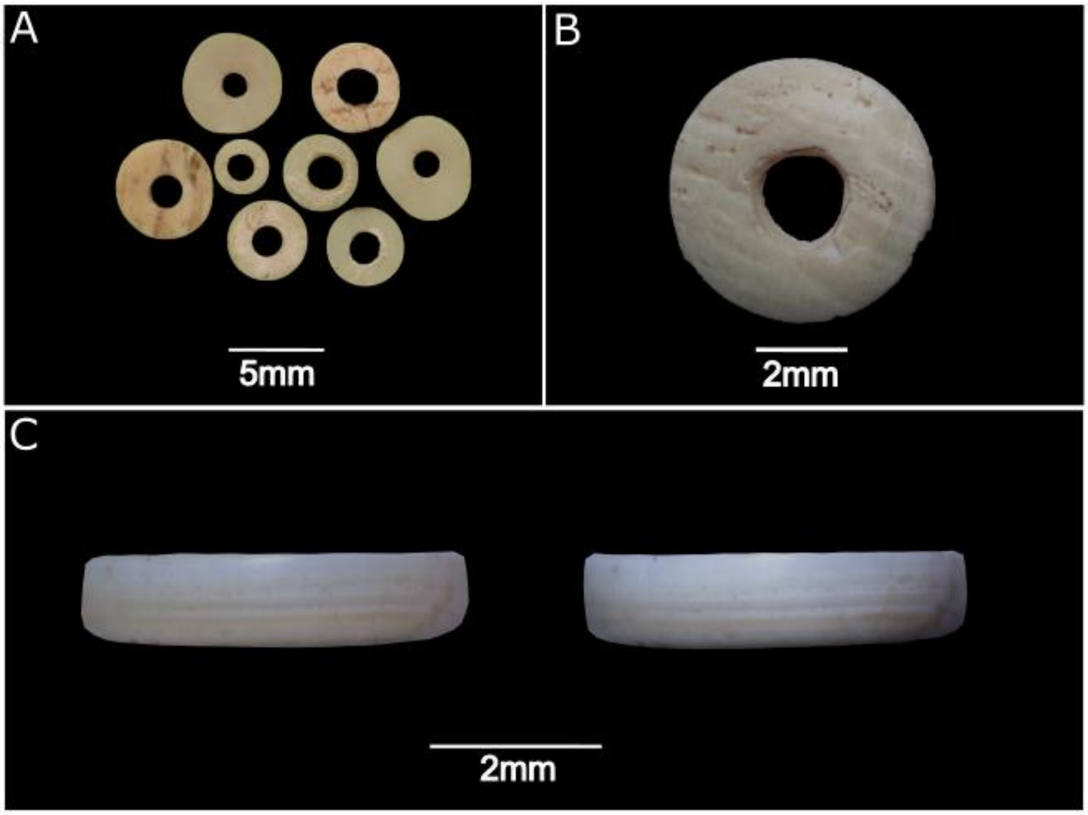


Figure 4.5: *Achatina* shell bead characteristics. A-*Achatina* disc beads; B- Outer surface of *Achatina* disc bead with distinctive ridges; C-Side view of laminated nacreous layers of an *Achatina* disc bead.

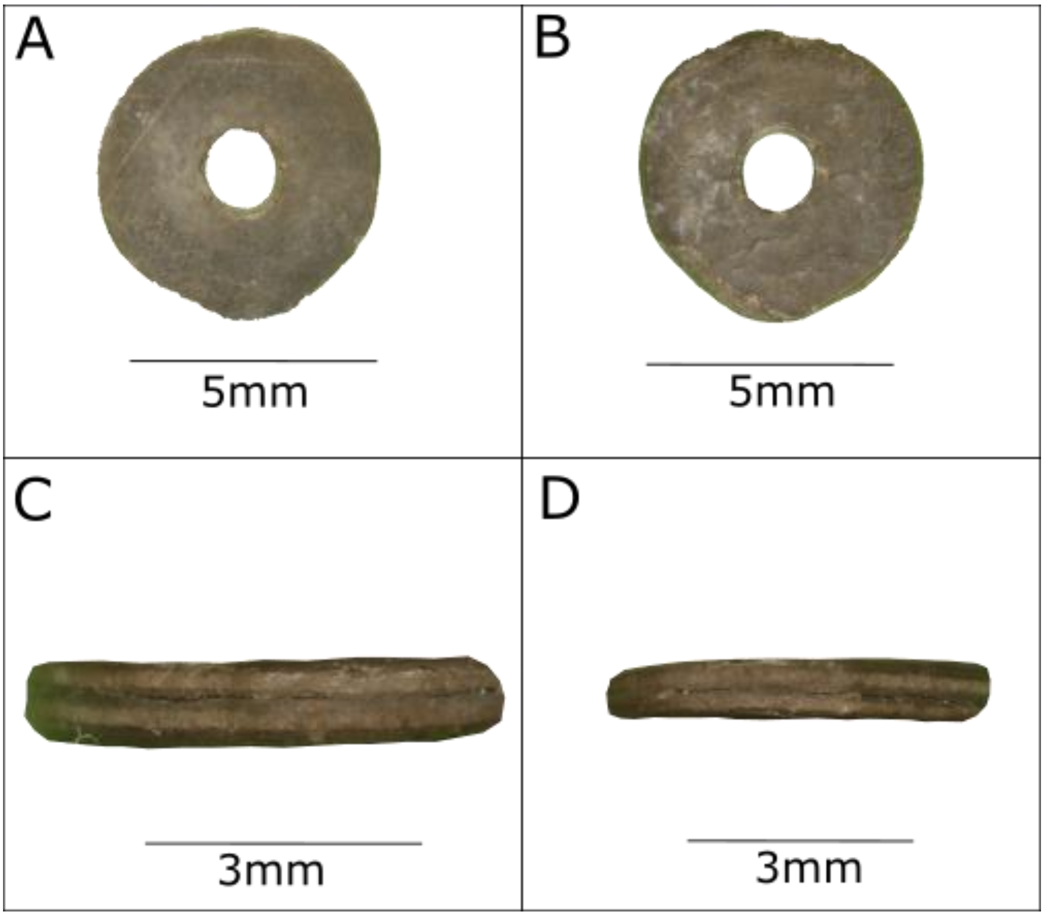


Figure 4.6: Heated *Achatina* shell beads. A-Front view; B-Back view; C&D-Side view of laminated nacreous layers.

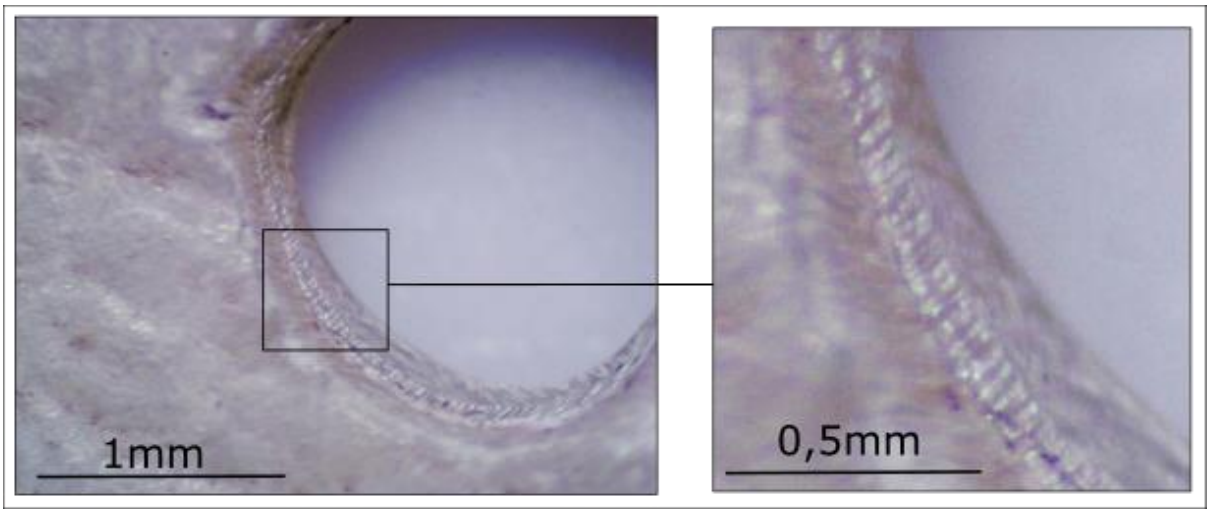


Figure 4.7: Foliation of outer prismatic layer exposing the inner cross-lamellar structure of the nacreous layers of an *Achatina* bead.

4.2.3 Unionidae

The Unionidae are a family of freshwater mussel (bivalve). Beads manufactured from different genera and species belonging to this family was collectively referred to as *Unionid*. Beads made from these shells have a glossy, mother of pearl shine, that is clearly visible with the naked eye when exposed to natural light (Figure 4.10 C). The shell structure is similar to *Achatina sp*. and consists of an arrangement of superimposed organic and inorganic layers (Figure 4.8). When viewed in cross section, these superimposed layers are clearly visible.

Samples recovered from the archaeological record are often very fragile. When inadequately stored, the superimposed layers flake apart in beads (Figure 4.10 B), and flakes are often crushed into a fine powder (Figure 4.9).

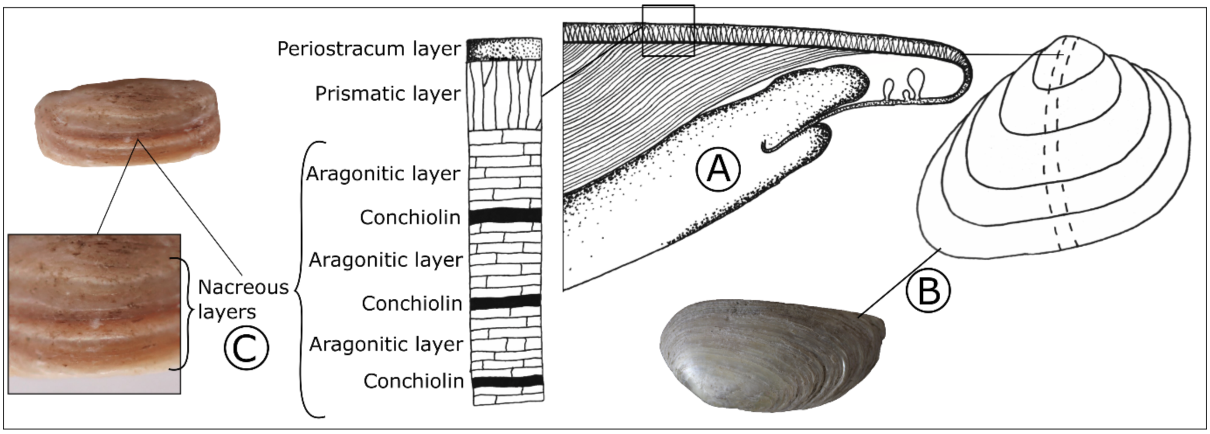


Figure 4.8: Schematic of *Unionid* shell structure. A-Scheme of *Unionid* shell structure; B-*Unionid* shell; C-Nacre layers visible in a side view of a disc bead. Schematic adapted from Checa & Rodriquez-Navarro (2001) and Lawfield *et al*. (2014).

Figure 4.9: Poorly stored *Unionid* fragments.

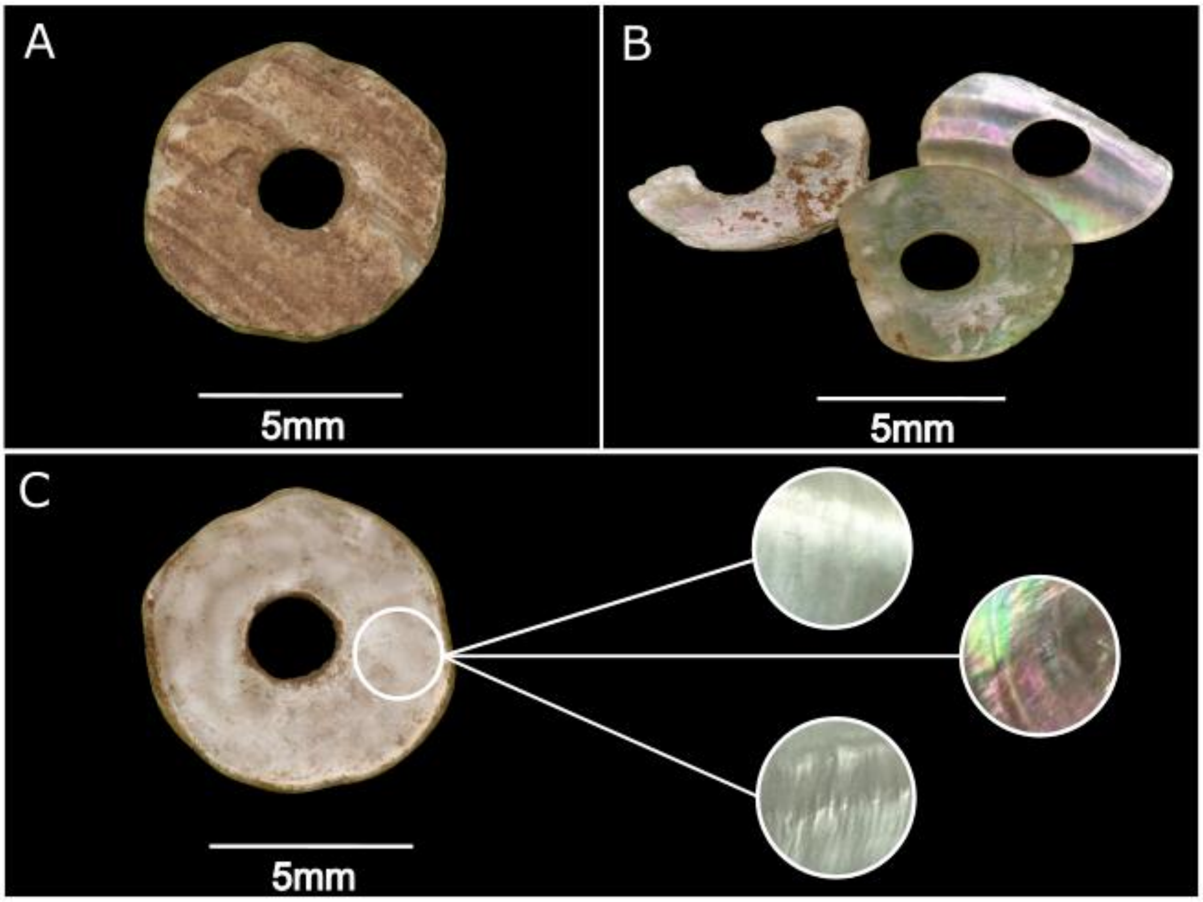


Figure 4.10: *Unionid* shell bead characteristics. A-Outer surface of *Unionid* shell with distinctive ridges; B- Laminar fragmentation of a single *Unionid* disc bead; C-Glossy, mother of pearl inner surface.

4.2.4 Non-shell materials: soapstone and calcite

Several soapstone and calcite beads were recovered from the Greefswald bead assemblages. Similar materials have been reported on several Iron Age sites in southern Africa (Harger 1940; Evers 1979; Hanisch 1980; Saitowitz 1996; Mouton 2018, Hopf 2018). These beads were not included in this study and their description here only serves as a means to distinguish them from shell types (Figure 4.12, p.63), as they are easily mistaken for ostrich, *Achatina*, and glass beads. When viewed with the naked eye, the dark colouration of soapstone can easily be misidentified as heated ostrich eggshell, while calcite beads have been mislabelled as glass beads. Soapstone and calcite have unique waxy surfaces which is clearly visible when viewed under a microscope or when lightly scratched with a scalpel (Mouton 2018: 26). Saitowitz (1996:131) described soapstone as being olive-green (Figure 4.11 A-B), while calcite is a milky-white (Figure 4.11 C-D) (Cairncross & Dixon 1999:60). The texture, and colouration, remains the easiest way to distinguish soapstone and calcite from shell types.

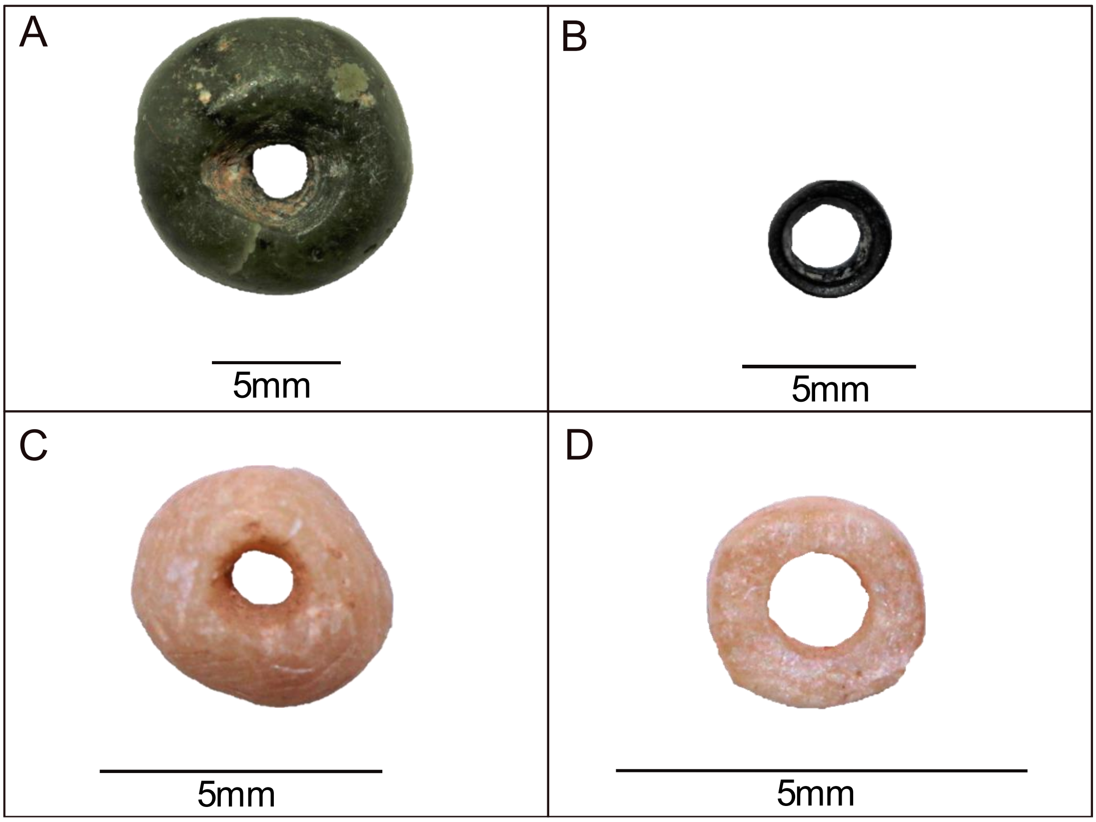


Figure 4.11: Soapstone and calcite beads. A-Rounded soapstone bead; B-Disc shaped soapstone bead; C-Rounded calcite bead; D-Disc shaped calcite bead.

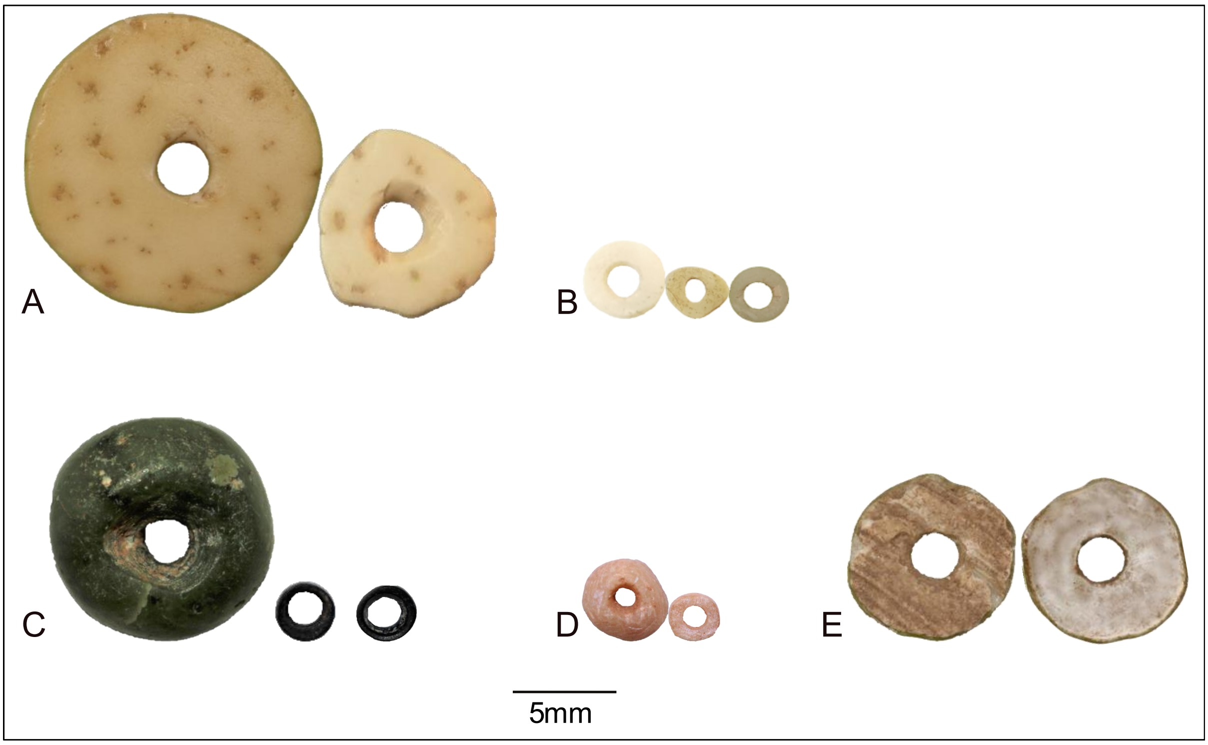


Figure 4.12: Comparative characteristics between shell types and other materials. A-Ostrich eggshell; B-*Achatina;* C-Soapstone; D-Calcite beads; E-*Unionid.*

4.3 Shell disc bead morphology

Several morphological characteristics were described. These characteristics were related to the perforation, edge, and general shape of the bead (Figure 4.13).

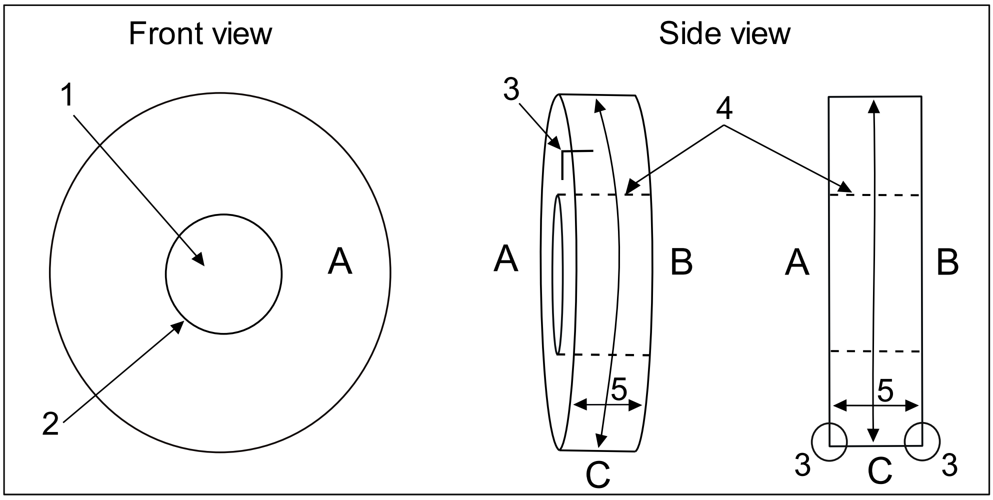


Figure 4.13: Morphology of a disc bead. A-Inner surface; B-Outer surface; 1-Perforation; 2-Perforation shoulder; 3-Bead shoulder; 4-Perforation shaft; 5-Bead edge.

4.3.1 Drilling direction

Where possible, attempts were made to determine whether the bead was drilled from the inner surface, outer surface, or from both surfaces. This was not always possible, particularly with delaminated or damaged beads. In case of delamination, determination was made between drilling from a single surface (labelled as side 1) or from both surfaces. This was generally the case with *Achatina* beads, as identifying the different surfaces is extremely difficult. In cases where the drilling direction could not be distinguished between single surface or both surfaces, drilling directions was labelled as unknown.

4.3.2 The perforations' shaft shape

The perforation shaft (wall) shape was also described (Figure 4.13 no. 4). Categories include conical, biconical, and cylindrical, which are a function of the drilling process (Figure 4.14, p.65). In cases where drill shaped could not be identified due to damage, the drill shape was labelled as unknown.

