

**THE ARCHAEOBOTANY OF MUTAMBA, A THIRTEENTH CENTURY  
MAPUNGUBWE SETTLEMENT IN NORTHERN SOUTH AFRICA**

**By**

**BIANCA STEYN**

**29070377**

**Submitted in fulfilment of the requirements for the degree Master of Arts**

**In the**

**FACULTY OF HUMANITIES**

**At the**

**UNIVERSITY OF PRETORIA**

**Supervisor: Dr Alexander Antonites**

**August 2018**

## Acknowledgements

---

---

I would first like to thank my supervisor Dr Alexander Antonites and Professor CZ Ashley. Dr Antonites for his generous support, advice and reading numerous drafts of this dissertation. Professor Ashley for the many opportunities she allowed me to see. I also wish to express my gratitude to Professor Dorian Fuller for his invaluable seed identification course