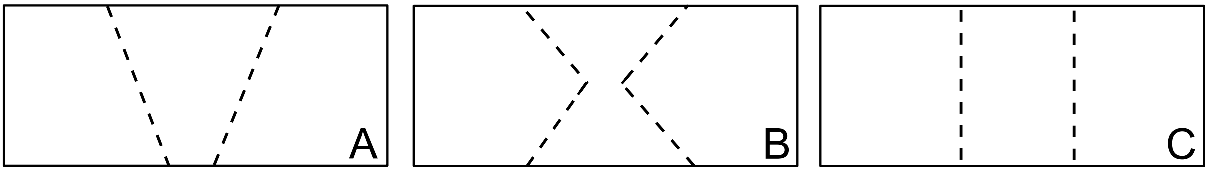


Figure 4.14: Schematic cross-sections of disc bead shaft shapes. A-Conical; B-Biconical; C-Cylindrical.

4.3.3 Beads' edge descriptions

The angularity of the beads edge (Figure 4.13 no. 5, p.64) described the extent to which the bead had been ground or worn, and consisted of five categories - well-rounded, rounded, angular, very angular, and unknown (Figure 4.15 and Table 4.1).

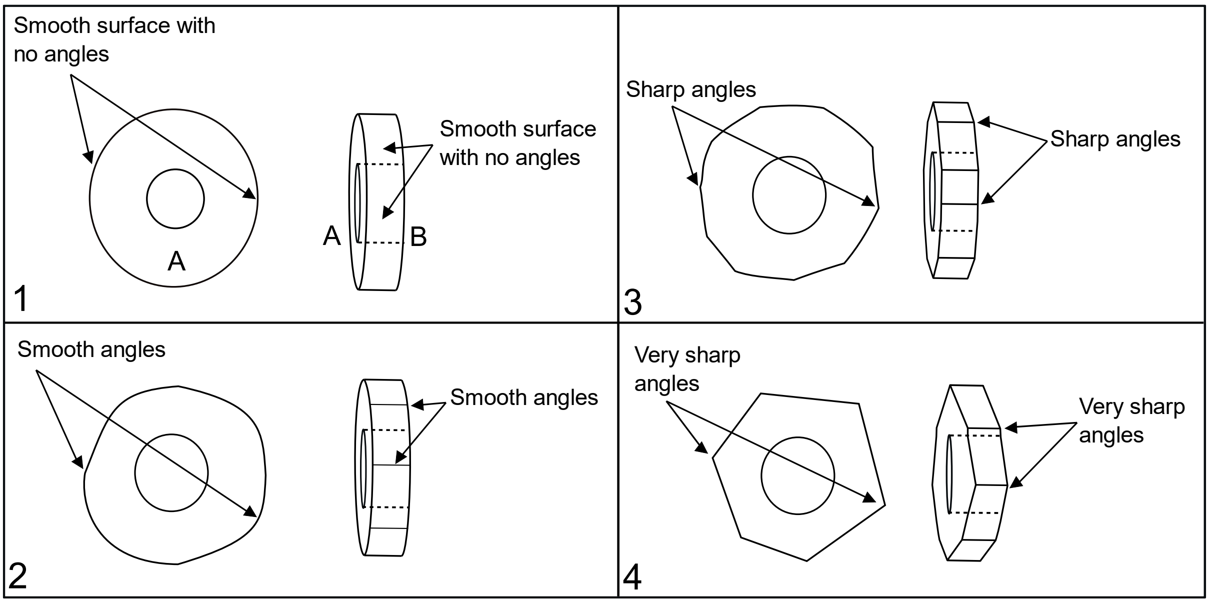


Figure 4.15: Schematic of disc bead edge categories. 1-Well rounded; 2-Rounded; 3-Angular; 4-Very angular.

Table 4.1: Description of bead edge categories.

Bead edge categories	**Description**
Well rounded	Bead is well rounded with a smooth surface indicating extensive grinding. No angles are present (Figure 4.15 nr. 1)
Rounded	Bead has soft and smooth angles indicating mild grinding (Figure 4.15 nr. 2)
Angular	Sharp angles are present indicating minimal grinding (Figure 4.15 nr. 3)
Very angular	All the angles are very sharp indicating no grinding (Figure 4.15 nr. 4)
Unknown	The bead has either been damaged or poorly preserved and little of the bead's edge remains

4.3.4 Bead shapes

The general shape was described by viewing the bead from the front and was categorised as either circular, ovoid, or irregular.

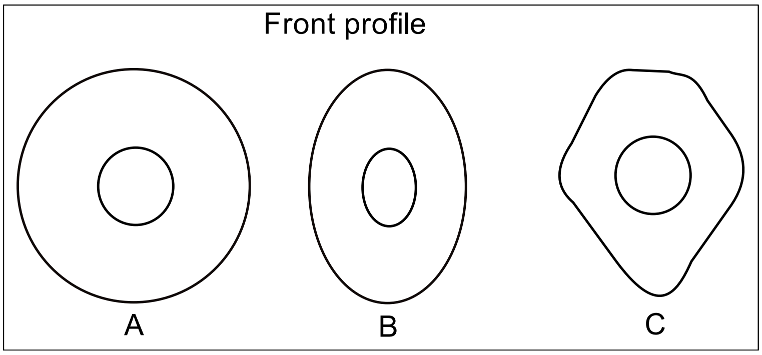


Figure 4.16: Different disc bead shapes. A-Circular; B-Ovoid; C-Irregular.

Table 4.2: Description of bead shapes.

Bead shape		Description
Circular	A	The bead is round with an even radius throughout the bead
Ovoid	B	The bead is elongated with an uneven radius throughout the bead
Irregular	C	No discernible shape

4.4 Heated beads

Colour variations in SDB were noted. Experimental research has shown that the different colours are related to the exposure to heat (Craig *et al*. 2020). This could be due to deliberate manufacturing decisions to darken beads or to post-depositional processes (Kandel & Conard 2005; Janssen *et al*. 2011; Collins & Steele 2017; Craig *et al*. 2020).

The colouration of heated beads was described from both sides of the bead. The colour groupings were grey, brown, black, white, and blue (Figure 4.17, p.67). Beads with variations of the same colour, or of different colours, were recorded as “mixed”. These beads were likely exposed to different levels of heat and were recorded as such.

Figure 4.17: Heated ostrich eggshell disc bead colours.

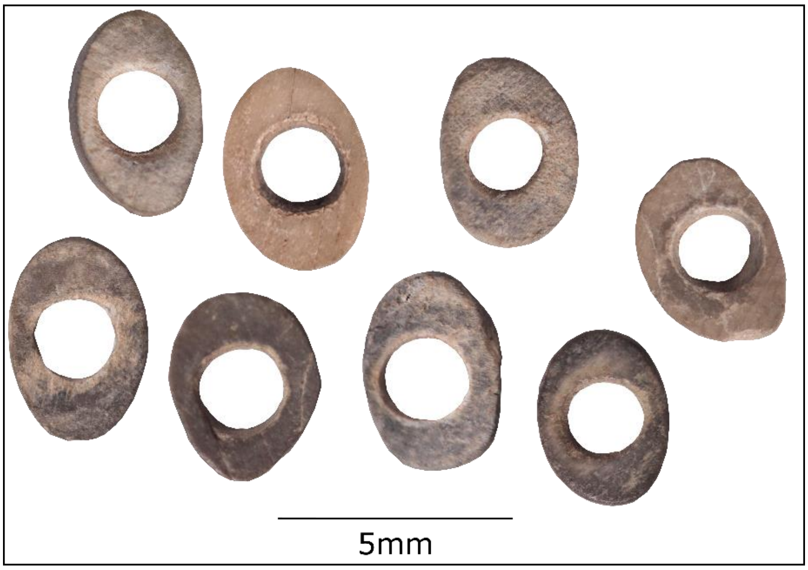


Figure 4.18: Ovoid heated *Achatina* beads.

4.5 Shell disc bead dimensions

Recorded dimensions include diameter, perforation, and thickness (Figure 4.19). The maximum external diameter was measured, while the minimum was measured for the perforation. All dimensions were measured with a digital calliper (TWIN-CAL IP67) in millimetres (mm) to two decimal places with an error range of 0.02mm per 100mm.

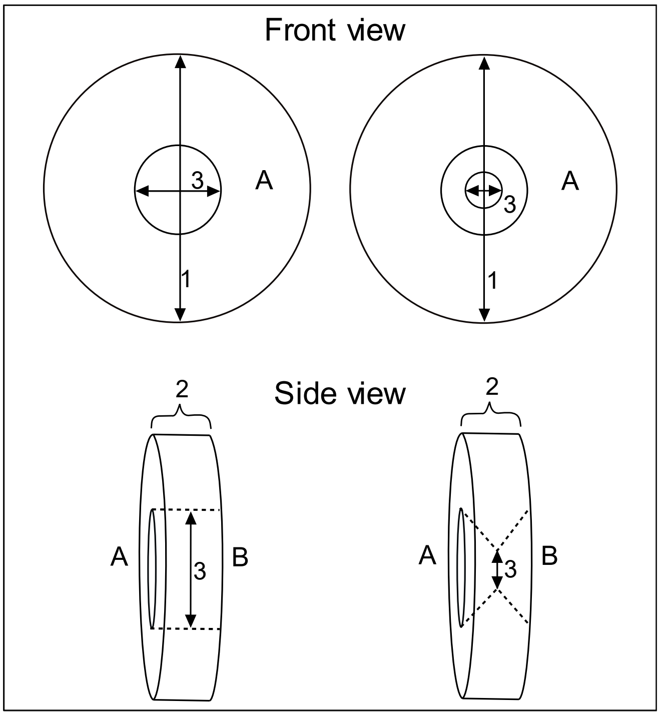


Figure 4.19: Dimensions of a shell disc bead. 1-External diameter; 2-Thickness; 3-Minimum perforation.

CHAPTER 5

RESULTS AND PRESENTATION OF DATA

The methods outlined in the previous chapter allow one to examine several characteristics of SDB, which together, revealed interesting differences between the Greefswald sites. For this study, 6172 SDB were analysed from K2, Mapungubwe Hill (MK), and the Southern Terrace (MST).[1] For the summary statistics tables, refer to the list of symbols (p.xiii).

Table 5.1: Total SDB analysed.

	K2	MK	MST
Phase	***n***	***n***	***n***
IV	Not settled	207	1998
III (b)	Not settled	477	271
III (a)	Not settled	326	211
II	2488	102	92
Total	**2488**	**1112**	**2572**

5.1 Raw material identification

The shell types identified - ostrich eggshell (OES), giant African land snail (*Achatina* - ACH), and freshwater mussel *(Unionid* - FWB) - were present throughout the occupation of the Greefswald sites (Figure 5.1). However, a clear split was observed in the distribution of ostrich eggshell and *Achatina* beads between the Mapungubwe sites and K2. On a site level, 70% (*n*=1733) of the sampled beads from K2 were made from *Achatina*, while 95% (*n*=1053) of the Mapungubwe Hill and 97% (*n*=2486) of the Southern Terrace sample consisted of ostrich eggshell. *Unionid* beads were only found at negligible numbers. They were more common at K2 (*n*=72), none were found on Mapungubwe Hill sample, and only three were recovered from the Southern Terrace.

[1] The totals (Table 5.1) may vary between the discussed results since some characteristics and parameters could not be analysed in some samples. Percentages were therefore calculated from the total measured, or analysed, and not the total SDB present.

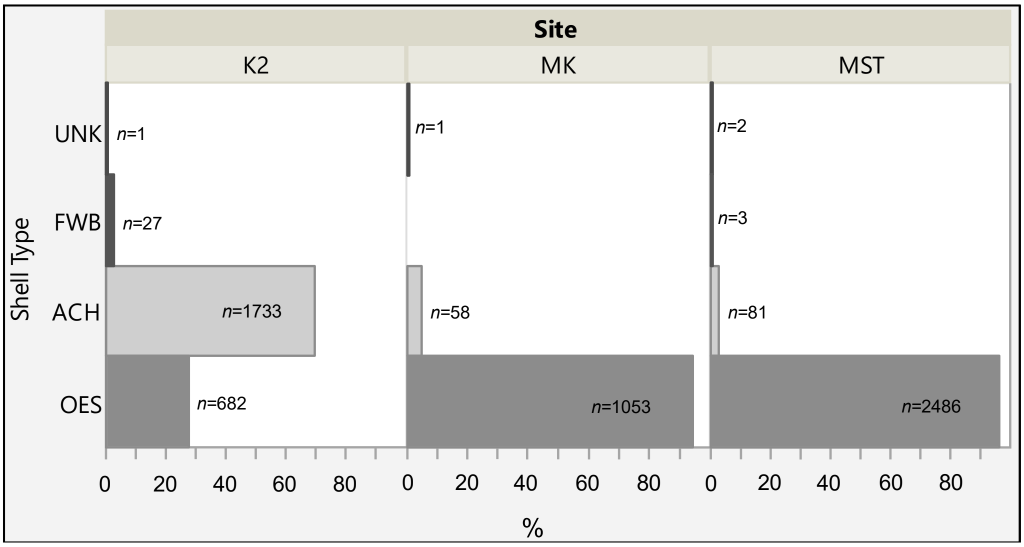


Figure 5.1: Raw material selection on a site level. UNK-Unknown material.

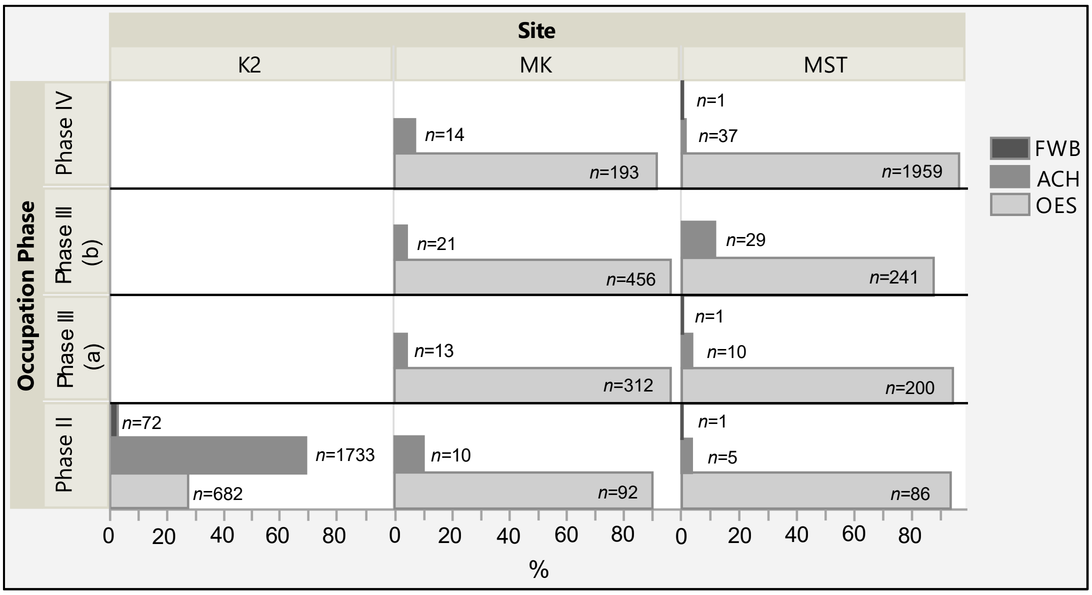


Figure 5.2: Chronological distribution of material types. Percentage calculated from total SDB per occupation phase.

While the vertical - chronological - distribution of shell types remained consistent throughout K2's and Mapungubwe's occupation (Figure 5.2), the horizontal - spatial - distribution of shell types varied between excavation units on K2 (Figure 5.3 and Table 5.2 below).

The units TS1 and TS2 from the north-eastern settlement area had roughly twice as many *Achatina* beads compared to ostrich eggshell beads, while the ratio for the rest of the site was much more equal. This variation, however, should be considered with the small sample size from each unit in mind.

Table 5.2: Chronological and spatial distribution of shell types.

		K2 excavation units													
		TS1		TS2		TS3		TS4		TS5		TS6		Rn2	
Phase	**Shell**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
II	ACH	147	79	676	74	397	78	281	59	97	75	89	51	46	45
	OES	35	19	207	23	113	22	160	34	32	25	79	46	56	54
	FWB	4	2	28	3	1	0	32	7	1	1	5	3	1	1
	UNK	1	0	-	-	-	-	-	-	-	-	-	-	-	-
	total	**187**	**100**	**911**	**100**	**511**	**100**	**473**	**100**	**130**	**100**	**173**	**100**	**103**	**100**

		Southern Terrace excavation units													
		E2		F4		K8		J10		I9		I10		I11	
Phase	**Shell**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
IV	ACH	16	7	6	8	2	8	1	1	2	2	2	1	2	0
	OES	214	93	65	92	24	92	132	99	86	97	222	99	1158	100
	FWB	-	-	-	-	-	-	-	-	1	1	-	-	-	-
	UNK	1	0	-	-	-	-	-	-	-		-	-	-	-
	total	**231**	**100**	**71**	**100**	**26**	**100**	**133**	**100**	**89**	**100**	**224**	**100**	**1160**	**100**
III(b)	ACH	10	12	9	9	12	12								
	OES	76	87	87	91	90	88								
	FWB	-		-	-	-	-								
	UNK	1	1	-	-	-	-								
	total	**87**	**100**	**96**	**100**	**102**	**100**								
III(a)	ACH	1	2	3	3	4	7								
	OES	44	98	91	96	53	93								
	FWB	-	-	1	1	-	-								
	UNK	-	-	-	-	-	-								
	total	**45**	**100**	**95**	**100**	**57**	**100**								
II	ACH			2	3	3	33								
	OES			80	96	6	67								
	FWB			1	1	-	-								
	UNK			-		-	-								
	total			**83**	**100**	**9**	**100**								

		Mapungubwe Hill units			
		MK1		MK3	
Phase	**Shell**	***n***	**%**	***n***	**%**
IV	ACH	8	6	6	8
	OES	125	94	68	92
	FWB	-	-	-	-
	UNK	-	-	-	-
	total	**133**	**100**	**74**	**100**
III(b)	ACH	21	5	-	-
	OES	429	95	27	100
	FWB	-	-	-	-
	UNK	-	-	-	-
	total	**450**	**100**	**27**	**100**
III(a)	ACH	13	4		
	OES	312	96		
	FWB	-	-		
	UNK	1	0		
	total	**326**	**100**		
II	ACH	10	10		
	OES	92	90		
	FWB	-	-		
	UNK	-	-		
	total	**102**	**100**		

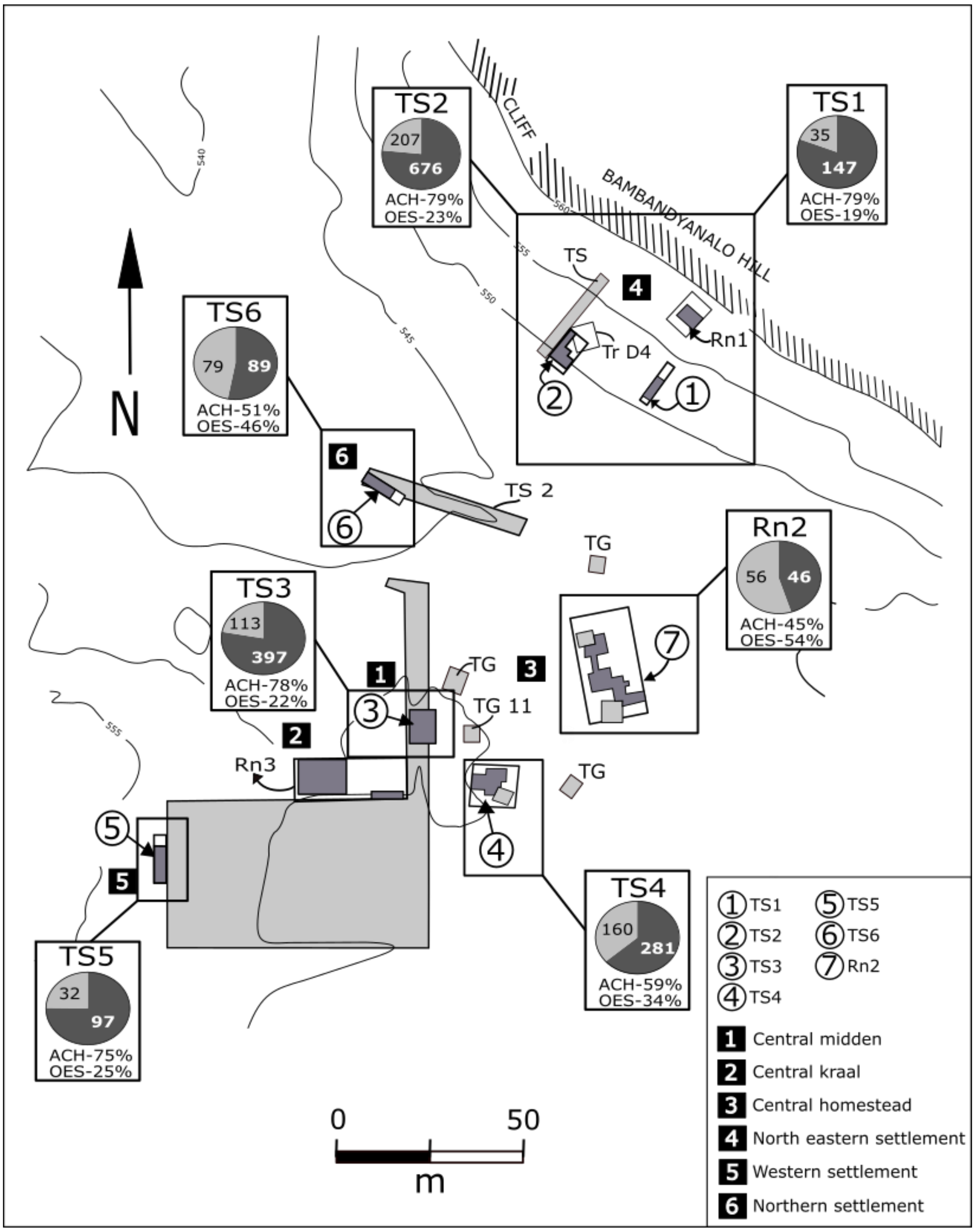


Figure 5.3: Spatial distribution of shell types on K2. Percentages were calculated from total SDB recovered per unit. Map: adapted from Meyer (1998: 61).

5.2 Shell disc bead size distributions

5.2.1 Diameter

Diameter trends at the population level suggested an increase in mean size over time (Figure 5.4 A). However, this is likely a factor of shell type since *Achatina* beads, which dominated the 10th century levels from K2, tends to have smaller diameters ($\overline{x}$=4,4mm) compared to ostrich eggshell beads which dominated later occupation phases on Mapungubwe Hill ($\overline{x}$=6mm) and the Southern Terrace ($\bar{x}$=7,90mm) (Figure 5.4 B). Therefore, analysis of bead diameter, and other parameters, has to differentiate between shell types as this skew results.

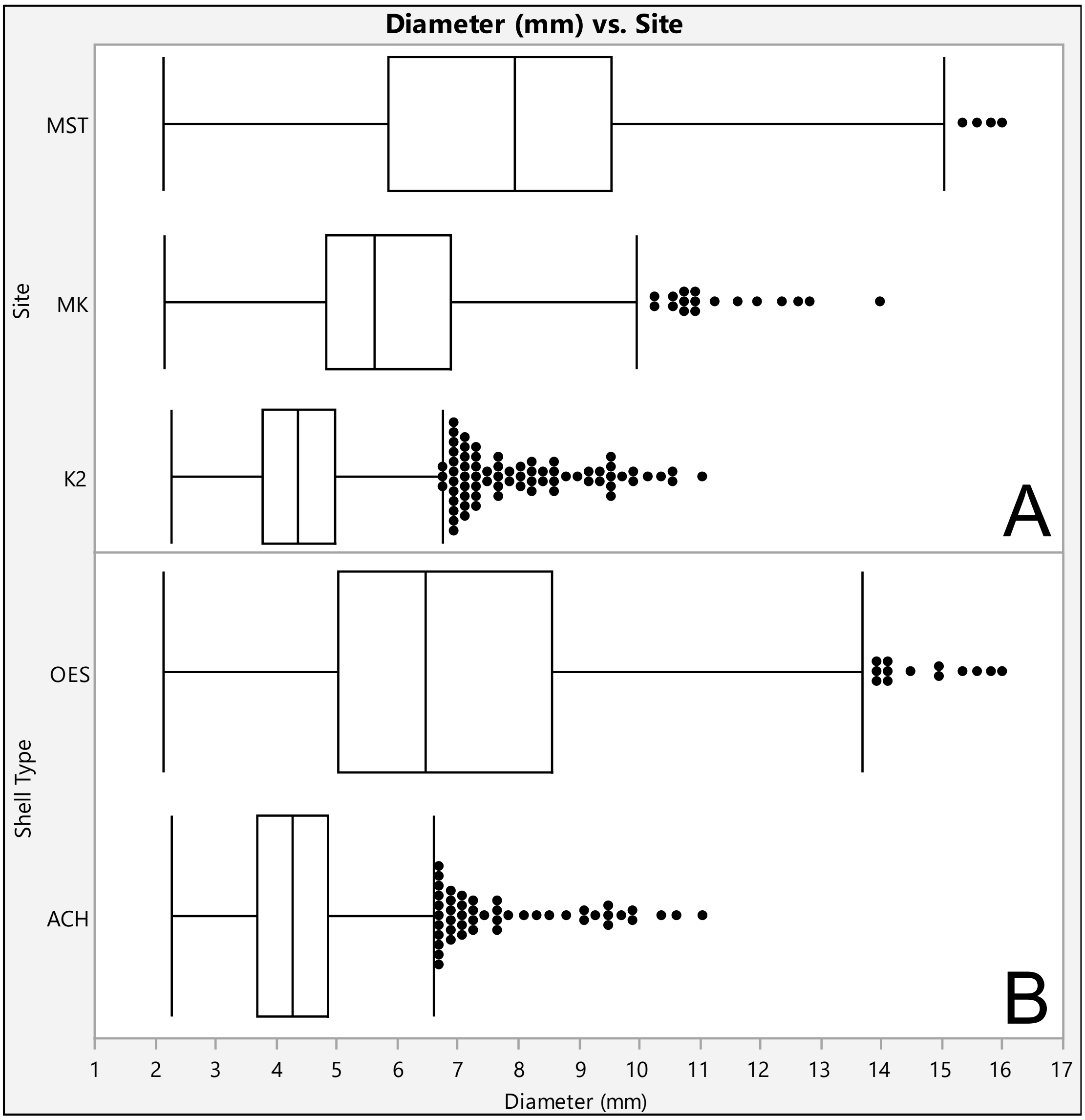


Figure 5.4: Diameter trends. A-Diameter sizes at site level with material types combined; B-Diameter trends per shell types with K2, MK, MST, and occupation phases combined.

Achatina

The Phase II *Achatina* beads from K2 predominantly ranged between 3 and 5mm, with a mean diameter of 4,4mm (Figure 5.5 and Table 5.3). The Phase II sample size for *Achatina* beads from Mapungubwe Hill and the Southern Terrace were too small (*n*=15) to serve as an accurate comparison to the hundreds of *Achatina* beads from K2. However, the available sample suggests a likely similar size distribution compared to K2 (Figure 5.6 and 5.7).

No significant changes in mean diameter were observable from occupation Phase II to IV (Figure 5.8). The Phase III (b) sample from Mapungubwe Hill had a slightly lower (3.9mm) mean – the result of a number of beads (*n*=4) smaller than 3mm. Save for a single bead from Phase IV for the Southern Terrace, beads measuring less than 3mm were restricted to Phase III (b) (Figure 5.6 and Table 5.3).

Table 5.3: Summary statistics for *Achatina* bead diameters.

Achatina																
Site	**Phase**	***n***	**s**	**x̄**	**Upper CI**	**Lower CI**	**s x̄**	**CV1**	**CV2**	**Max**	**90%**	**Q3**	**x̃**	**Q1**	**10%**	**Min**
K2	II	1719	0,98	4,4	4,4	4,3	0,02	22,48	17,84	11,0	5,5	4,8	4,3	3,7	3,3	2,3
MK	IV	14	1,27	4,2	4,9	3,5	0,34	30,06	20,61	7,7	6,8	4,6	3,8	3,4	3,2	3,0
	III (b)	21	0,96	3,9	4,4	3,5	0,20	24,12	24,12	5,9	5,6	4,7	3,9	3,2	2,8	2,6
	III (a)	13	1,05	4,2	4,9	3,6	0,29	24,93	24,93	6,2	6,1	4,9	3,7	3,5	3,2	3,2
	II	10	0,71	4,3	4,8	3,8	0.22	16,82	16,82	5,4	5,4	5,1	4,0	3,8	3,5	3,5
MST	IV	36	0,98	4,4	4,7	4,1	0,16	22,31	17,05	7,0	6,0	4,7	4,2	3,8	3,3	2,9
	III (b)	28	1,18	4,6	5,0	4,1	0,22	25,89	25,89	6,9	6,1	5,5	4,7	3,4	2,9	2,6
	III (a)	9	1,00	4,5	5,3	3,7	0,33	22,43	22,43	5,7	5,7	5,5	4,6	3,5	3,3	3,3
	II	5	1,08	4,7	6,0	3,3	0,48	23,21	23,21	6,1	6,1	5,7	4,3	3,8	3,4	3,4

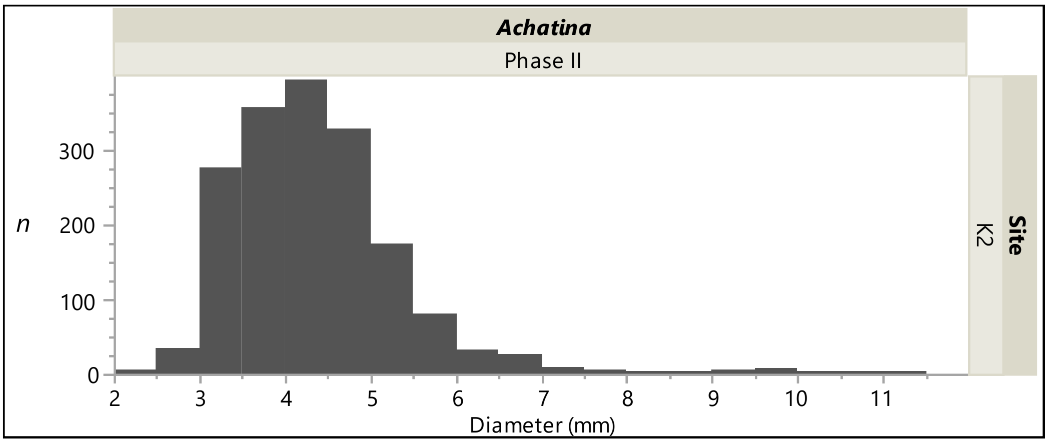


Figure 5.5: Distribution of *Achatina* diameter sizes for Phase II from K2.

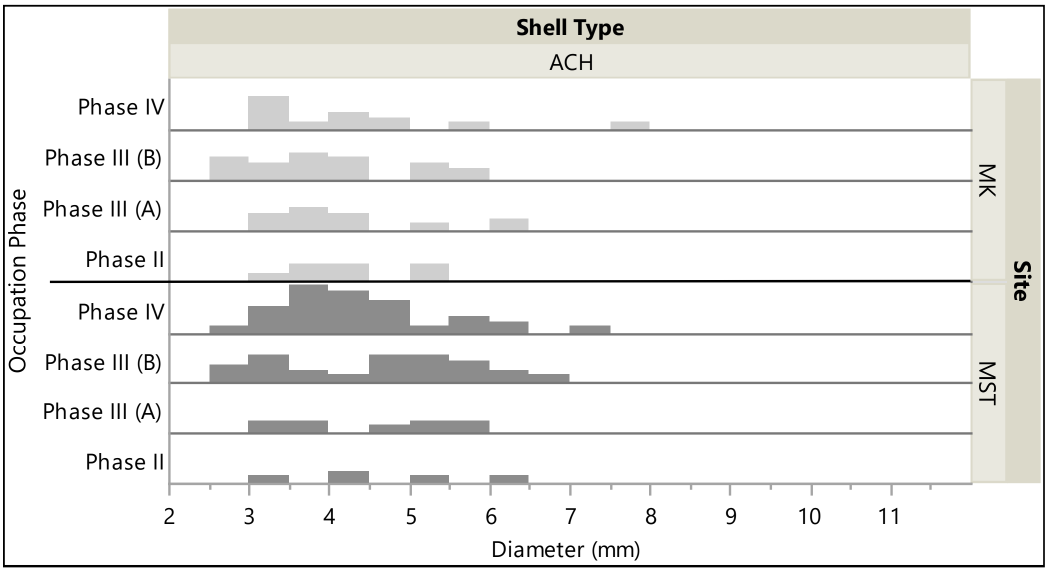


Figure 5.6: Chronological distribution of *Achatina* diameter sizes from MK and MST.

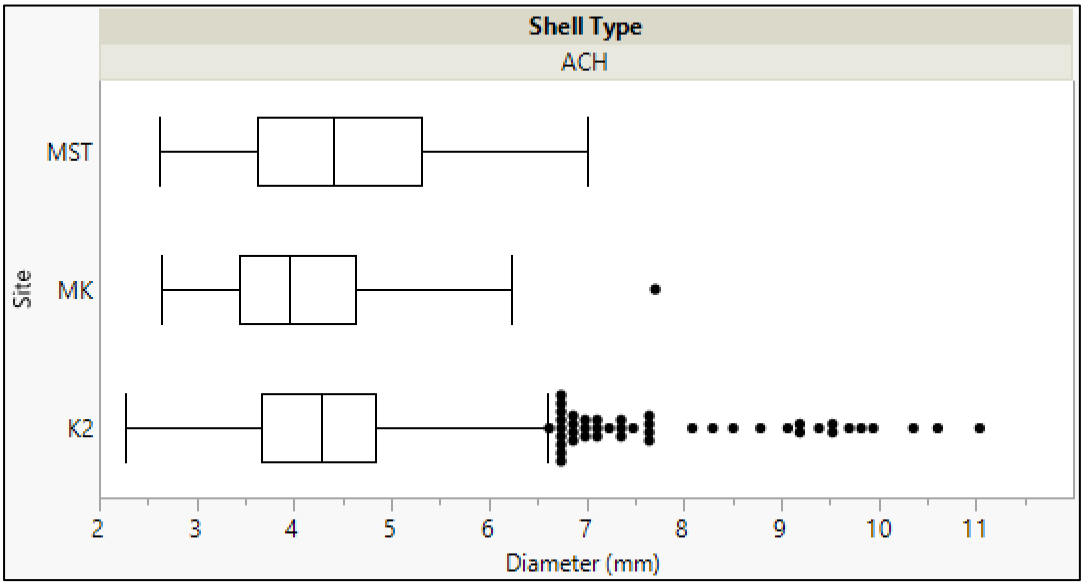


Figure 5.7: Distribution of *Achatina* diameter sizes on a site level.

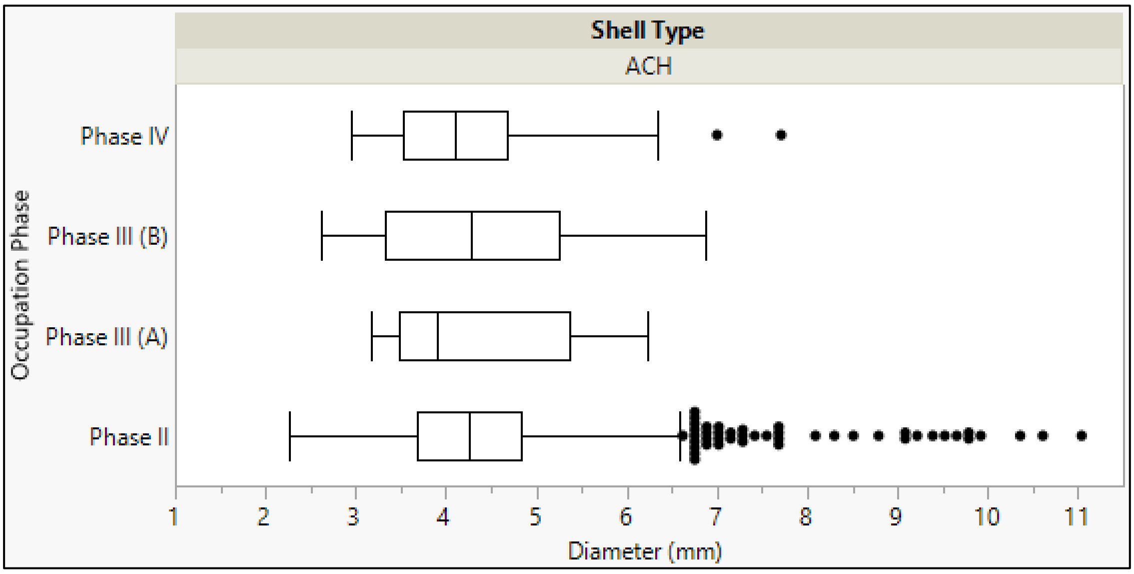


Figure 5.8: Chronological distribution of *Achatina* diameter sizes across all sites.

Ostrich eggshell

Ostrich eggshell beads had a wider spread of diameter sizes compared to the *Achatina* beads. On a site level, the average diameter for ostrich eggshell beads from K2 was smaller compared to those from Mapungubwe suggesting a slight mean increase over time (Figure 5.9 and Table 5.4). However, when the diameter distributions are compared per occupation phase (Figures 5.10, 5.11, and 5.12), the differences between K2 and Mapungubwe Hill become negligible. More notable differences, however, exists within the Southern Terrace sample (Figure 5.13 B, p.79).

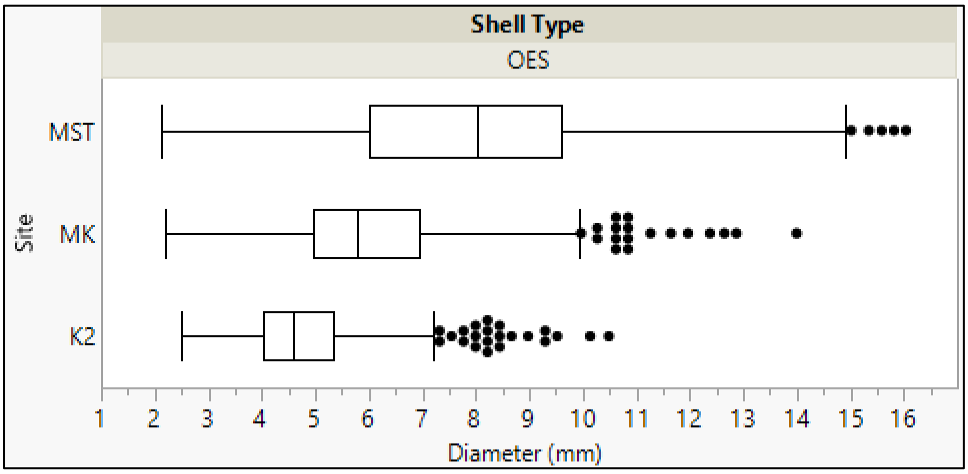


Figure 5.9: Distribution of ostrich eggshell diameter sizes on a site level.

The Southern Terrace sample presented the greatest level of dispersion, both chronologically (Figure 5.13 B, p.79) and spatially (Figure 5.16, p.81). The spread of diameter sizes for ostrich eggshell beads remained fairly standard for Mapungubwe Hill, with a similar mean throughout its occupation and similar levels of variation (CV1 values) from Phase II to Phase IV (Table 5.4, p.77). Although the CV1 values indicated high levels of variation within the spread, the CV2 values suggest fewer outliers compared to the Southern Terrace. Besides the mean diameter difference, the Phase II beads from Mapungubwe Hill and from K2 presented similar levels of variation.

The Southern Terrace CV values are not too dissimilar compared to the Hill. Even so, the CV2 values suggest far more outliers in the Southern Terrace sample. There is also a slight but noticeable increase in mean diameter from Phase II ($\bar{x}$=5,4mm) to Phase IV ($\bar{x}$=8,3mm), with the greatest degree of variation within Phase III (a) and (b) (CV1=31,38 and 31,13).

Table 5.4: Summary statistics for ostrich eggshell bead diameters.

Ostrich eggshell																
Site	**Phase**	***n***	**s**	**$\bar{x}$**	**Upper CI**	**Lower CI**	**s $\bar{x}$**	**CV1**	**CV2**	**Max**	**90%**	**Q3**	**$\tilde{x}$**	**Q1**	**10%**	**Min**
K2	II	676	1,14	4,8	4,9	4,7	0,04	23,96	19,77	10,5	6,2	5,3	4,6	4,0	3,5	2,5
MK	IV	188	1,58	5,9	6,2	5,7	0,11	26,64	24,78	11,7	8,1	6,9	5,4	4,8	4,4	2,8
	III (b)	439	1,65	6,2	6,3	6,0	0,07	26,70	24,73	14,0	8,1	7,3	6,1	4,9	4,1	2,2
	III (a)	301	1,25	5,8	5,9	5,7	0,07	21,49	17,84	12,7	7,3	6,5	5,7	5,0	4,4	3,3
	II	92	1,28	5,8	6,1	5,6	0,13	22,07	15,32	10,7	7,6	6,3	5,5	5,0	4,4	3,9
MST	IV	1729	2,15	8,3	8,4	8,2	0,05	25,94	25,78	15,8	10,9	9,9	8,5	6,8	5,2	2,6
	III (b)	231	2,12	6,8	7,0	6,5	0,13	31,38	26,04	15,6	9,4	7,9	6,6	5,3	4,6	2,1
	III (a)	193	2,09	6,7	7,0	6,4	0,15	31,13	21,80	16,0	9,6	7,4	6,4	5,4	4,5	3,6
	II	85	0,73	5,4	5,5	5,2	0,08	13,74	10,78	8,2	6,2	5,7	5,2	4,9	4,7	3,9

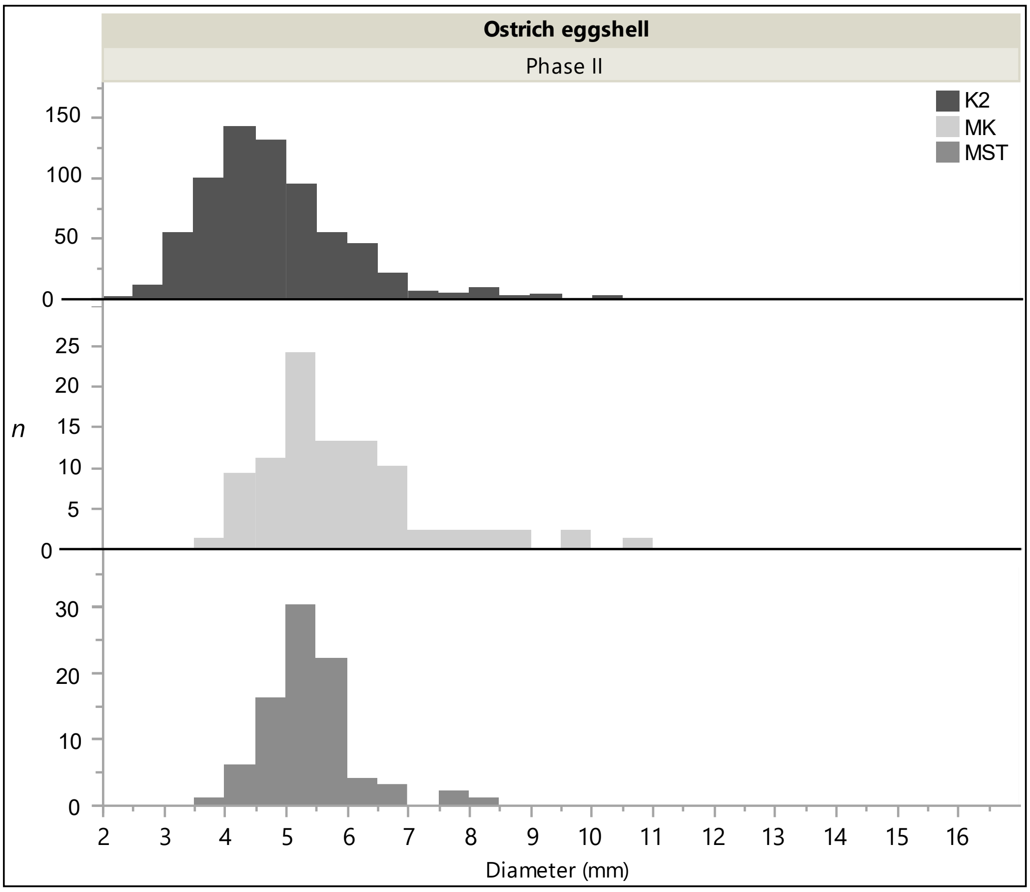


Figure 5.10: Distribution of ostrich eggshell bead diameter sizes for Phase II.

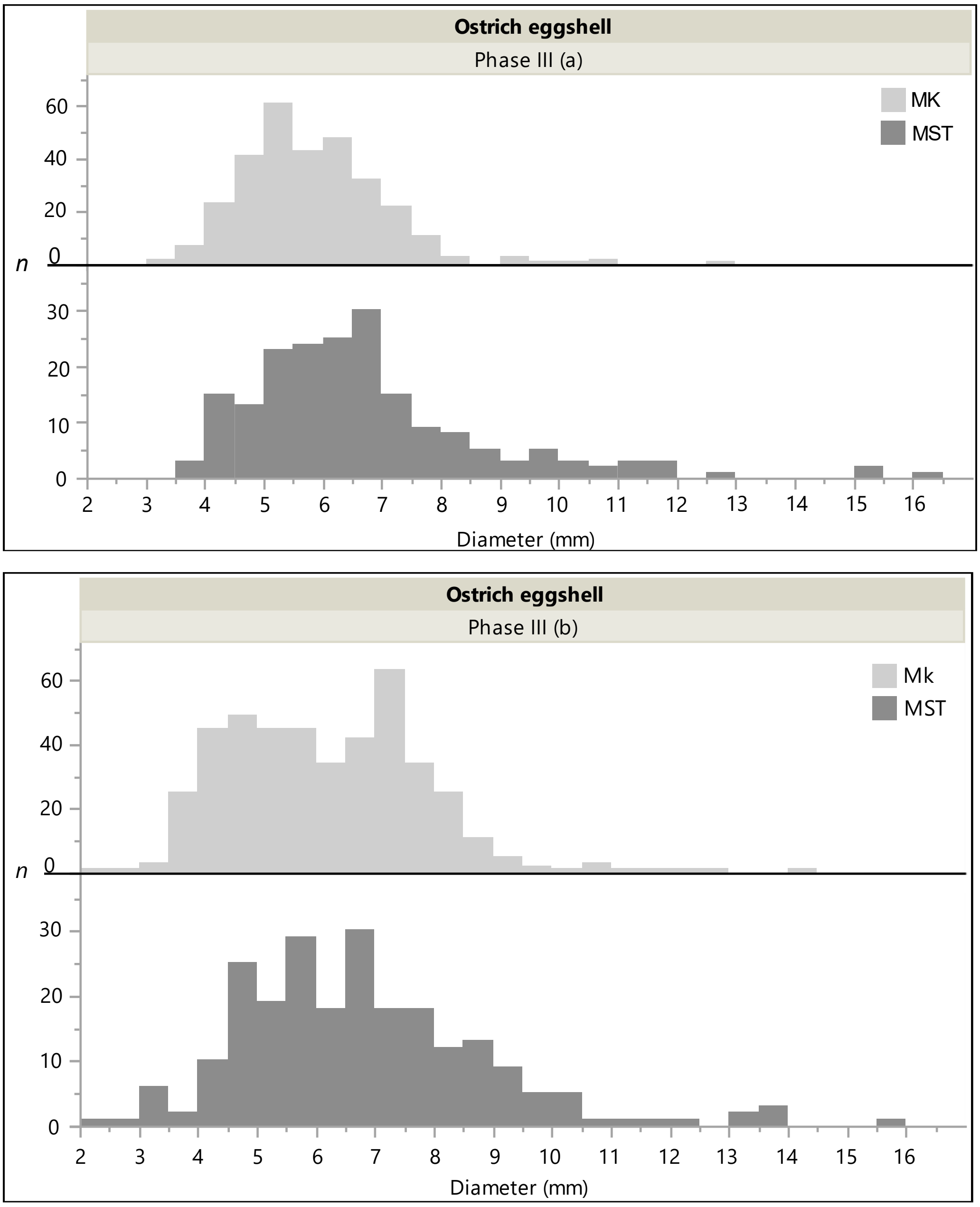


Figure 5.11: Distribution of ostrich eggshell bead diameter sizes for Phase III. Top-Phase III (a); Bottom-Phase III (b).

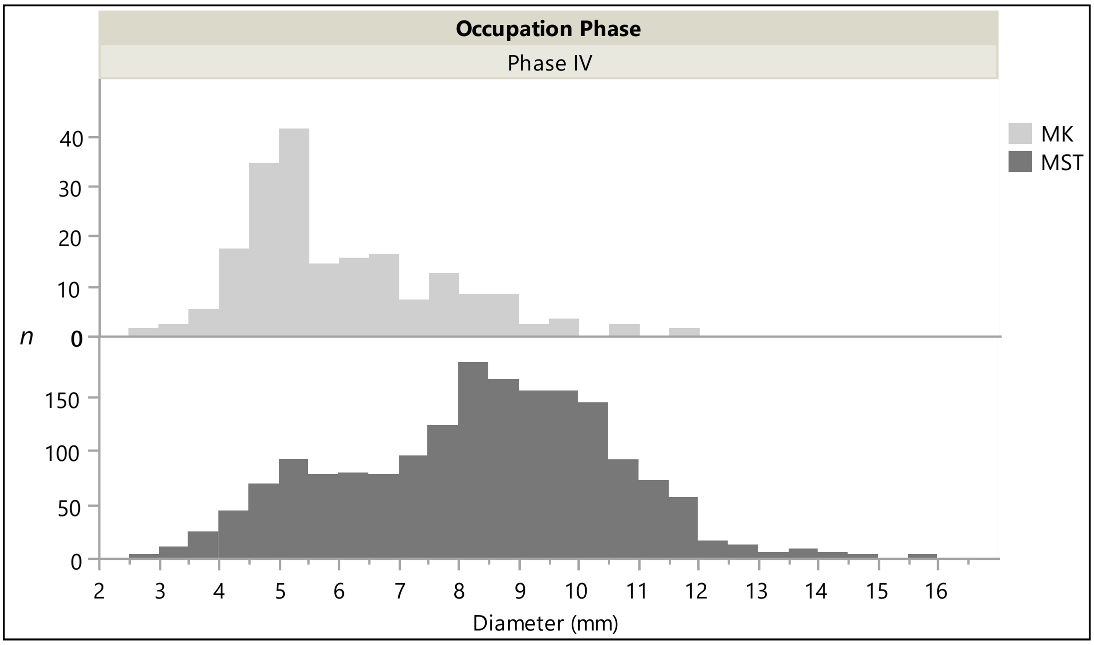


Figure 5.12: Distribution of ostrich eggshell bead diameter sizes for Phase IV.

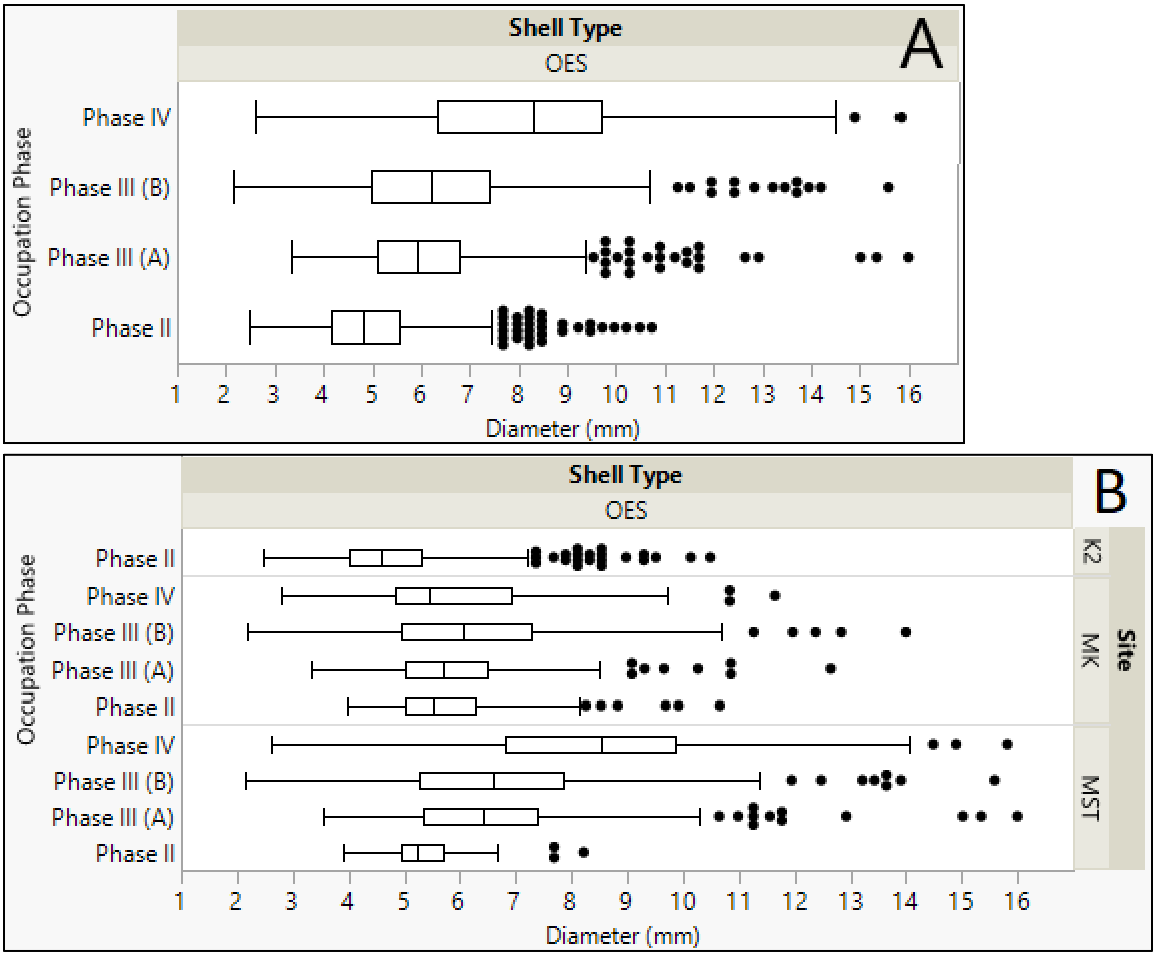


Figure 5.13: Chronological distribution of ostrich eggshell diameter sizes. A-K2, MK, and MST combined; B-On a site level.

Furthermore, the distribution of diameter sizes during Phase IV not only increased compared to earlier occupation phases on the Southern Terrace (Table 5.4, p.77), it also presents a bimodal distribution, suggesting that there may be two diameter size groups (Figure 5.12, p.79). When breaking this down to the individual excavation units, two size groupings were noted on the Southern Terrace during Phase IV.

Within squares J10, I10, and I11, the 10% and 90% quantiles ranged between 6,3 and 11mm with a mean around 9mm (Figure 5.14 and Table 5.5). The spread, and subsequent mean diameter, from these squares are therefore larger compared to the other squares on the Southern Terrace (E2, F4, MST1, K8) where the 10% and 90% quantiles range between 3,8 and 7,8mm with a mean around 5,6mm (Figure 5.15). The first peak within the Bimodal distribution can therefore be attributed to the spread of diameter sizes for squares E2, F4, and MST1, while the second peak can be attributed to squares J10, I10, and I11 (Figure 5.16, p.81).

Temporarily excluding squares J10, I10, and I11 presents a near identical distribution during Phase IV for the Hill and the Southern Terrace (Figure 5.17, p.82). Without these squares, little change took place between the settlement of K2 and Mapungubwe in terms of ostrich eggshell disc beads (Figure 5.18, p.83).

Table 5.5: Summary statistics for Phase IV ostrich eggshell beads from MST.

Ostrich eggshell																
Phase	**Square**	***n***	**s**	$\bar{x}$	**Upper CI**	**Lower CI**	$s\bar{x}$	**CV1**	**CV2**	**Max**	**90%**	**Q3**	$\tilde{x}$	**Q1**	**10%**	**Min**
IV	J10	115	1,93	9,0	9,4	8,7	0,18	21,45	21,45	13,3	11,3	10,5	9,2	7,8	6,2	3,9
	I11	1113	1,68	9,1	9,2	8,9	0,05	18,54	16,38	15,8	11,1	10,2	9,1	8,1	7,0	3,9
	I10	74	1,89	9,0	9,4	8,5	0,22	21,09	21,09	13,1	11,4	10,5	8,9	7,6	6,3	4,2
	I9	85	2,18	7,6	8,1	7,1	0,23	28,70	28,70	12,7	10,5	9,4	7,6	5,6	4,8	3,9
	K8	22	1,03	6,4	6,9	5,9	0,21	16,09	16,09	8,4	7,9	7,1	6,4	5,3	5,1	4,9
	F4	64	1,37	5,8	6,2	5,5	0,17	23,64	22,55	8,7	7,8	6,7	5,7	4,9	4,2	2,6
	E2	204	1,29	5,5	5,7	5,3	0,09	23,39	18,59	10,1	7,1	6,1	5,4	4,7	4,0	2,9
	MST1	52	1,36	5,6	5,9	5,2	0,18	24,32	22,27	9,9	7,3	6,3	5,5	4,6	3,9	3,4

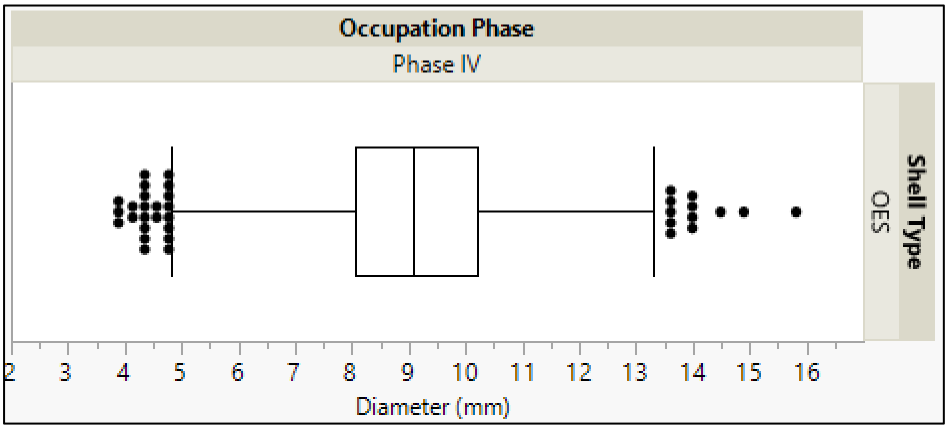


Figure 5.14: Ostrich eggshell diameters for Square J10, I10, and I11.

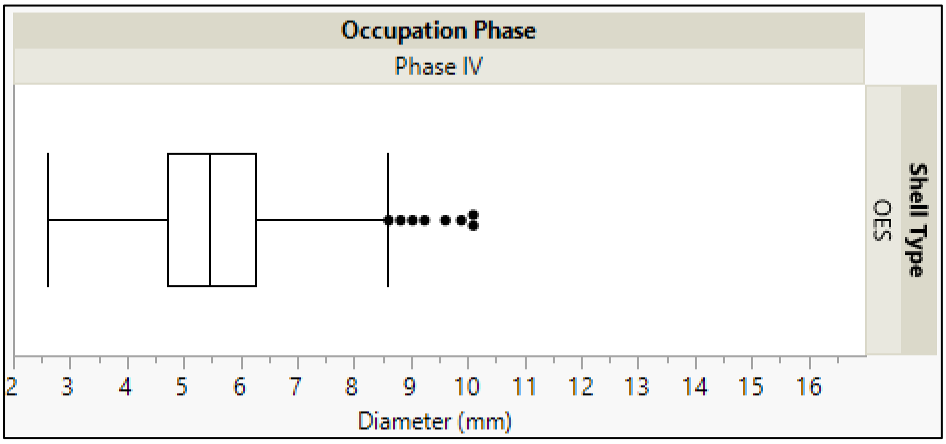


Figure 5.15: Ostrich eggshell diameters for Square F4, E2, and MST1.

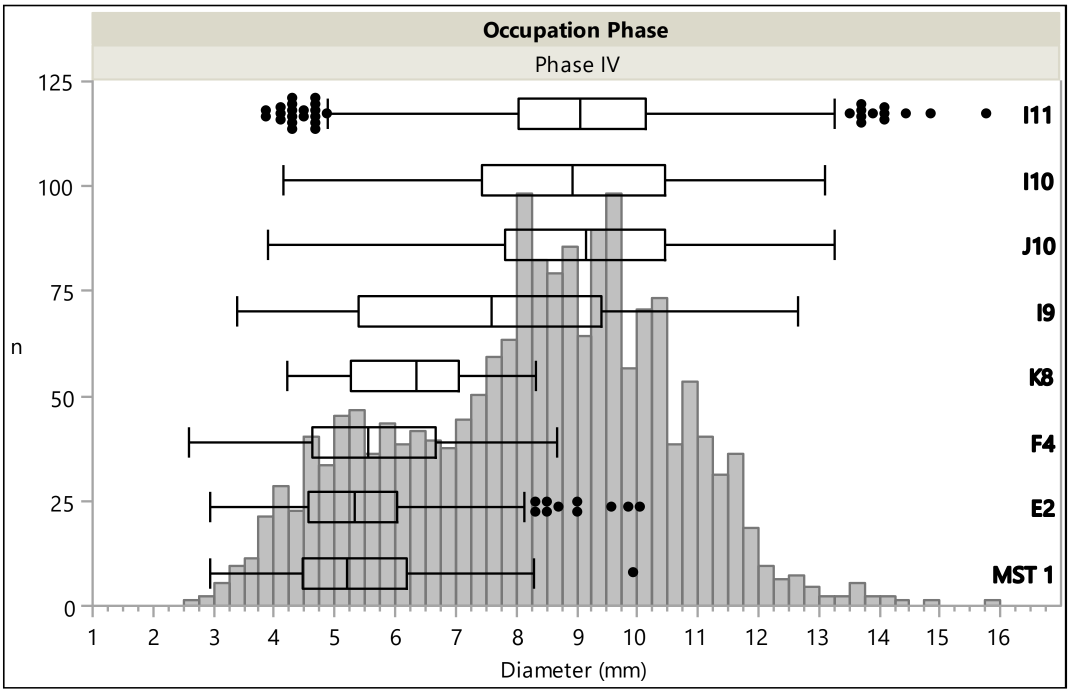


Figure 5.16: Spatial distribution of ostrich eggshell diameter sizes for MST during Phase IV. Box plot overlay of individual excavation units.

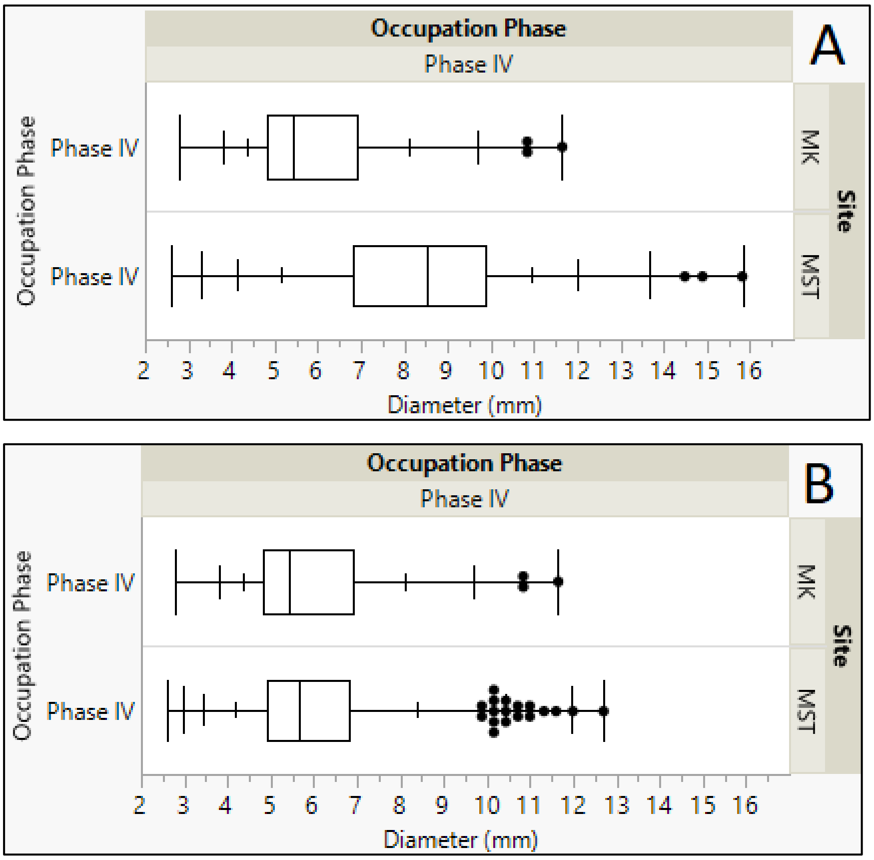


Figure 5.17: Comparison between MK and MST ostrich eggshell diameters for Phase IV. A-All excavation units included; B-Squares J10, I10, and I11 for MST excluded.

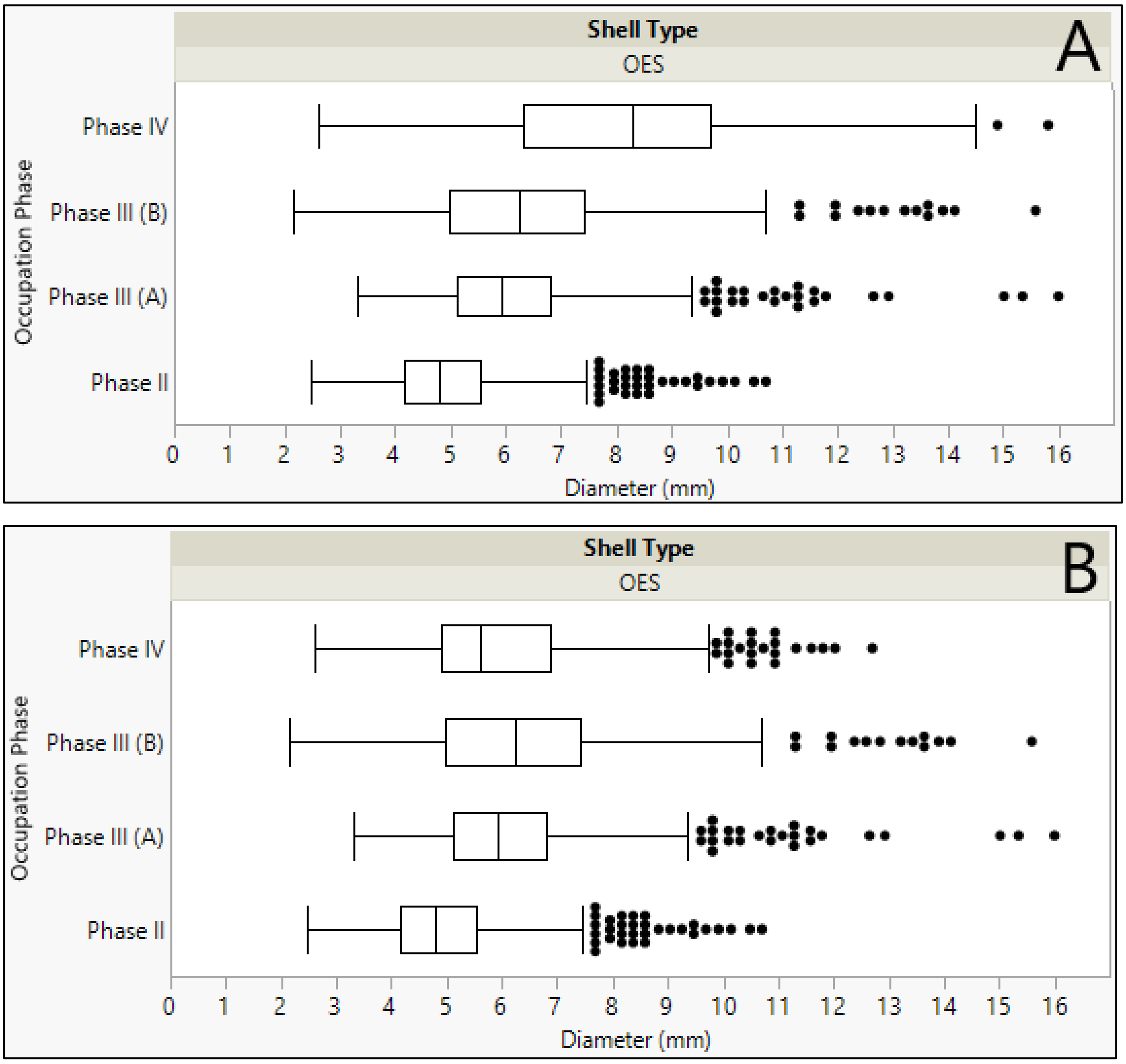


Figure 5.18: Chronological distribution of ostrich eggshell diameters. A-K2, MK, MST and all subsequent excavation units included; B-Squares J10, I10, and I11 for MST excluded.

5.2.2 Thickness and perforation

The thickness measurements were very similar between the sites for both *Achatina* and ostrich eggshell beads (Figure 5.19). However, the CV values suggested greater variation in thickness for *Achatina* (Table 5.6, p.85). Perforation measurements varied between the sites. While the *Achatina* beads were similar, the ostrich eggshell bead perforations from K2 were clearly smaller compared to the ones from Mapungubwe (Figure 5.20).

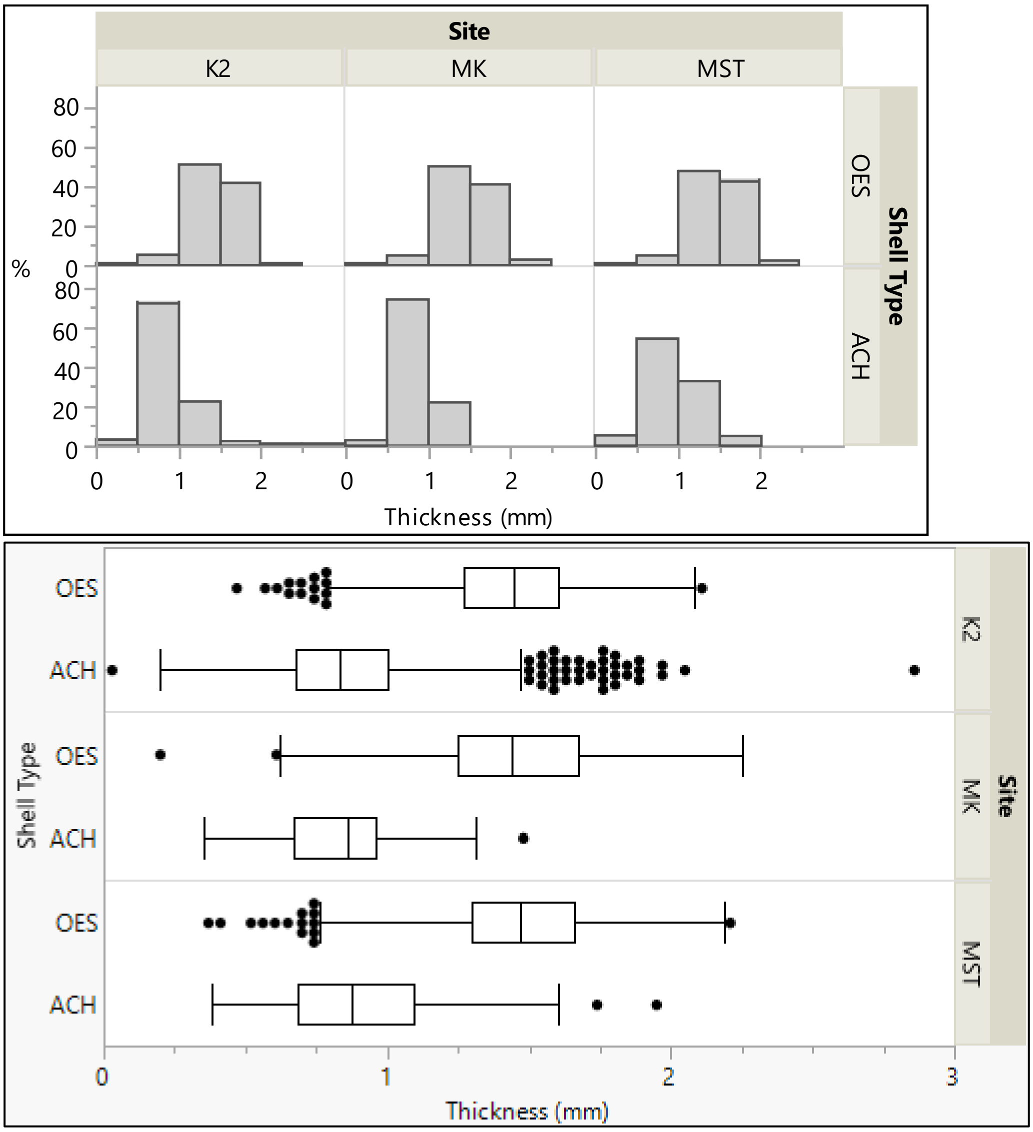


Figure 5.19: Distribution of thickness measurements at site level. Percentages calculated from total measured from each material type.

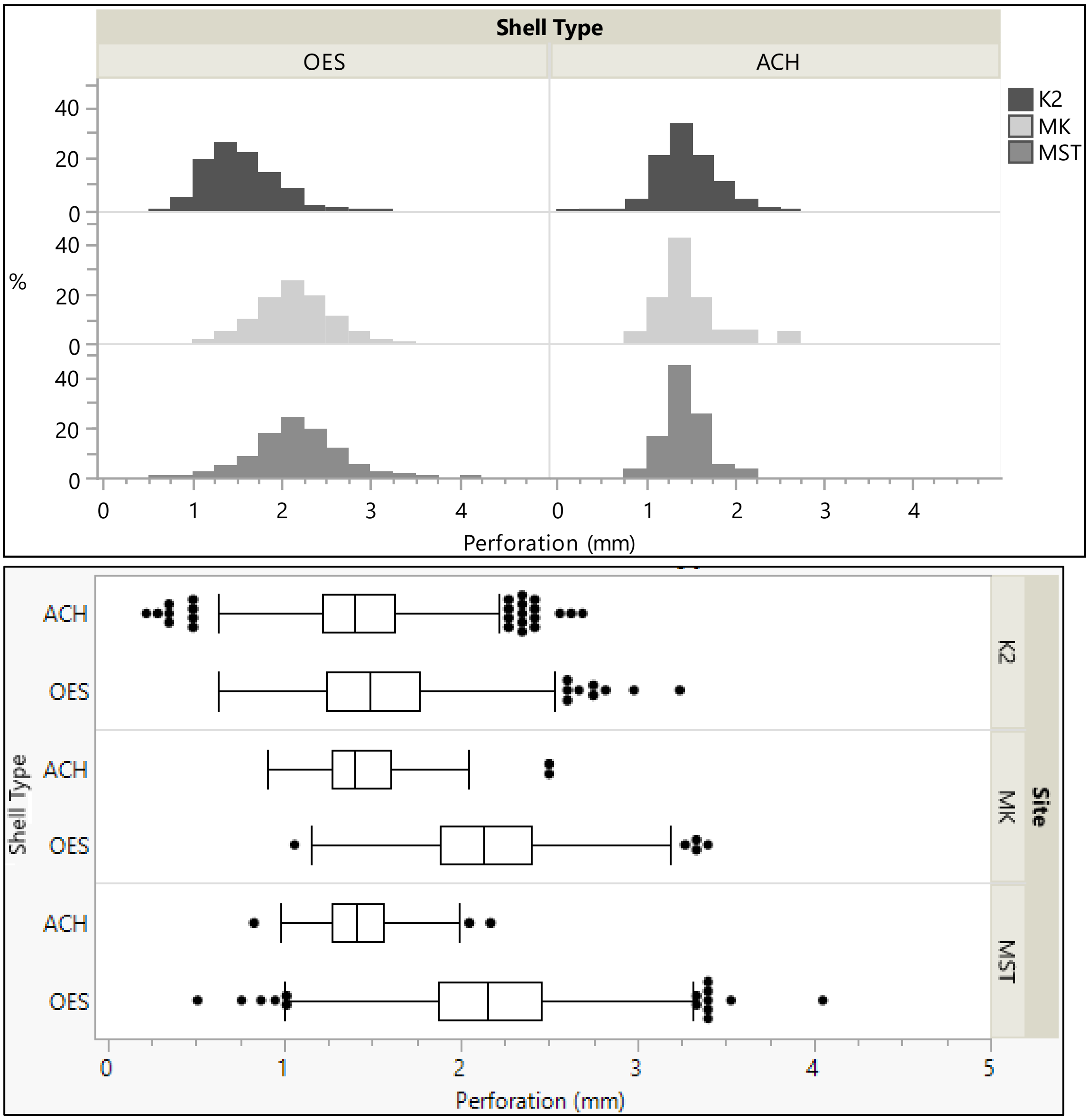


Figure 5.20: Distribution of perforation measurements at site level. Percentages calculated from total measured from each material type.

Table 5.6: Summary statistics for thickness and perforation measurements.

Thickness												
Shell type	**Site**	***n***	**s**	**x̄**	**Upper CI**	**Lower CI**	**s x̄**	**CV1**	**CV2**	**Max**	**x̃**	**Min**
OES	K2	677	0,25	1,4	1,5	1,4	0,01	18,19	16,34	2,1	1,5	0,5
	MK	1052	0,29	1,5	1,5	1,4	0,01	19,99	19,64	2,3	1,5	0,2
	MST	2339	0,27	1,5	1,5	1,5	0,01	18,82	18,04	2,2	1,5	0,4
ACH	K2	1732	0,25	0,9	0,9	0,8	0,01	30,00	25,50	2,9	0,8	0,1
	MK	58	0,23	0,9	0,9	0,8	0,03	27,11	25,83	1,5	0,9	0,4
	MST	80	0,31	0,9	0,9	0,8	0,03	34,37	29,85	1,9	0,9	0,4
Perforation												
OES	K2	674	0,38	1,5	1,6	1,5	0,01	25,18	23,12	3,2	1,5	0,6
	MK	1015	0,39	2,1	2,2	2,1	0,01	18,36	18,03	3,4	2,1	1,1
	MST	2221	0,43	2,2	2,2	2,1	0,01	20,31	19,21	4,1	2,2	0,5
ACH	K2	1719	0,31	1,4	1,5	1,4	0,22	21,78	19,95	2,7	1,4	0,2
	MK	57	0,32	1,5	1,5	1,4	0,04	22,52	18,61	2,5	1,4	0,9
	MST	78	0,23	1,4	1,5	1,4	0,02	16,53	13,10	2,2	1,4	0,8

5.3 Shell disc bead drilling directions

Close examination of the perforations revealed the *Achatina* beads from K2 showed little preference for drilling direction while ostrich eggshell presented a clear preference for drilling from a single surface (Figure 5.21). A contingency analysis indicated this too was related to shell type (Figure 5.23, p.87). The mosaic plot shows a numerical difference while the Pearsons and likelihood ChiSquare scores indicate that the distribution of drilling direction varies as a function of shell type (cf. Appendix B). From here, the single surface ostrich eggshell samples were predominantly drilled from the inner mammillary surface (Figure 5.22). Of the three sites, the sample from K2 presented the highest percentage of beads drilled from both surfaces, even for its ostrich eggshell sample. Chronologically, there was little change in drilling direction between the occupation phases (Figure 5.24, p.88). Mapungubwe Hill experiences a drop in single surface drilling for ostrich eggshell samples during Phase IV, which was accompanied by a corresponding rise in single surface drilling on the Southern Terrace.

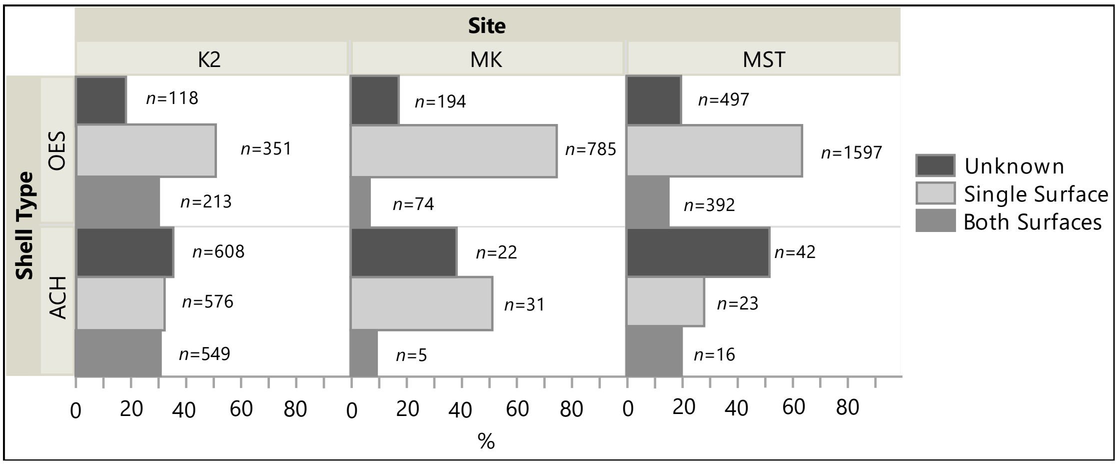


Figure 5.21: Drilling direction at site level. Percentages were calculated from the total shell type analysed per site.

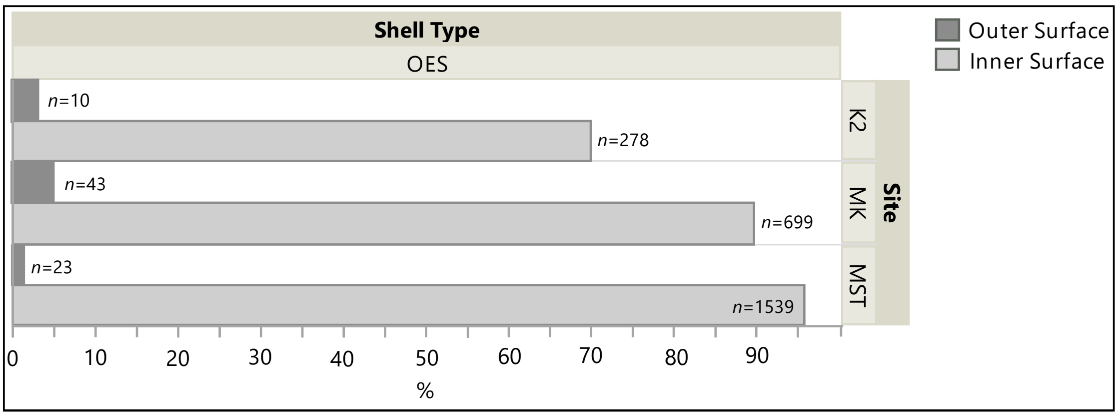
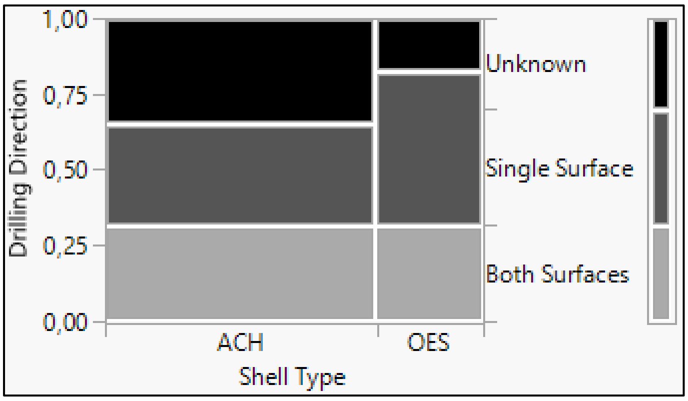


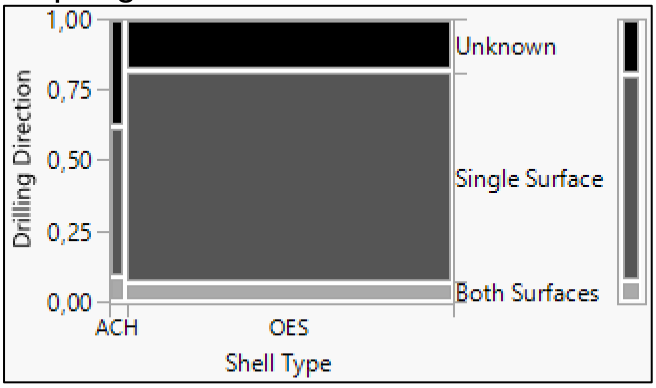
Figure 5.22: Single surface drilling of ostrich eggshell. Percentages were calculated from the total single surface samples for each site.

K2



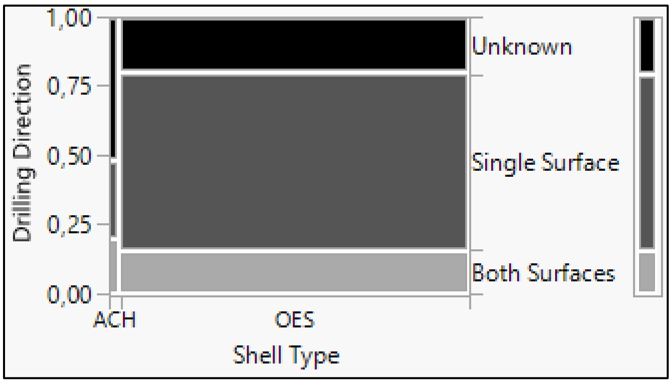
Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	97,469	<,0001
Pearson	93,873	<,0001

Mapungubwe Hill



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	12,381	0,0020
Pearson	14,288	0,008

Southern Terrace



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	47,896	<,0001
Pearson	54,676	<,0001

Figure 5.23: Contingency analysis of drilling direction versus shell type. Mosaic plot with hypothesis test table.

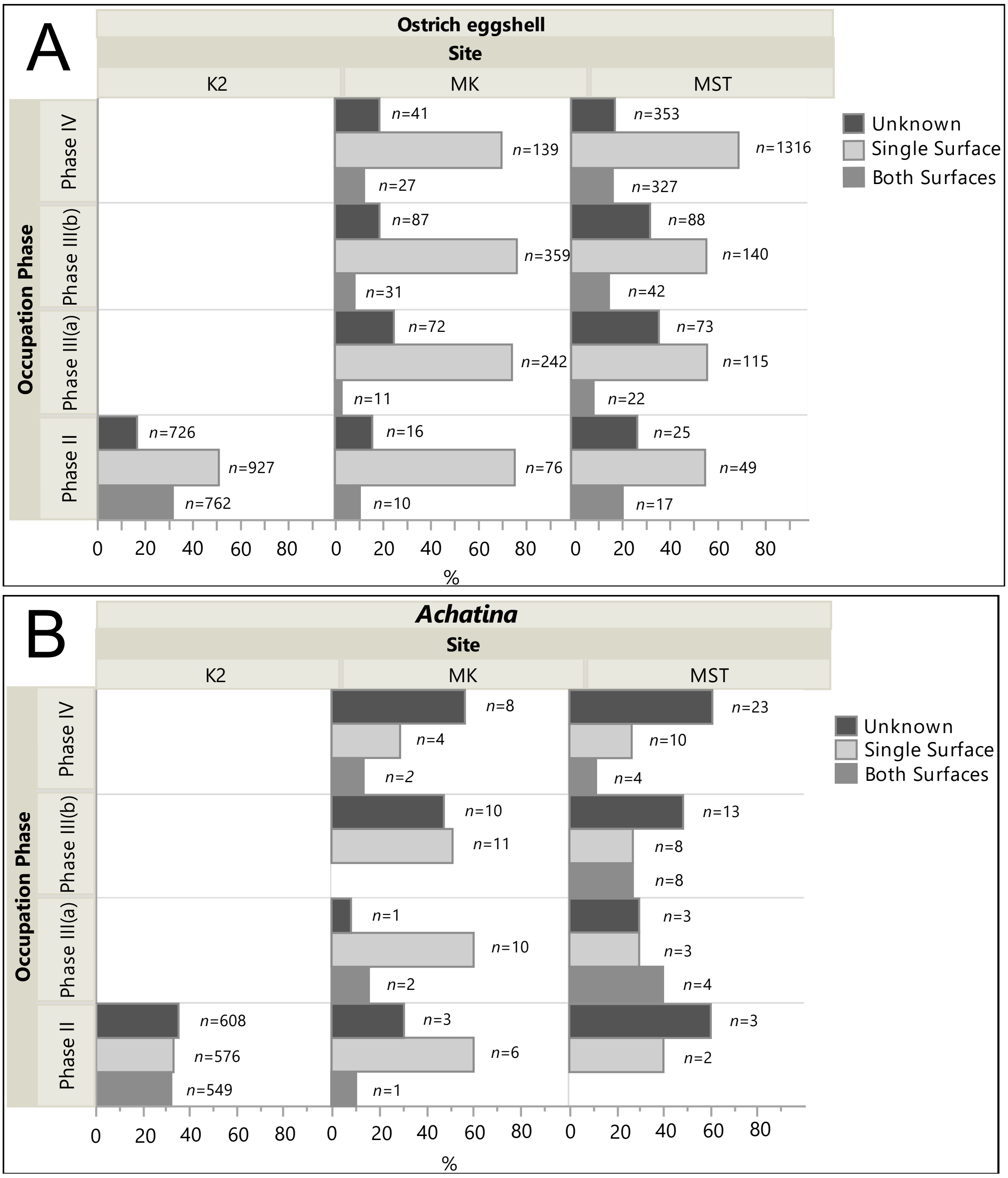
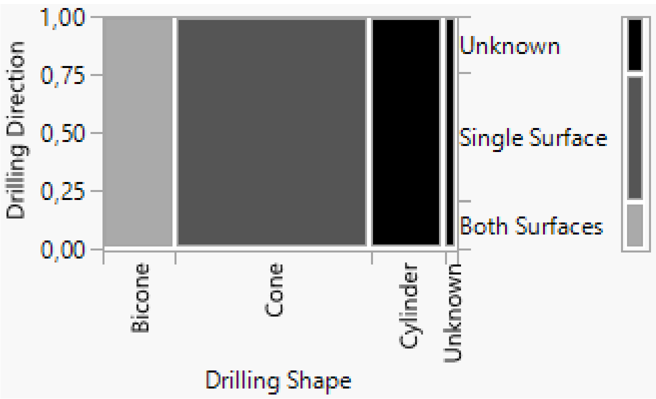


Figure 5.24: Chronological distribution of drilling direction. A-Ostrich eggshell; B-*Achatina*. Percentages were calculated from total shell type analysed per occupation phase.

5.4 Shell disc bead perforation shaft shapes

Perforation shaft shape is a factor of drilling direction (Figure 5.25). As a result, *Achatina* beads from K2 showed little preference in terms of perforation shaft shape, with samples evenly distributed between the categories (Figure 5.26). From Mapungubwe, the *Achatina* beads from the Hill were mostly cone shaped, while the Southern Terrace beads were predominantly cylindrical. The large percentage (52% (*n*=42)) of unknown drilling direction for the Southern Terrace was due to this predominance of cylindrical drill shape as opposed to directions that could simply not be identified (Figures 5.21 and 5.26).



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	12145,65	<,0001
Pearson	12186,00	<,0001

Figure 5.25: Contingency analysis of drilling direction versus shaft shape.

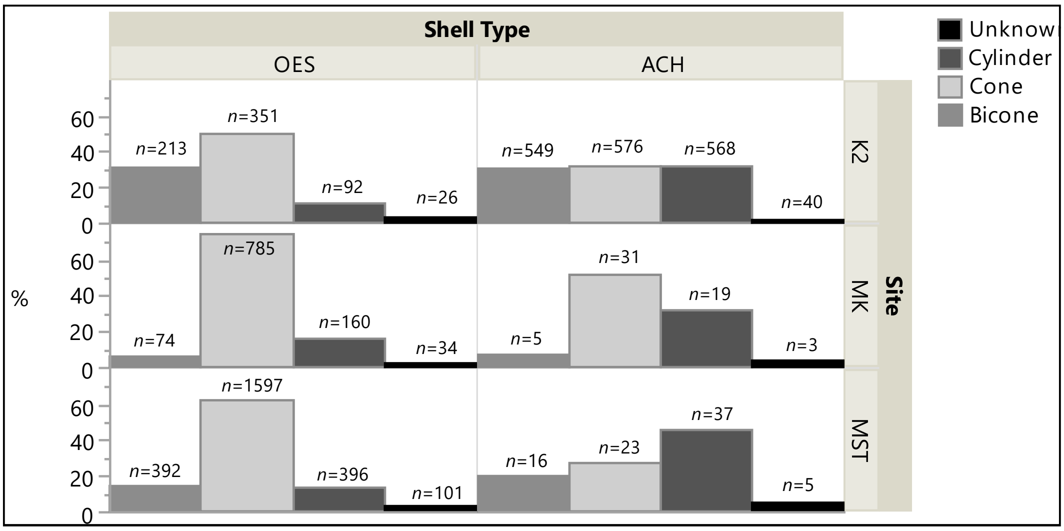


Figure 5.26: Distribution of perforation shaft shapes. Percentages calculated from total SDB analysed.

5.5 Heated bead descriptions

For the sample from K2, only 9% (*n*=236) of the SDB were exposed to heat, and these were dominated by variations of grey (Tables 5.7 and 5.8). Mapungubwe Hill had similarly low numbers of heated beads, with only 12% (*n*=135) of beads showing signs of heat exposure. The sample from the Southern Terrace, on the other hand, had higher counts of heated beads. More than half (57% (*n*=1473)) of the analysed assemblage was exposed to heat. The spatial distribution of heated beads for the Southern Terrace indicated that the heated beads predominantly came from square I11 (Figure 5.27). Here, 86% (*n*=1002) of the beads recovered were exposed to heat, while the square produced 68% of the total heated beads recovered from the Southern Terrace. A significant percentage of the beads recovered from the adjacent squares J10, I9, and I10 were also exposed to heat (Table 5.9, p.91).

Table 5.7: Number of heated beads.

	K2		MK		MST	
Heated	***n***	**%**	***n***	**%**	***n***	**%**
Yes	236	9	135	12	1473	57
No	2250	91	975	88	1060	41
Unknown	2	0	2	0	39	2
Total SDB	**2488**	**100**	**1112**	**100**	**2572**	**100**

Table 5.8: Heated bead colours. The mixed category presents a combination of different colours. *n1*-Inner surface colour. *n2*-Outer surface colour.

	K2		MK		MST	
Colour	***n1***	***n2***	***n1***	***n2***	***n1***	***n2***
Grey	182	185	74	76	979	907
Brown	41	37	41	29	464	366
Black	2	2	2	5	4	40
White	4	1	17	15	3	0
Blue	3	4	0	0	0	1
Mixed	4	7	1	10	23	159
Total Heated	**236**	**236**	**135**	**135**	**1473**	**1473**

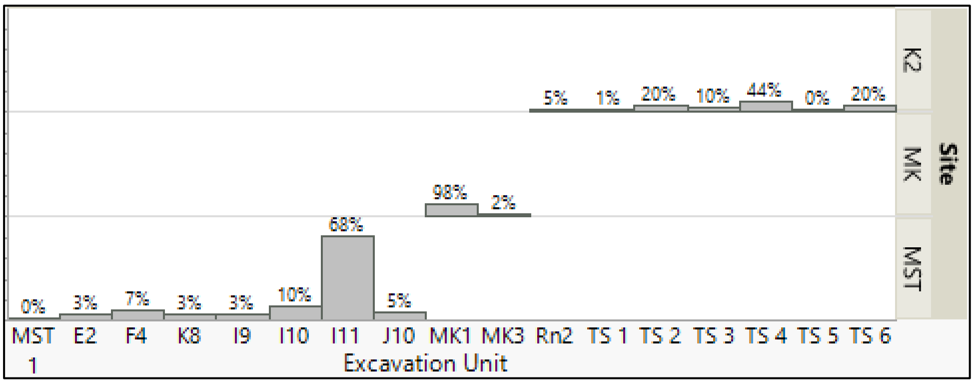


Figure 5.27: Spatial distribution of heated beads. Percentages calculated from total heated beads analysed for each of the sites.

Table 5.9: Percentage of heated beads per excavated unit. *n*1-total shell disc beads analysed for the unit. *n*2-total heated beads for the unit. Percentage calculated from the total shell disc beads analysed for the excavation unit.

Site	K2								
Unit	TS1	TS2	TS3	TS4	TS5	TS6	Rn2	**Total**	
***n*1**	186	911	511	473	130	173	103	**2488**	
***n*2**	3	47	23	104	1	47	11	**236**	
%	2%	5%	5%	22%	1%	27%	11%	**9%**	

Site	MK								
Unit	MK1	MK3	**Total**						
***n*1**	1010	101	**1112**						
***n*2**	132	3	**135**						
%	13%	3%	**12%**						

Site	MST								
Unit	E2	F4	MST1	K8	J10	I9	I10	I11	**Total**
***n*1**	361	345	64	194	133	89	224	1160	**2572**
***n*2**	44	103	2	50	75	45	152	1002	**1473**
%	12%	30%	3%	26%	56%	51%	68%	86%	**57%**

Several observations were noted for the inner surface and the bead shoulder for heated ostrich eggshell discs. Beads exposed to higher temperatures presented a loss in mass whereby the inner surface was degraded or completely missing (Figure 4.2 B, p.56) (cf. Collins & Steele 2017; Craig *et al*. 2020). For the Southern Terrace, 62% (*n*=911) of the burnt ostrich eggshell beads were missing their inner surface, while at 48% (*n*=48) for K2 and 43% (*n*=52) for the Hill. These samples generally had a dark grey colouration suggesting prolonged or intense exposure to heat (Janssen *et al*. 2011: 660; Craig *et al*. 2020: 3).

5.6 Beads' edge descriptions

The angularity of the beads edge was investigated across all sites (Figure 5.28, p.92). The K2 sample was near evenly distributed between the well-rounded and rounded categories for the *Achatina* discs, while the Mapungubwe sites had a higher percentage of well-rounded beads. The ostrich eggshell sample generally consisted of a higher percentage well-rounded for all three sites. The low numbers of angular edge types are negligible in comparison to the rounded types. Assessing the distribution of the angular types spatially indicated a large percentage of the samples from the Southern Terrace came from square I11, while the sample from K2 came from TS2, and the Hill from MK1 (Figure 5.29). The angular categories from the Southern Terrace were fairly evenly distributed vertically, while the sample from K2 (TS2) exclusively came from layer 1 and Mapungubwe Hill (MK1) predominantly from layer 8 (Figure 5.30).

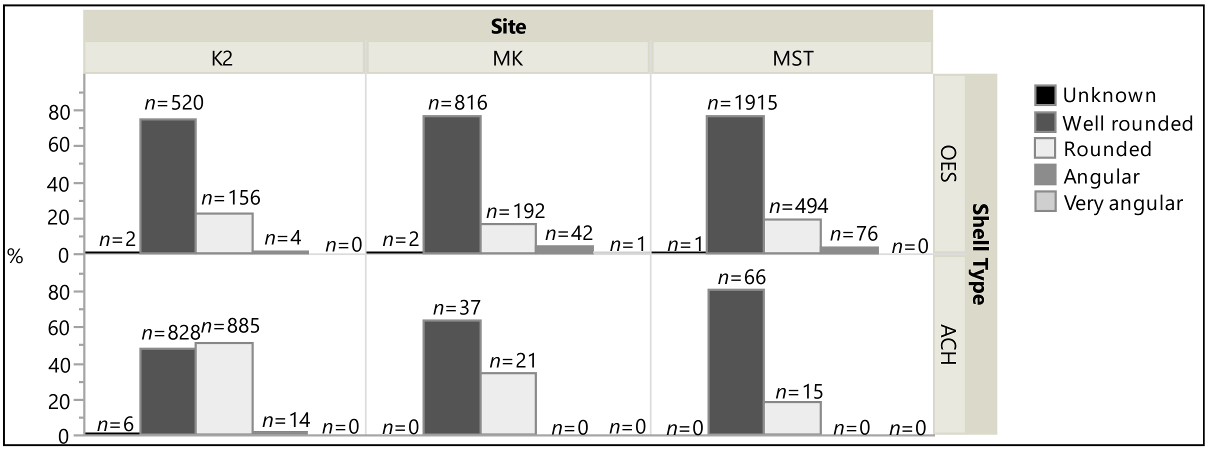


Figure 5.28: Distribution of bead edge categories. WR-Well rounded; R-Rounded; A-Angular; VA-Very angular; U-Unknown.

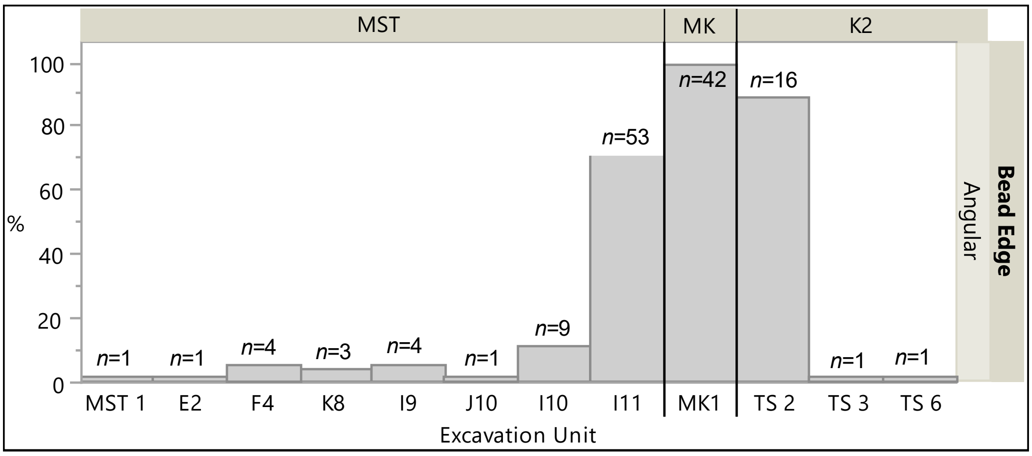


Figure 5.29: Spatial distribution of the angular bead edge category. Percentages calculated from the total angular for each site.

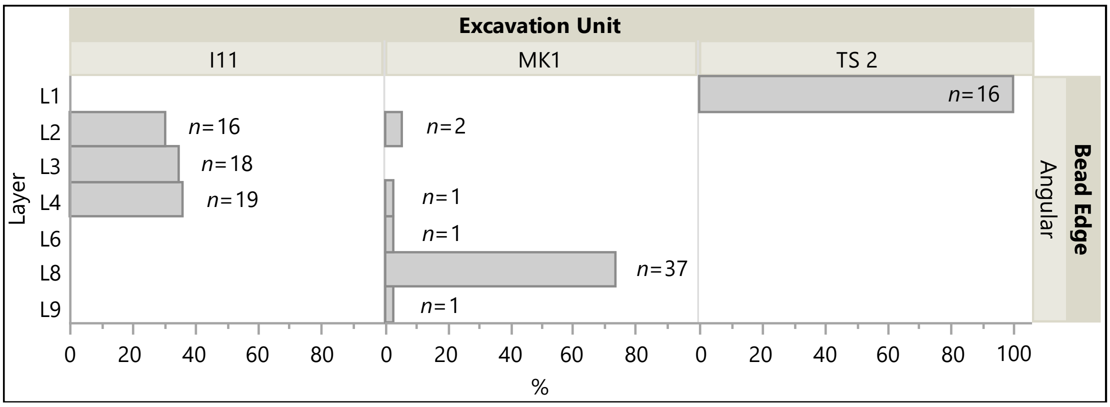


Figure 5.30: Vertical distribution of the angular bead edge category. Percentages calculated from the total angular for each excavation unit.

5.7 Bead shapes

All three sites were dominated by beads with a circular shape (Table 5.10). The sample analysed from K2 had a noteworthy occurrence of light grey coloured ovoid *Achatina* beads (Figure 4.18, p.67). Several of these beads were recovered from TS4 and shared a uniform shape, size, and colour. Based on their uniformity, their design appears intentional. None of these beads were recovered from the Hill or the Southern Terrace and their existence appears unique to the site of K2.

Table 5.10: Distribution of bead shapes. Percentages calculated from total SDB per site.

		K2		MK		MST	
Shell	**Shape**	***n***	**%**	***n***	**%**	***n***	**%**
ACH	Circular	1463	85	56	97	80	99
	Ovoid	158	9	-	-	-	-
	Irregular	112	6	2	3	1	1
	Total	**1733**	**100**	**58**	**100**	**81**	**100**
OES	Circular	660	97	1039	99	2477	100
	Ovoid	-	-	2	0	-	-
	Irregular	22	3	12	1	9	0
	Total	**682**	**100**	**1053**	**100**	**2486**	**100**

5.8 *Unionid* bead sample

The *Unionid* bead samples were poorly preserved with several displaying flaking of the nacreous layers (p.61-62). Of the *Unionid* bead sample, 71% (*n*=51) from K2 and 67% (*n*=2) from the Southern Terrace displayed some degree of flaking. It was extremely difficult to confidently match flaked fragments to the same beads. For this reason, thickness and perforation measurements were deemed pointless. Furthermore, the totals (Figure 5.1, p.70) and size presentations (Figure 5.31, p.94) for *Unionid* beads should not be considered as representative of complete beads. Their presentation here therefore serves only as a broad summary.

The samples were predominantly circular with most bead edge categories ranging between well-rounded and rounded. The beads covered a wide range of diameter sizes. However, considering the flaking nature of this shell type, the spread is likely not representative. For drilling direction, the large count of beads within the unknown category reiterates the need for caution when interpreting this data (Figure 5.32). For the beads where drilling direction could be identified, the sample from K2 presented a significant percentage (38% (*n*=27)) of beads drilled from both surfaces, with far less samples drilled from a single surface when compared to the other material types (Figure 5.21, p.86).

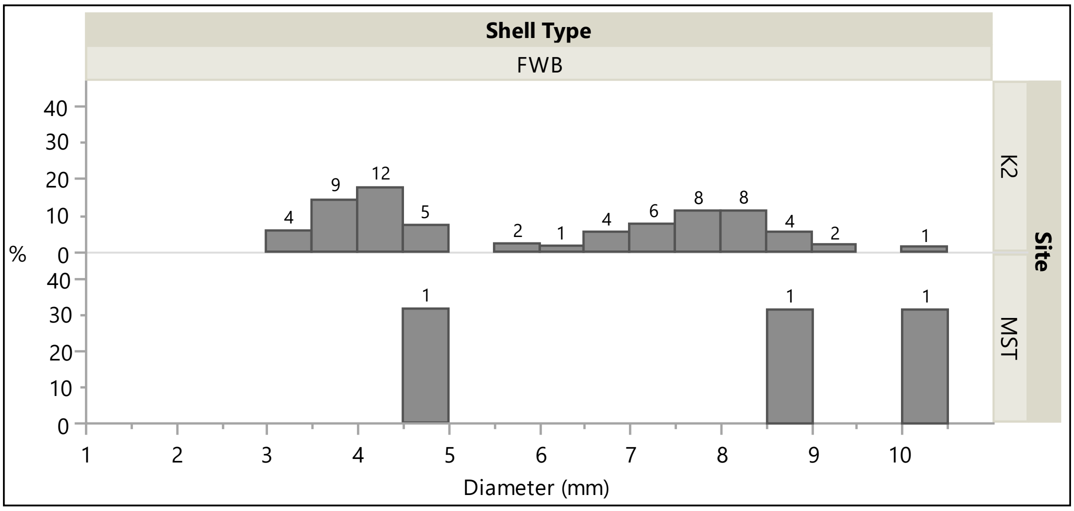


Figure 5.31: Distribution of *Unionid* diameter sizes.

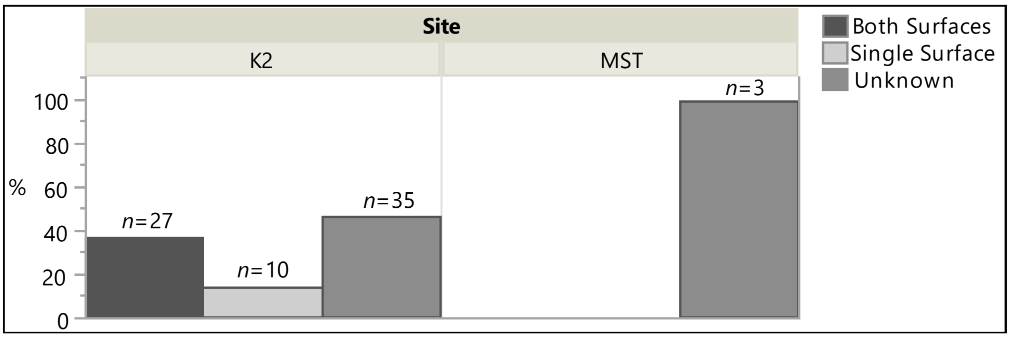


Figure 5.32: Distribution of *Unionid* bead drilling directions.

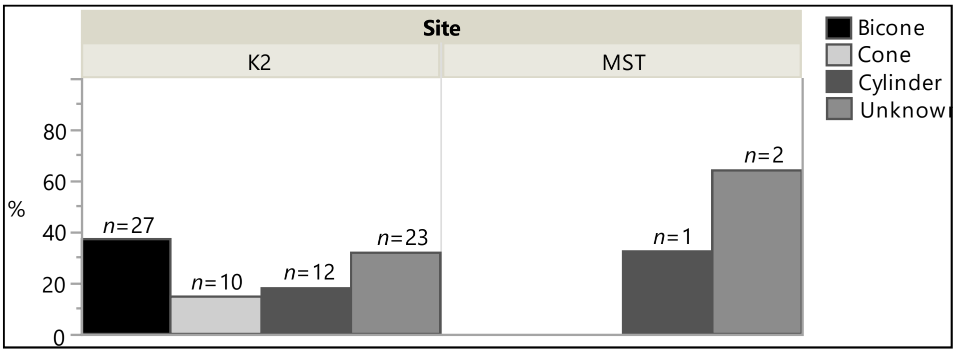


Figure 5.33: Distribution of *Unionid* bead perforation shaft shapes.

5.9 Beads from grave contexts

Several graves (TS2.G1, TS2.G2, TS2.G3, TS4.G1, TS5.G2) were recovered during the research phase three excavations on K2. The small sample size severely limits any conclusions being drawing in regards to characteristics unique to SDB from grave contexts. The only characteristic worth considering at this point is the distribution of shell types from TS2.G2 which presented a near equal distribution of ostrich eggshell and *Achatina* beads, while the rest of TS2 consisted predominantly of *Achatina* (Table 5.2, p.71). Too many beads were unaccounted for from the other graves to confidently remark on their distribution of shell types (p.31, 33, 35).

Interestingly, *Unionid* beads were recovered from two of the graves (TS2.G1 and TS2.G2) from K2. Considering their negligible numbers from other contexts, their use in graves indicate their importance.

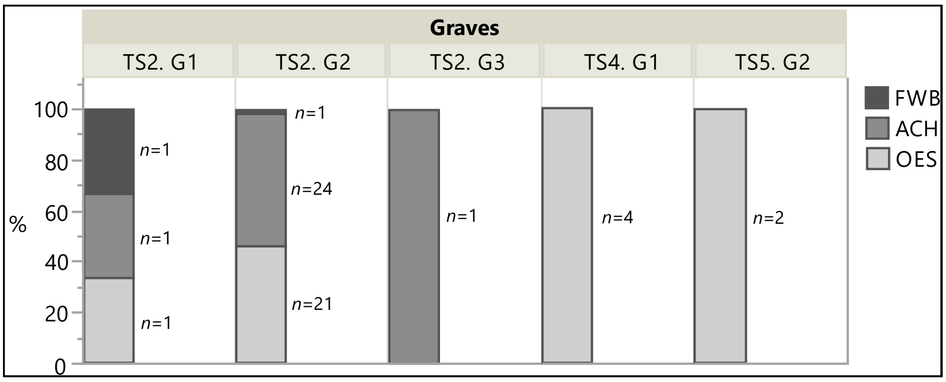


Figure 5.34: Distribution of shell types for the Graves from K2.

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1 Raw material selection

6.1.1 Temporal changes in shell use

The Greefswald SDB assemblages indicated changes in the use of raw materials for the manufacture of SDB over time. At a site level, the majority of the SDB from Phase II at K2 were manufactured from *Achatina* shell, while the majority of the beads from the Mapungubwe complex were manufactured from ostrich eggshell. Furthermore, although the K2 SDB assemblage consisted predominantly of *Achatina* beads, the assemblage also presented large quantities of other shell types, such as ostrich eggshell and to a lesser degree, *Unionid* beads. The Mapungubwe sites, on the other hand, presented low counts of shell types other than ostrich eggshell.

This could indicate greater availability of all shell types during the occupation of K2 (Phase II), or that these groups simply had no preference for any one specific shell type. On the other hand, the predominance of ostrich eggshell at Mapungubwe could indicate that other shell types were not easily attainable during Phase III and Phase IV, or that ostrich eggshell beads were preferred. The faunal assemblages from Greefswald indicates that the latter is more probable since other shell types, albeit in disproportionate quantities, were present throughout most of the deposits on K2, Mapungubwe Hill, and the Southern Terrace (Gardner 1963; Voigt 1979, 1983, 1998).

Despite the presence of these materials on Mapungubwe, the SDB were predominantly manufactured from ostrich eggshell. The presence of various shell types in the faunal assemblages, and the reluctance for their use in the manufacture of SDB on Mapungubwe suggest there was a clear preference for ostrich eggshell. The K2 SDB assemblage, on the other hand, presented greater variability in the use of raw materials.

6.1.2 Spatial distribution of shell types on K2

In addition to the chronological differences, variability also existed in the spatial distribution of shell types between the different excavations on K2. The excavation units of TS1, TS2, and TS5 were utterly dominated by *Achatina* disc beads, while TS4, Rn2, and TS3 presented a more even ratio of ostrich eggshell to *Achatina* disc beads. In an attempt to better understand these ratios within a broader social and economic context, the SDB distributions (Table 5.2, p. 71) were compared with the glass bead data (p.24, 36-37) from Wood (2005) and Saitowitz (1996).

For the outer residential areas of TS1 and TS2 in the north-eastern settlement (Figure 5.3, p.72), *Achatina* outnumbered ostrich eggshell beads 3:1. Both excavation units consisted of midden deposits, and both presented glass bead assemblages akin to the overall K2 pattern. Incidentally, the grave TS2.G2 presented a near even distribution of ostrich eggshell (*n*=21) and *Achatina* (*n*=24) with a glass bead colour profile consisting predominantly of East Coast Indo-Pacific (EC-IP) brownish-red beads (Wood 2005: 118). While the sample size for grave TS2.G1 was small (*n*=3), the sample consisted of one of each shell type with a glass bead profile exclusively consisting of K2 Indo-Pacific (K2-IP) blue-green beads (Ibid.).

TS5, on the western side of K2, produced deposits and material culture similar to that of TS1 and TS2 (north-eastern settlement area), with a glass bead assemblage typical of the overall K2 pattern with the dominant colour profile consisted of blue-green beads.

Unlike the units discussed above, the ratio between *Achatina* and ostrich eggshell (4:1) for TS3 was the result of a large concentration of *Achatina* discs in layer 12 (Appendix A-TS3). This concentration clearly stands out and consists of more SDB than occur in the other layers combined. No contextual explanation for this concentration could be found and it likely represents a single episode deposit. When this single occurrence is removed, a small percentage (11%) of the total *Achatina* remained with an overall SDB ratio similar to that observed for TS4 and the central homestead area (Table 6.1, p.98). TS3 formed part of the central midden adjacent to the central homestead (Figure 5.3, p.72), but presented a glass bead assemblage dominated by K2-IP blue-green beads with low counts of the EC-IP brownish-red beads.

Excavations' Rn2 and TS4 from the central homestead presented a much more even ratio between *Achatina* and ostrich eggshell. Rn2 was also the only area in which ostrich eggshell outnumbered *Achatina*. However, this was not the result of higher counts of ostrich eggshell, but rather because of fewer *Achatina* beads. TS4, on the other hand, produced a significant percentage of the total ostrich eggshell from K2. Similarly, the beads securely related to grave TS4.G1 exclusively consisted of ostrich eggshell (*n*=4). TS6 similarly produced a significant percentage of the ostrich eggshell but a low percentage of the total *Achatina.* Contrary to the central residential areas of TS4 and Rn2, TS6 mostly consisted of midden deposits on the northern end of K2.

From this it can be said that the north-eastern settlement units TS1 and TS2 were responsible for the majority of *Achatina* beads from K2. These units presented glass bead assemblages akin to the overall K2 pattern. The exception being the grave TS2.G2 which consisted of a SDB and glass bead profile similar to the central homestead units of Rn2 and TS4.

The units (TS4, Rn2, TS3) with higher counts of ostrich eggshell, or rather, more even ratios between the shell types, are all within the central homestead area. Rn2 and TS4 present shell type ratios with glass bead profiles more similar to Mapungubwe. Similar to the aforementioned excavation units, Grave TS2.G2 therefore likely dates to the end of the occupation of K2 and represents a pattern in SDB and glass bead distribution which became more prominent on Mapungubwe (cf. Wood 2005).

The overall dominance of *Achatina* at a site level was therefore greatly influenced by the beads collected from the north-eastern settlement, while the central homestead presented ratios more akin to that of Mapungubwe.

Table 6.1: Spatial distribution of shell types on K2. Row A-Percentages were calculated from the total shell disc beads recovered for the specific excavated unit; Row B-Percentages were calculated from the total of the specific material type for the site. *Percentages for TS3 was calculated excluding layer 12.

		Achatina	**Ostrich**	**Ratio**
North-eastern settlement area				
TS1	A	79%	19%	4:1
	B	8%	5%	
TS2	A	74%	23%	3:1
	B	39%	30%	
Central homestead area				
TS4	A	59%	34%	2:1
	B	16%	23%	
TS3	A	*62%	*38%	2:1
	B	*11%	*15%	
Rn2	A	45%	54%	1:1
	B	3%	8%	

6.1.3 Variability in shell use in the greater Limpopo region

On the whole, there is a clear increase in the overall use off ostrich eggshell with the shift from K2 to Mapungubwe. Similar variation in the use of raw materials, both chronologically and spatially, seems to be present in the greater Limpopo region. Past studies indicate ostrich eggshell disc beads predominate Later Stone Age hunter-gatherer contexts (Plug 1982; Ambrose 1998; Kandel & Conard 2005; d'Errico *et al*. 2012). For example, Bushman Rock Shelter, 290km south east, contained an abundance of *Achatina* shell fragments within the Later Stone Age deposits, yet there were only 6 complete beads and 2 unfinished beads, compared to the 138 complete ostrich eggshell beads and 181 samples in various stages of manufacture (Plug 1982: 61). Likewise, at Balerno Shelter in the Shashe-Limpopo Confluence Area (SLCA) in northern South Africa, prior to 2000BP, both ostrich eggshell and *Achatina* fragments are present while only ostrich eggshell was worked into beads (Hall & Smith 2000: 36). This suggests that the use of *Achatina* shell for the manufacture of SDB gained importance later in prehistory with the arrival of farmers (cf. Mazel 1987: 279; Ward & Maggs 1988: 407; Hall & Smith 2000: 36; Miller *et al*. 2018: 347).

Achatina shell beads have been found on several Iron Age sites across northern South Africa (Fouchè 1937; Gardner 1963; Hanisch 1980; Calabrese 2005; Antonites 2012; Raath 2014; Lippert 2015; Mouton 2018; Hopf 2018). Not only are *Achatina* disc beads common on Iron Age sites (Voigt 1979: 269), Hanisch (1980) reported on the predominance of *Achatina* SDB for the archaeological sites of Pont Drift (9^{th} to 11^{th} century CE) and Schroda (9^{th} to 11^{th} century CE) (Figure 3.1, p.19). Here, *Achatina* represented 74% of Schroda's SDB assemblage, outnumbering ostrich eggshell 6:1, while at Pont Drift, the *Achatina* beads outnumbered ostrich eggshell 2:1 (Ibid.: 171, 290). A large cache of ostrich eggshell was recovered from TSR 6 – area 6 from Schroda (Hall & Smith 2000; Raath 2014: 201) and TPD 1/3 – Unit 3 from Pont Drift (Hanisch 1980: 250, 286). However, when these single large occurrences are set aside, both sites are still dominated by *Achatina* disc beads. In addition, both likely date to 11^{th} century Leokwe contexts when ostrich eggshell was starting to become more dominant in regional assemblages. The cache from Schroda is particularly significant since it contained hundreds of strung beads seemingly in the process of being shaped. This cache was found in a pit, buried into a sterile deposit (A. R. Antonites 2021 pers comm.).

Regionally therefore, it seems that *Achatina* SDB's are more common on settlements with extensive Zhizo occupations (c. 10^{th} – 11^{th} centuries CE), while an increase in the use of ostrich eggshell could possibly be associated with the appearance of Leopards Kopje groups in the SLCA (c. 11^{th} – 13^{th} centuries CE). Examples of Zhizo deposits where assemblages are dominated by *Achatina* beads include Schroda, Pont Drift (Hanisch 1980; Raath 2014), Baobab, and Castle Rock (Calabrese 2005: 157, 192) (Figure 3.1, p.19). At Leokwe Hill, the Zhizo areas of the site were dominated by *Achatina* beads, while the K2 and Mapungubwe deposits had more ostrich eggshell beads (Ibid.: 219, 242, 262). Likewise, the early 13th century TK2 assemblage of Skutwater consisted entirely of ostrich eggshell beads (Van Ewyk 1987: 55).

It is evident that variability, both chronologically and spatially, existed in the use of shell types during the Iron Age when comparing different sites within the greater Limpopo region. Varying frequencies of shell types between sites could simply relate to the availability of materials, both locally and/or exotically. While distinguishing between traded materials and those obtained in other ways is difficult, the predominance of a specific shell types could simply reflect greater availability either way. While the factors influencing this change remains a topic for more extensive research, some suggestions are explored below.

6.1.4 Factors contributing to variability in shell use

Environmental factors

Environmental factors, such as annual rainfall and average temperature, can greatly affect the availability of natural resources used for craft production. Maggs (1980: 138) argued that variation in shell-type use in sites in the Thukela Basin in KwaZulu-Natal is reflective of ecological differences, as various species prefer different environments. Maggs (1980, 1984) therefore interprets the predominance of *Metachatina* (a genus within the family Achatinidae) SDB within these assemblages as indicative of its overall abundance in the immediate environment, while ostrich eggshell was introduced via exchange from elsewhere.

If the expansion of Zhizo groups into the SLCA corresponds with an increase in annual rainfall (Huffman 1996), it could explain the dominance of *Achatina* beads. As increased rainfall displaced semi-arid habitats preferred by ostriches (cf. Cooper *et al*. 2009), *Achatina* would have been more easily obtainable. However, Smith *et al*. (2007) argued that settlement of the Shashe-Limpopo River Basin by Zhizo agropastoralists occurred during a dry phase between 880 and 1030 CE, representing a semi-arid environment, similar to present-day conditions. Alternatively, if the expansion of Leopards Kopje groups occurred during a wetter phase, beginning around 1030 CE and continuing beyond the abandonment of Mapungubwe at 1290 CE (Ibid.: 124), we would see a similar displacement of favourable ostrich habitats.

If these particular environmental conditions affected the availability of raw materials, one would expect ostrich eggshell to be more abundant on Zhizo period settlements, and less so during the Leopards Kopje occupation of the region. Yet the opposite appears true. Furthermore, some *Achatina sp.* and ostriches could also have survived in the same environments. Voigt (1998: 281) not only points out the adaptability of most genera of Achatinidae to mopane savannah vegetation, but also indicated that *Achatina immaculata* is particularly adapted to the arid savannah environment of Greefswald (cf. Voigt 1979: 265).

Micro-climates play an important role, creating ecological niches in which environmental variables, such as temperature and moisture, can greatly affect the diversity of species. And each ecological niche exhibits its own unique responses to changes to regional climatic fluctuations (cf. Rotach & Calanca 2003). Until a refined micro-environmental reconstruction of the SLCA is performed, the origins of raw materials remain speculative.

Socio-political factors

Other explanations for the distribution of raw materials could suggested a socio-political context. The period between the 10th and 13th century saw significant changes in the socio-political landscape in the Limpopo Valley. Considering the large scale of craft production and accumulation of exotic items on capitals, such as Schroda, K2, and Mapungubwe, it's clear this period saw the intensification of trade, both local and exotic, and the accumulation of wealth. A regional pattern of differential access to prestige items existed with the greatest amount of trade wealth accumulated within these large capitals (cf. Calabrese 2000b, 2005; Chirikure 2014; Huffman 2000, 2009).

If *Achatina* was the dominant shell type because it was simply more readily available, and ostrich eggshell was not easily obtainable, then this could explain the caches of ostrich eggshell found on Pont Drift and Schroda. If rarity is linked to value (cf. Brock 1968; Hall 1987; Lynn 1991, 1992), and an object's value lies in its role as a signifier of status (Calabrese 2005: 63), then one could argue that ostrich eggshell would have been more valuable because of its greater rarity.

Calabrese (2000a, 2005) suggested that the distribution of SDB at Leokwe Hill might be based on status, since *Achatina* beads were concentrated in the lower status Zhizo areas, and ostrich eggshell beads, along with prestige items such as glass beads, were concentrated in elite Leopards Kopje areas of the site. The distribution of shell types therefore reflects differential access to prestige goods, and possibly, to the raw materials used in their manufacture (Calabrese 2000a: 202). Huffman (2007b), however, disputed the presence of fully formed class distinction at Leokwe. According to Huffman (Ibid.: 183, 185) the main deposits on

Leokwe Hill (the Western Summit) represent the ritual activity of rainmaking and not that of elite vs non-elite groups.

Furthermore, Schroda is considered an important regional centre during the Zhizo period and accumulated a large quantity of trade wealth (Hanisch 1980), yet both the Zhizo and Leokwe occupations produced significant amounts of *Achatina* disc beads, far outnumbering ostrich eggshell (Hanisch 1980; cf. Raath 2014). The exception being TSR6 (Area 6), consisting predominantly of Leokwe deposits, produced more ostrich eggshell beads than *Achatina* (Raath 2014: 207). The comparatively larger amount ostrich eggshell is likely due to the cache of strung unshaped beads recovered from TSR 6 (Ibid.: 201; cf. p.99). The large cache therefore speaks to the value of ostrich eggshell - viz a viz *Achatina* during the late 10th and early 11th centuries.

Over time, ostrich eggshell beads increasingly become more prominent in the Middle Iron Age archaeological record. Regionally, *Achatina* beads were more abundant within Zhizo assemblages with an increase in ostrich eggshell use in K2 assemblages, while in Mapungubwe contexts, ostrich eggshell was used almost exclusively.

Exchange networks

The drastic shift to an assemblage which almost exclusively consist of ostrich eggshell beads could indicate that the people of Mapungubwe had greater access to the eggshells. While ostrich beads were present throughout the K2 sequence, they were more abundant in the first two surface layers dating to the last phase of its occupation. The increase could indicate new trade contacts with communities where environmental conditions are more amenable to ostriches. These routes could have originated during the latter part of K2's occupation in the late 12th century CE, fully manifesting itself by the time K2 was abandoned for Mapungubwe.

Evidence for this could come from the eastern edge of the Kalahari basin in Botswana. In this region, Bantu-speaking agro pastoralists established a hierarchy of settlements (Denbow *et al*. 2008). At the prominent site of Bosutswe, there is evidence to suggest the establishment of an elite core in the 13th century who had clear links with Mapungubwe (Denbow *et al*. 2008). Archaeological work not only indicated trade between Bosutswe and the indigenous hunter-gatherers, but also presented evidence for an extensive regional economy of production and exchange extending westward across the Kalahari to the Okavango region by the 11th century CE (Denbow 1990, 1999; Denbow & Wilmsen 1986; Wilmsen & Denbow 1990). The Kalahari region is prime Ostrich environment and therefore had large scale access to eggshell. In addition, mobile hunter-gatherers who occupied more arid regions likely formed part of this exchange network and could provide eggshells from great distances. The establishment of such formal trade relations would provide communities in the SLCA with greater access to trade goods and could explain the increase of Ostrich eggshell usage in the 13th century at Mapungubwe.

6.2 Shell disc bead size distributions

Diameter trends suggested an increase in mean size occurred from K2 to Mapungubwe (Chapter 6). However, this trend was the result of a difference in shell use. Since *Achatina* beads tended to have a smaller diameter compared to ostrich eggshell discs, the diameter size variance between the sites was due to the predominance of *Achatina* discs at K2 and ostrich eggshell at Mapungubwe.

Achatina

The distribution of diameter sizes for *Achatina* showed little variation between the sites or between the occupation phases (Chapter 6; cf. Appendix B). Overall, *Achatina* beads were mostly small compared to ostrich eggshell, with an interquartile range between 3mm and 5mm. This might be due to the nature of the shell. The *Achatina* snail is smaller compared to an ostrich egg, and thus have greater curvature. If beads were left too large, the concave/convex shape became extremely prominent.

Ostrich eggshell

Variation in diameter between the sites was more noticeable with ostrich eggshell disc beads (Chapter 6; cf. Appendix B). Since the *Achatina* sample from Mapungubwe was exceptionally small, ostrich eggshell beads represented the best shell type for comparison between the Greefswald sites. The sampled beads from K2 covered a wide range of diameter sizes, but presented similar levels of variation between the different occupation areas with similar levels of dispersion around the mean. At a site level, most of the assemblage measured less than 5mm. The exception being TS6 which presented greater levels of variation.

The sample from Mapungubwe Hill presented similar levels of dispersion around the mean and within the spread. Even with varying sample sizes, the mean diameter showed little change through the occupation of the Hill which suggests a trend towards greater standardization. In contrast, the Southern Terrace presented large levels of dispersion, both spatially and chronologically.

It is worth delving into the Southern Terrace assemblage in more detail. The greatest level of variation occurred during Phase III when occupation intensified on Mapungubwe (Meyer 1998: 181). Throughout its occupation, the ostrich eggshell disc beads for the Southern Terrace increase in mean diameter. This was particularly noticeable during Phase IV. Here, the mean diameter not only increased, but the overall spread did so as well which suggested that two size groupings were present on the Southern Terrace during the later stage of its occupation.

This overall increase in diameter was greatly affected by localized changes in mean diameter from squares J10, I10, and I11 (p.80). While I9, K8, F4, E2, and MST1 presented a spread more similar to that observed for Mapungubwe Hill, bead diameters from square J10, I10, and I11 tended to be larger than elsewhere on the site. The reasons for the clear differences from square J10, I10, and I11 are unclear.

The only information available on this area consists of unpublished excavation reports by Eloff (1978, 1980). These reports, however, provide very little detail which could provide context for the large number of SDB discovered here (p.49). No further information was published regarding the rest of the material culture which could shed light on the activities that took place within this specific area. Considering the large quantity of SDB found within this area, and their general uniformity in terms of mean diameter, we could be looking at a cache or beads belonging to a single composite object.

Nevertheless, this specific group of beads represents a unique occurrence reflective of an overall pattern observed for the Southern Terrace: Of localized differences and greater variability.

6.3 Shell disc bead morphology

The technological processes, or activities, involved in the manufacture of SDB leave behind unique characteristics. Analysis of these characteristics indicated some spatial and chronological differences between the Greefswald sites. As the materials from which SDB were manufactured greatly affects these characteristics, *Achatina*, ostrich eggshell, and *Unionid* beads are discussed separately.

6.3.1 Drilling directions

At first glance, it appeared as though *Achatina* was predominantly drilled from both sides, with very low frequencies for inner, outer, and side 1. Be that as it may, the inner and outer surface for *Achatina* could only be determined when the distinctive ridges on the outer surface were present, or when the natural concave/convex shape was preserved. The preservation of these characteristics was generally rare. For the most part, it was simply determined whether the *Achatina* beads were drilled from a single surface or from both. Combining the inner surface, outer surface, and side 1 categories therefore indicated key differences in preferred drilling direction in the Greefswald sites (p.104).

The *Achatina* beads from K2 showed very little preference for drilling direction, while Mapungubwe Hill presented a preference for single surface drilling. The Southern Terrace, on the other hand, presented a large percentage of cylindrically shaped perforations, for which the drilling direction remains undeterminable. The beads from K2 did present much higher counts of beads drilled from both surfaces compared to any of the Greefswald sites.

Ostrich eggshell, on the other hand, not only presented a clear preference for single surface drilling, but also drilling from the inner surface, particularly for the Mapungubwe assemblage. The beads from K2, however, presented higher counts of beads drilled from both surfaces when compared with Mapungubwe. Single surface drilling seems to be a standard practice for ostrich eggshell (Plug 1982: 60; Orton 2008: 1767; Wingfield 2003: 57; Wang *et al*. 2009: 3890). Wang *et al*. (2009: 3890) argued the microstructure of the inner surface makes drilling from this surface easier, reducing the possibility of breakage. The outer surface, on the other hand, is too compact and 'slippery', making the drilling process from this surface difficult (Ibid.: 3891).

6.3.2 Bead edges

It has been suggested that angular bead types could be used to identify on-site bead manufacturing. However, some ethnographic and archaeological studies (Plug 1982: 61; Tapela 2001: 64) note on the use of angular beads as completed ornaments. Therefore, beads with an angular edge cannot be viewed as evidence for on-site manufacture in isolation, and should be considered alongside other sources, such as blanks, partially drilled blanks or very angular beads. The Greefswald SDB assemblages produced several angular examples of ostrich eggshell and *Achatina* beads (p.105). However, these examples all consisted of well-worn perforations and bead edges and did not represent unfinished beads. A large percentage (70% (*n*=53) of the Southern Terrace angular category was recovered from square I11. Here, 87% of the beads were also burnt and damaged, particularly around the perforations shoulder and the bead edge (Figure 4.13, p.64 for bead morphology). The sample from K2 exclusively came from layer 1 and presented similar signs of wear indicating the angular sample could be attributed to post depositional activities occurring on the surface. The sample of angular beads from MK1 showed similar signs of wear, but here, the beads predominantly came from a single context labelled B3.8.4 (layer 8-block B3-accession 4). Eloff (1979 Vol 1: 273) described the context as the remains of a ceramic pot, but makes no mention of beads, or other artefacts.

Beck (1937: 111) noted that the SDB collected from Mapungubwe "showed considerable signs of weathering". Based on this study, the beads likely represent angular edges due to wear and damage, and do not necessarily indicate minimal grinding or in-progress beads.

6.4 Heated shell disc beads

In terms of exposure to heat, both K2 and Mapungubwe Hill showed low frequencies of heated beads. A large percentage of the heated beads from K2 were recovered from contexts associated with the disposal of burnt household refuse or the deliberate burning of household structures from TS4, TS2, and TS6 (cf. Meyer 1998 for layer descriptions).

From TS4, the heated beads were predominantly recovered from layer 1, 2, and 6. Layer 6 formed part of a large burnt deposit consisting of burnt hut structures and ash, while layer 2 consisted of a large quantity of ash and household refuse (cf. Meyer 1998: 81-82). The heated beads recovered from TS2 came predominantly from layer 2 and 1. Here too the deposits presented burnt hut rubble and ash (cf. Ibid.: 99). The heated beads recovered from TS6 were mostly restricted to layer 1 and 3 which consisted of burnt daga, charcoal, charred grains, and ash (Ibid.: 113). The percentage of heated beads drop significantly in layers not associated with any burnt features.

The heated beads recovered from MK1 on Mapungubwe Hill were similarly concentrated in deposits associated with burnt features at the base of layers 9, 10, and 11. Meyer (1998: 120) described multiple burnt features within these layers which included the remains of burnt hut structures and a large refuse pit with ash. The number of heated beads drops significantly outside of these deposits.

The Southern Terrace had a higher frequency of heated beads with more than half of the analysed assemblage exposed to some levels of heat (*n*=1473) (p.90). Some beads were only partially exposed with only sections of the beads showing colour changes, generally patches of light brown. Several samples also showed evidence of unequal heat exposure, exhibiting multiple colour combinations such as black, grey, and brown. The largest percentage of heated beads were collected from square I11, while the remainder came from I10 and J10 (Table 5.9, p.91). Here, the heated beads were predominantly from layer 2 and 3. Eloff (1978, 1980) provided very little contextual information for squares J10, I10 and I11, and made no mention of any burnt features.

Half of the heated beads recovered from square I11 were burnt dark grey (55% (*n*=555)), while the remainder were a mixture of light yellows and browns. The samples which presented uneven heat exposure or a mixture of heat-related colours might indicate that the majority of these beads were indirectly exposed to heat and not directly to fire (Collins & Steele 2017). Since no contextual information exists providing post depositional explanations for heat exposure, the possibility remains that some of the beads could have been purposefully heated to alter colouration. The quantity of SDB that were recovered from these squares is unique compared to the rest of the Southern Terrace. Perhaps the area represents a manufacturing area, or an area where complete beads were processed for use.

6.5 Shell disc bead manufacture on K2 and Mapungubwe

No debris related to the manufacture of SDB could be located from either K2 or Mapungubwe, nor any publications presenting such evidence (Meyer 2000: 11; Calabrese 2005: 354; cf. Beck 1937; Gardner 1963). Gardner (1963: 52, 112, 136) did mention coarse ostrich discs and hundreds of ‘rough’ ostrich eggshell discs from Mapungubwe Hill, as well as unfinished ostrich discs from K2, but does not provide a description or elaborate on any manufacturing activity. These specific materials could also not be located within the Greefswald assemblages. This would suggest total absence of manufacturing debris, or that they occurred in very low numbers. Then again, the number of samples definitively related to manufacture are generally low from settlements around the SLCA (cf. Hanisch 1980; Calabrese 2005).

No publications involving the faunal assemblages mentions the presence of fragments of *Achatina,* or ostrich eggshell, showing signs of alterations. The large quantity of ostrich eggshell beads recovered from squares I10 and I11 could indicate a manufacturing area for the Southern Terrace. However, without clear evidence of manufacture, such as unfinished discs, it cannot be determined whether beads were manufactured here. If such evidence exists, it was not stored with the bead assemblages.

Considering the large scale of other craft production activities, such as wood, bone, and ivory working (Voigt 1983; Plug & Voigt 1985; Plug 2000; Antonites A. R. *et al*. 2016), garden roller industry (Gardner 1963; Wood 2000, 2005; Robertshaw *et al*. 2010), hide and leather working (Voigt 1981, 1983; Plug 2000; Antonites A. R. *et al*. 2016), metallurgy (Miller 2001; Calabrese 2000b, 2005), and cotton spinning (Huffman 1971; Meyer 1980, 2000) at the Greefswald sites, K2 and Mapungubwe can be described as centres of craft production. One can therefore assume the manufacture of SDB would also take place. The lack of debris related to the manufacture of SDB is therefore interesting.

Calabrese (2005: 355-356) suggested that an overall decrease in the range of craft activities took place on Mapungubwe in relation to the earlier K2 period, and that these activities were increasingly occurring on lower-status settlements. In other words, during the K2 period, large-scale craft activities took place on K2, whereas craft activities in the Mapungubwe period increasingly occurred outside the capital on lower-status sites. Considering the diversity of sites throughout the region which presented evidence for shell bead production, it was clearly not a craft activity restricted to specific communities (p.17-18). Meyer (1998) and Badenhorst *et al*. (2011) noted on several satellite settlements around Mapungubwe. However, only three sites, Map 4, Map 23, and Map 24, shared an occupation period with Mapungubwe, and neither Meyer (1998) or Badenhorst *et al*. (2011) presented evidence for the manufacture of SDB on any of these settlements. It may therefore be the case that beads were manufactured in communities located further afield and traded in as finished objects.

6.6 Conclusion

The goal of this dissertation was to broaden the approach to SDB studies by analysing changes in the use of raw materials and manufacturing techniques in South Africa, with specific application to farming communities during the Middle Iron Age in the SLCA in northern South Africa. Analysis of the Greefswald assemblage indicated some differences between the sites of K2, Mapungubwe Hill, and the Southern Terrace. Many of the observed differences could be explained as a result of shell type rather than a result of cultural, economic, or social factors. This variation in shell use accentuates the significance of raw materials and the importance of discriminating between different shell types when comparing the SDB assemblages of multiple sites.

The SDB assemblage from K2 displayed little standardization, both in raw material use and manufacturing techniques. The variation in manufacturing techniques were particularly noticeable with *Achatina* beads. Here, the manufacturers presented little preference for drilling direction or the angularity of the beads edge. The lack of preference for drilling direction presented many different shaft shapes and sizes. If beads were manufactured on site, it could indicate large groups were producing, each with their own preferred methods. On the other hand, if beads were traded in as complete objects, the people of K2 presented little preference in terms of preferred raw materials. Contrarily, Mapungubwe presented greater standardization. Not only was the assemblage dominated by ostrich eggshell indicating a clear preference for this specific material, the beads were predominantly drilled from the inner surface with conical perforations.

There was also a small, but noticeable difference in diameter size distributions between K2, the Hill, and the Southern Terrace. However, this too was largely the result of the difference in shell use between the sites. Overall, *Achatina* beads were mostly dominated by small size ranges, while ostrich eggshell was generally larger. Of the sites, the Southern terrace presented the greatest level of variability in diameter sizes, both chronologically and spatially. Not only did the mean diameter increase through time, but different occupation areas presented different size preferences. These flexible preferences in diameter sizes could indicate diverse groups were producing SDB for the Southern Terrace.

The Hill sample presented more specific preferences and greater standardization indicating smaller groups were producing for the Hill. However, the possibility exists that beads were not produced on K2 or Mapungubwe. In this scenario, K2 presented less preference for specific material types compared to Mapungubwe as beads of all shell types were traded in. At Mapungubwe Hill, a narrower range of sizes were sourced and almost exclusively from ostrich eggshell. Although the Southern Terrace presented a similar preference for ostrich eggshell beads, there were less preference for specific bead sizes traded in as evident by variability in size distributions between different occupation areas.

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APPENDIX A
DISTRIBUTION OF SHELL DISC BEADS FOR THE GREEFSWALD SITES

The following tables list the stratigraphic distribution shell disc beads (SDB) for the Greefswald sites of K2, Mapungubwe Hill (MK), and the Southern Terrace (MST). Tables are presented per individual excavation unit for each site, while the SDB are separated into material types consisting of *Achatina* (ACH), ostrich eggshell (OES), *Unionid* (FWB), and unknown (UNK) beads.

Row A - Percentages were calculated from the total SDB for the specific excavated unit;
Row B - Percentages were calculated from the total material type for the site.

K2

Table A.1: Excavation TS1, TS2, TS3, TS4, TS5, TS6, and Rn2. #Missing layers.

Excavation TS1						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	1	50	13	2	1	**66**
	2	41	7	1	-	**49**
	3	11	2	-	-	**13**
	4	41	10	1	-	**52**
	5	4	3	-	-	**7**
	Total	**147**	**35**	**4**	**1**	**187**
	A %	79%	19%	2%	1%	
	B %	8%	5%	6%	100%	

Excavation TS2						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	1	201	86	8	-	**295**
	2	237	57	11	-	**305**
	3	129	22	2	-	**153**
	TS2.G1	1	1	1	-	**3**
	TS2.G2	24	21	1	-	**46**
	TS2.G3	1	-	-	-	**1**
	4	33	10	3	-	**46**
	4 (a)	29	6	2	-	**37**
	4 (b)	19	3	-	-	**22**
	6	2	1	-	-	**3**
	Total	**676**	**207**	**28**	-	**911**
	A %	74%	23%	3%	-	
	B %	39%	30%	39%	-	

Excavation TS3						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	Burrow Surface	6	5	-	-	**11**
	1	32	40	-	-	**72**
	2	15	4	-	-	**19**
	3	11	6	-	-	**17**
	4 #	-	-	-	-	**-**
	5	3	5	-	-	**8**
	6	4	3	-	-	**7**
	7	6	8	-	-	**14**
	8	8	3	-	-	**11**
	9	23	10	-	-	**33**
	10	15	14	-	-	**29**
	11	3	3	-	-	**6**
	12	223	6	1	-	**230**
	13	2	1	-	-	**3**
	14	15	3	-	-	**18**
	15	10	-	-	-	**10**
	16 #	-	-	-	-	**-**
	17	4	1	-	-	**5**
	18 #	-	-	-	-	**-**
	19	5	-	-	-	**5**
	20	12	1	-	-	**13**
	21 #	-	-	-	-	**-**
	22 #	-	-	-	-	**-**
	23 #	-	-	-	-	**-**
	Total	**397**	**113**	**1**	-	**511**
	A %	78%	22%	0%	-	
	B %	23%	17%	1%	-	

Excavation TS4						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	1	63	23	-	-	**86**
	2	44	56	12	-	**112**
	TS4.G1	-	4	-	-	**4**
	3	13	11	-	-	**24**
	4	7	2	-	-	**9**
	5	19	6	1	-	**26**
	6	65	50	17	-	**132**
	7	70	8	2	-	**80**
	Total	**281**	**160**	**32**	-	**473**
	A %	59%	34%	7%	-	
	B %	16%	23%	44%	-	

Excavation TS5						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	Surface	7	2	-	-	**9**
	1	28	6	-	-	**34**
	TS5.G2	-	2	-	-	**2**
	2	15	16	1	-	**32**
	3	47	6	-	-	**53**
	Total	**97**	**32**	**1**	-	**130**
	A %	75%	25%	1%	-	
	B %	6%	5%	1%	-	

Excavation TS6						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	1	10	31	-	-	**41**
	2	3	4	-	-	**7**
	3	17	12	2	-	**31**
	4	1	3	-	-	**4**
	5	7	8	2	-	**17**
	6	17	11	-	-	**28**
	7	8	4	1	-	**13**
	8	6	2	-	-	**8**
	9 #	-	-	-	-	**-**
	10	6	3	-	-	**9**
	11	8	-	-	-	**8**
	12	2	1	-	-	**3**
	13	4	-	-	-	**4**
	Total	**89**	**79**	**5**	-	**173**
	A %	51%	46%	3%	-	
	B %	5%	12%	7%	-	

Excavation Rn2						
Phase	**Layer**	**ACH**	**OES**	**FBW**	**UNK**	**Total**
II	1	23	32	-	-	**55**
	2	11	18	-	-	**29**
	3	4	4	1	-	**9**
	4	4	-	-	-	**4**
	5	-	1	-	-	**1**
	6	2	1	-	-	**3**
	7	2	-	-	-	**2**
	Total	**46**	**56**	**1**	-	**103**
	A %	45%	54%	1%	-	
	B %	3%	8%	1%	-	

Mapungubwe Hill

Table A.2: Excavation MK1 and MK3.

Excavation MK1					
Phase	**Layer**	**ACH**	**OES**	**UNK**	**Total**
IV	Surface	-	2	-	**2**
	1	5	40	-	**45**
	2	2	72	-	**74**
	3	1	11	-	**12**
III (b)	4	2	50	-	**52**
	5	8	73	-	**81**
	6	2	87	-	**89**
	7	2	86	-	**88**
	8	7	133	-	**140**
III (a)	9	3	43	-	**46**
	9 (i)	-	4	-	**4**
	9 (ii)	3	63	-	**66**
	10	3	42	-	**45**
	10 (i)	1	60	-	**61**
	10 (ii)	2	47	1	**50**
	10 (iii)	1	29	-	**30**
	10 (iiii)	-	24	-	**24**
II	11	10	92	-	**102**
	Total	**52**	**958**	**1**	**1011**
	A %	5%	95%	0%	
	B %	90%	91%	100%	

Excavation MK1: SDB per phase				
Phase	**ACH**	**OES**	**UNK**	**Total**
IV	8	125	-	**133**
III (b)	21	429	-	**450**
III (a)	13	312	1	**326**
II	10	92	-	**102**
Total	**52**	**958**	**1**	**1011**

Excavation MK3					
Phase	**Layer**	**ACH**	**OES**	**UNK**	**Total**
IV	1	-	5	-	**5**
	2	-	1	-	**1**
	3	-	16	-	**16**
	4 (i)	2	6	-	**8**
	4 (ii)	1	10	-	**11**
	4 (iii)	2	17	-	**19**
	5	1	13	-	**14**
III (b)	6	-	18	-	**18**
	7	-	9	-	**9**
	Total	**6**	**95**	-	**101**
	A %	6%	94%	-	
	B %	10%	9%	-	

Excavation MK3: SDB per phase				
Phase	**ACH**	**OES**	**UNK**	**Total**
IV	6	68	-	74
III (b)	-	27	-	27
III (a)	-	-	-	-
II	-	-	-	-
Total	6	95	-	101

Southern Terrace

Table A.3: Square E2, F4, MST1, K8, J10, I9, I10, and I11. #Missing layers.

Square E2							
Phase	**Layer**	**Layer**	**ACH**	**OES**	**FWB**	**UNK**	**Total**
IV	+6"/0"	2	3	39	-	-	42
	0"/-6"	3	7	147	-	-	154
	-6"/-12" #	4	-	-	-	-	-
	-12"/-18"	5	6	21	-	1	28
	-18"/-20"	6	-	7	-	-	7
III (b)	-20"/-30"	7	7	20	-	-	27
	-30"/-34"	8	-	17	-	1	18
	-34"/-42"	9	1	20	-	-	21
	-42"/-48"	10	-	7	-	-	7
	-48"/-54"	11	2	12	-	-	14
III (a)	-54"/-60"	12	1	28	-	-	29
	-60"/-66"	13	-	16	-	-	16
	Total		**27**	**334**	-	**2**	**363**
	A %		7%	92%	-	1%	
	B %		33%	13%	-	100%	

Square E2: SDB per phase					
Phase	**ACH**	**OES**	**FWB**	**UNK**	**Total**
IV	16	214	-	1	**231**
III (b)	10	76	-	1	**87**
III (a)	1	44	-	-	**45**
II	-	-	-	-	**-**
Total	**27**	**334**	-	**2**	**363**

Square F4					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1	-	18	-	**18**
	2	6	47	-	**53**
III (b)	3	4	27	-	**31**
	4	1	5	-	**6**
	5	2	17	-	**19**
	6	-	16	-	**16**
	7(i)-7(ii)	2	22	-	**24**
III (a)	7(iii)-7(iv)	1	41	-	**42**
	8(i)	-	2	-	**2**
	8(ii)	1	27	-	**28**
	8(iii)	1	11	1	**13**
	8(iv)	-	10	-	**10**
II	9(i)	-	15	1	**16**
	9(ii)	-	6	-	**6**
	10	2	59	-	**61**
	Total	**20**	**323**	**2**	**345**
	A %	6%	94%	1%	
	B %	25%	13%	67%	

Square F4: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	6	65	-	**71**
III (b)	9	87	-	**96**
III (a)	3	91	1	**95**
II	2	80	1	**83**
Total	**20**	**323**	**2**	**345**

Square MST1					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1	-	9	-	**9**
	2	-	15	-	**15**
	3	6	34	-	**40**
	4-15 #	-	-	-	**-**
	Total	**6**	**58**	-	**64**
	A %	9%	91%	-	
	B %	8%	2%	-	

Excavation MST1: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	6	58	-	**64**
III (b)	-	-	-	**-**
III (a)	-	-	-	**-**
II	-	-	-	**-**
Total	**6**	**58**	-	**64**

Square K8					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1	1	9	-	**10**
	2 #	-	-	-	**-**
	3	1	15	-	**16**
III (b)	4	-	16	-	**16**
	5	2	14	-	**16**
	6	6	17	-	**23**
	7	4	36	-	**40**
	8	-	7	-	**7**
III (a)	9	3	30	-	**33**
	10	1	11	-	**12**
	11	-	6	-	**6**
	12	-	5	-	**5**
	13 #	-	-	-	**-**
	14	-	1	-	**1**
II	15	-	4	-	**4**
	16 #	-	-	-	**-**
	17	3	2	-	**5**
	Total	**21**	**173**	-	**194**
	A %	11%	89%	-	
	B %	26%	7%	-	

Square K8: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	2	24	-	**26**
III (b)	12	90	-	**102**
III (a)	4	53	-	**57**
II	3	6	-	**9**
Total	**21**	**173**	-	**194**

Square J10					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1	-	21	-	**21**
	2	-	49	-	**49**
	3	1	48	-	**49**
	4 #	-	-	-	**-**
	5 #	-	-	-	**-**
	6	-	14	-	**14**
	Total	**1**	**132**	-	**133**
	A %	1%	99%	-	
	B %	1%	5%	-	

Square J10: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	1	132	-	**133**
III (b)	-	-	-	**-**
III (a)	-	-	-	**-**
II	-	-	-	**-**
Total	**1**	**132**	-	**133**

Square I9					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1 #	-	-	**-**	**-**
	2	2	40	**1**	**43**
	3	-	25	**-**	**25**
	4 #	-	-	**-**	**-**
	5	-	6	**-**	**6**
	6	-	15	**-**	**15**
	Total	**2**	**86**	**1**	**89**
	A %	2%	97%	1%	
	B %	2%	3%	33%	

Square I9: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	2	86	1	**89**
III (b)	-	-	-	-
III (a)	-	-	-	-
II	-	-	-	-
Total	**2**	**86**	**1**	**89**

Square I10					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1	-	-	-	**-**
	2	2	184	-	**186**
	3	-	36	-	**36**
	4 #	-	-	-	**-**
	5	-	2	-	**2**
	Total	**2**	**222**	-	**224**
	A %	1%	99%	-	
	B %	2%	9%	-	

Square I10: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	2	222	-	**224**
III (b)	-	-	-	**-**
III (a)	-	-	-	**-**
II	-	-	-	**-**
Total	**2**	**222**	-	**224**

Square I11					
Phase	**Layer**	**ACH**	**OES**	**FWB**	**Total**
IV	1 #	-	-	-	**-**
	2	2	503	-	**505**
	3	-	464	-	**464**
	4	-	191	-	**191**
	Total	**2**	**1158**	-	**1160**
	A %	0%	100%	-	
	B %	2%	47%	-	

Square I11: SDB per phase				
Phase	**ACH**	**OES**	**FWB**	**Total**
IV	2	1158	**-**	**1160**
III (b)	-	-	**-**	**-**
III (a)	-	-	**-**	-
II	-	-	**-**	-
Total	**2**	**1158**	**-**	**1160**

APPENDIX B
DATA DISPLAY AND SUMMARY TABLES FOR K2 AND MAPUNGUBWE SHELL DISC BEADS

Spatial distribution of shell disc bead diameter sizes

Table B.1: Summary statistics for bead diameters per excavation unit on K2.

Diameter (mm)														
Unit	Rn2		TS 1		TS 2		TS 3		TS 4		TS 5		TS 6	
Shell Type	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES
n	42	55	147	35	672	203	396	112	278	160	95	32	89	79
$\bar{x}$	4,2	4,8	4,2	4,4	4,6	4,7	4,0	4,5	4,4	5,1	4,3	4,2	4,7	5,2
S	0,69	0,91	0,66	1,02	1,03	1,02	0,94	0,92	0,88	1,13	0,70	1,01	1,24	1,64
$s\bar{x}$	0,11	0,12	0,05	0,17	0,04	0,07	0,05	0,09	0,05	0,09	0,07	0,18	0,13	0,18
CV1	16,57	19,26	15,79	23,16	22,38	21,57	23,66	20,70	20,00	22,35	16,20	23,98	26,29	31,76
Max	5,88	7,22	5,59	6,54	11,04	10,49	7,64	7,33	8,3	8,15	6,11	6,98	8,79	9,37
$\tilde{x}$	4,12	4,55	4,08	4,37	4,45	4,57	3,6	4,43	4,3	5,16	4,42	4,17	4,48	4,74
Min	3,18	3,18	2,52	2,71	2,54	3,00	2,45	2,48	2,48	2,69	2,27	2,96	2,92	3,1

Table B.2: Summary statistics for bead diameters per excavation unit on Mapungubwe Hill.

Mapungubwe Hill				
Diameter (mm)				
Unit	MK1		MK3	
Shell Type	ACH	OES	ACH	OES
n	52	930	6	90
$\bar{x}$	4,1	5,9	4,4	6,9
S	0,93	1,39	1,68	2,24
$s\bar{x}$	0,13	0,05	0,69	0,24
CV1	22,50	23,46	38,21	32,65
Max	6,22	12,65	7,71	14
$\tilde{x}$	3,95	5,73	3,77	6,255
Min	2,63	2,18	3,33	3,42

Table B.3: Summary statistics for bead diameters per excavation unit on the Southern Terrace.

Southern Terrace																
Diameter (mm)																
Unit	MST 1		E2		F4		K8		I9		I10		I11		J10	
Shell Type	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES	ACH	OES
n	6	52	27	323	20	310	19	166	2	85	1	74	2	1113	1	115
$\bar{x}$	4,0	5,6	4,6	5,9	4,4	6,3	4,7	6,7	3,6	7,6	4,2	9,0	4,3	9,0	4,7	9,0
S	0,74	1,37	1,08	1,66	1,21	1,98	1,04	1,77	0,28	2,18	.	1,9	0,28	1,68	.	1,93
$s\bar{x}$	0,3	0,19	0,21	0,09	0,27	0,11	0,24	0,14	0,2	0,24	.	0,22	0,2	0,05	.	0,18
CV1	18,51	24,32	23,48	28,26	27,5	31,48	22,05	26,36	7,7	28,7	.	21,1	6,56	18,54	.	21,46
Max	4,96	9,97	6,34	11,95	7	16	6,17	13,68	3,78	12,7	4,17	13,12	4,51	15,82	4,66	13,31
$\tilde{x}$	3,985	5,485	4,62	5,58	4,1	5,725	4,79	6,565	3,585	7,64	4,17	8,985	4,31	9,08	4,66	9,18
Min	2,96	3,43	2,62	2,94	2,76	2,6	3,22	2,14	3,39	3,88	4,17	4,22	4,11	3,85	4,66	3,9

Chronological distribution of shell disc bead diameter sizes

Table B.4: Data table for bead diameters per occupation Phase.

		K2				MK				MST			
		ACH		OES		ACH		OES		ACH		OES	
Phase	**Diameter**	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
IV	< 3mm							1	1	1	3	2	0
	≥ 3mm < 4mm			**N**		7	50	7	4	14	39	32	2
	≥ 4mm < 5mm			**O**		5	36	51	27	14	39	109	6
	≥ 5mm < 6mm			**T**		1	7	55	29	4	11	166	10
	≥ 6mm < 7mm							31	16	2	6	153	9
	≥ 7mm < 8mm			**S**		1	7	19	10	1	3	215	12
	≥ 8mm < 9mm			**E**				16	9			344	20
	≥ 9mm < 10mm			**T**				5	3			307	18
	≥ 10mm < 11mm			**T**				2	1			234	14
	≥ 11mm < 12mm			**L**				1	1			125	7
	≥ 12mm < 13mm			**E**								26	2
	≥ 13mm < 14mm			**D**								11	1
	≥ 14mm < 15mm											4	0
	≥ 15mm < 16mm											1	0
	Total measured					**14**		**188**		**36**		**1729**	
III (b)	< 3mm					4	19	2	0	3	11	2	1
	≥ 3mm < 4mm			**N**		8	38	28	6	7	25	8	3
	≥ 4mm < 5mm			**O**		4	19	94	21	6	21	35	15
	≥ 5mm < 6mm			**T**		5	24	90	21	9	32	48	21
	≥ 6mm < 7mm							76	17	3	11	48	21
	≥ 7mm < 8mm			**S**				97	22			36	16
	≥ 8mm < 9mm			**E**				36	8			25	11
	≥ 9mm < 10mm			**T**				7	2			14	6
	≥ 10mm < 11mm			**T**				4	1			6	3
	≥ 11mm < 12mm			**L**				2	0			2	1
	≥ 12mm < 13mm			**E**				2	0			1	0
	≥ 13mm < 14mm			**D**								5	2
	≥ 14mm < 15mm							1	0				
	≥ 15mm < 16mm											1	0
	Total measured					**21**		**439**		**28**		**231**	
III (a)	< 3mm												
	≥ 3mm < 4mm			**N**		7	54	9	3	4	44	3	2
	≥ 4mm < 5mm			**O**		3	23	64	21	1	11	28	15
	≥ 5mm < 6mm			**T**		1	8	104	35	4	44	47	24
	≥ 6mm < 7mm					2	15	80	27			55	28
	≥ 7mm < 8mm			**S**				33	11			24	12
	≥ 8mm < 9mm			**E**				3	1			13	7
	≥ 9mm < 10mm			**T**				4	1			8	4
	≥ 10mm < 11mm			**T**				3	1			5	3
	≥ 11mm < 12mm			**L**								6	3
	≥ 12mm < 13mm			**E**				1	0			1	1
	≥ 13mm < 14mm			**D**									
	≥ 14mm < 15mm												
	≥ 15mm < 16mm											2	1
	≥ 16mm < 17mm											1	1
	Total measured					**13**		**301**		**9**		**193**	
II	< 3mm	35	2	11	2								
	≥ 3mm < 4mm	631	37	153	23	4	40	1	1	1	20	1	1
	≥ 4mm < 5mm	718	42	273	40	3	30	20	22	2	40	22	26
	≥ 5mm < 6mm	252	15	148	22	3	30	37	40	1	20	52	61
	≥ 6mm < 7mm	55	3	66	10			23	25	1	20	7	8
	≥ 7mm < 8mm	12	1	10	1			4	4			2	2
	≥ 8mm < 9mm	4	0	10	1			4	4			1	1
	≥ 9mm < 10mm	9	1	3	0			2	2				
	≥ 10mm < 11mm	2	0	2	0			1	1				
	≥ 11mm < 12mm	1	0										
	Total measured	**1719**		**676**		**10**		**92**		**5**		**85**	

Table B.5: Summary statistics for bead diameters per occupation Phase.

Achatina																
Site	**Phase**	***n***	**s**	**$\bar{x}$**	**Upper CI**	**Lower CI**	**s $\bar{x}$**	**CV1**	**CV2**	**Max**	**90%**	**Q3**	**$\tilde{x}$**	**Q1**	**10%**	**Min**
K2	II	1719	0,98	4,4	4,4	4,3	0,02	22,48	17,84	11,0	5,5	4,8	4,3	3,7	3,3	2,3
MK	IV	14	1,27	4,2	4,9	3,5	0,34	30,06	20,61	7,7	6,8	4,6	3,8	3,4	3,2	3,0
	III (b)	21	0,96	3,9	4,4	3,5	0,20	24,12	24,12	5,9	5,6	4,7	3,9	3,2	2,8	2,6
	III (a)	13	1,05	4,2	4,9	3,6	0,29	24,93	24,93	6,2	6,1	4,9	3,7	3,5	3,2	3,2
	II	10	0,71	4,3	4,8	3,8	0.22	16,82	16,82	5,4	5,4	5,1	4,0	3,8	3,5	3,5
MST	IV	36	0,98	4,4	4,7	4,1	0,16	22,31	17,05	7,0	6,0	4,7	4,2	3,8	3,3	2,9
	III (b)	28	1,18	4,6	5,0	4,1	0,22	25,89	25,89	6,9	6,1	5,5	4,7	3,4	2,9	2,6
	III (a)	9	1,00	4,5	5,3	3,7	0,33	22,43	22,43	5,7	5,7	5,5	4,6	3,5	3,3	3,3
	II	5	1,08	4,7	6,0	3,3	0,48	23,21	23,21	6,1	6,1	5,7	4,3	3,8	3,4	3,4
Ostrich eggshell																
Site	**Phase**	***n***	**s**	**$\bar{x}$**	**Upper CI**	**Lower CI**	**s $\bar{x}$**	**CV1**	**CV2**	**Max**	**90%**	**Q3**	**$\tilde{x}$**	**Q1**	**10%**	**Min**
K2	II	676	1,14	4,8	4,9	4,7	0,04	23,96	19,77	10,5	6,2	5,3	4,6	4,0	3,5	2,5
MK	IV	188	1,58	5,9	6,2	5,7	0,11	26,64	24,78	11,7	8,1	6,9	5,4	4,8	4,4	2,8
	III (b)	439	1,65	6,2	6,3	6,0	0,07	26,70	24,73	14,0	8,1	7,3	6,1	4,9	4,1	2,2
	III (a)	301	1,25	5,8	5,9	5,7	0,07	21,49	17,84	12,7	7,3	6,5	5,7	5,0	4,4	3,3
	II	92	1,28	5,8	6,1	5,6	0,13	22,07	15,32	10,7	7,6	6,3	5,5	5,0	4,4	3,9
MST	IV	1729	2,15	8,3	8,4	8,2	0,05	25,94	25,78	15,8	10,9	9,9	8,5	6,8	5,2	2,6
	III (b)	231	2,12	6,8	7,0	6,5	0,13	31,38	26,04	15,6	9,4	7,9	6,6	5,3	4,6	2,1
	III (a)	193	2,09	6,7	7,0	6,4	0,15	31,13	21,80	16,0	9,6	7,4	6,4	5,4	4,5	3,6
	II	85	0,73	5,4	5,5	5,2	0,08	13,74	10,78	8,2	6,2	5,7	5,2	4,9	4,7	3,9

Table B.6: Summary statistics for spatial and chronological distribution of bead diameters for Mapungubwe Hill.

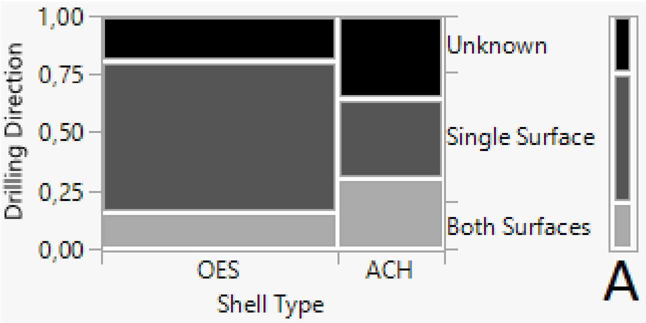
	Mapungubwe Hill									
Shell	**Unit**	**Phase**	***n***	**$\bar{x}$**	**S**	**s $\bar{x}$**	**CV1**	**Max**	**$\tilde{X}$**	**Min**
Achatina	MK1	IV	8	4,1	0,97	0,34	23,69	5,95	3,82	3,02
		III (b)	21	4,0	0,96	0,20	24,12	5,89	3,95	2,63
		III (a)	13	4,2	1,05	0,29	24,93	6,22	3,74	3,18
		II	10	4,3	0,71	0,22	16,82	5,43	4,01	3,46
	MK3	IV	6	4,4	1,68	0,68	38,21	7,71	3,77	3,33
Ostrich eggshell	MK1	IV	124	5,7	1,28	0,11	22,61	8,91	5,31	2,81
		III (b)	413	6,1	1,51	0,07	24,95	11,97	5,99	2,18
		III (a)	301	5,8	1,25	0,07	21,49	13,65	5,69	3,33
		II	92	5,8	1,28	0,13	22,07	10,66	5,50	3,99
	MK3	IV	64	6,5	1,96	0,24	30,31	11,65	5,60	3,42
		III (b)	26	7,8	2,61	0,51	33,26	14	6,74	4,94

Table B.7: Summary statistics for spatial and chronological distribution of bead diameters for the Southern Terrace.

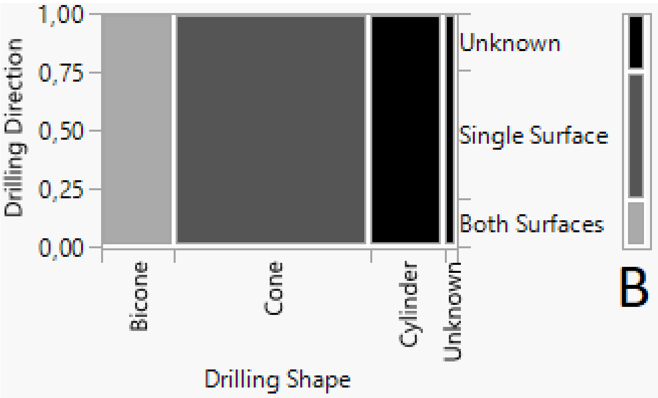
	Southern Terrace									
Shell	**Unit**	**Phase**	***n***	**x̄**	**S**	**s x̄**	**CV1**	**Max**	**x̃**	**Min**
Achatina	MST1	IV	6	3,9	0,74	0,3	18,51	4,96	3,98	2,96
	E2	IV	16	4,6	1,04	0,26	22,81	6,34	4,30	3,14
		III (b)	8	4,6	1,2	0,42	26,4	5,81	4,90	2,62
		III (a)	3	4,9	1,35	0,78	27,77	5,71	5,55	3,3
	F4	IV	6	4,4	1,32	0,54	29,92	7	3,84	3,59
		III (b)	9	4,3	1,43	0,48	33,15	6,87	3,86	2,76
		III (a)	3	4,4	0,94	0,54	21,51	5,18	4,6	3,34
		II	2	4,8	0,77	0,55	15,97	5,37	4,83	4,28
	K8	IV	2	5,2	1,36	0,96	26,16	6,15	5,19	4,23
		III (b)	11	4,8	1,01	0,30	20,99	6,17	5,07	3,22
		III (a)	3	4,2	0,99	0,58	23,76	5,36	3,67	3,59
		II	3	4,6	1,42	0,82	31,08	6,12	4,19	3,36
	I9	IV	1	4,7	-	-	-	4,66	4,66	4,66
	I10	IV	2	4,3	0,28	0,2	6,56	4,15	4,31	4,11
	I11	IV	1	4,2	-	-	-	4,17	4,17	4,17
	J10	IV	2	3,6	0,28	0,19	7,69	3,78	3,58	3,39
Ostrich eggshell	MST1	IV	52	5,6	1,36	0,18	24,32	9,97	5,48	3,43
	E2	IV	204	5,5	1,29	0,09	23,39	10,05	5,38	2,94
		III (b)	63	6,2	1,98	0,25	31,89	11,95	6,02	3,09
		III (a)	56	6,7	2,03	0,27	30,47	10,99	6,53	3,56
	F4	IV	64	5,8	1,37	0,17	23,64	8,71	5,66	2,6
		III (b)	83	7,1	2,31	0,25	32,87	15,59	6,43	2,89
		III (a)	84	6,8	2,33	0,25	34,26	16	6,28	4,02
		II	79	5,3	0,66	0,07	12,52	7,71	5,21	3,9
	K8	IV	22	6,4	1,02	0,21	16,09	8,35	6,43	4,92
		III (b)	85	6,9	1,97	0,21	28,59	13,68	6,74	2,14
		III (a)	53	6,6	1,74	0,23	26,41	12,93	6,49	3,6
		II	6	6,4	0,93	0,37	14,47	8,22	6,07	5,75
	I9	IV	85	7,6	2,18	0,23	28,70	12,7	7,64	3,88
	I10	IV	74	9,0	1,89	0,22	21,09	13,12	8,98	4,22
	I11	IV	1113	9,1	1,68	0,05	18,54	15,82	9,08	3,85
	J10	IV	115	9,0	1,93	0,18	21,45	13,31	9,18	3,9

Contingency analysis of drilling direction, shaft shape, and shell type.

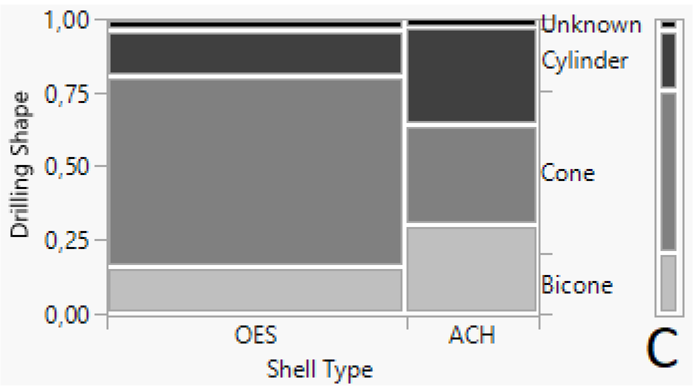
Table B.8: Contingency analyses. A- Drilling direction vs. shell type; B-Drilling direction vs. shaft shape; C-Shaft shape vs. shell type.



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	510,677	<,0001
Pearson	507,026	<,0001



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	12145,65	<,0001
Pearson	12186,00	<,0001



Test	ChiSq.	Prob>ChiSq.
Likelihood Ratio	562,926	<,0001
Pearson	564,434	<,0001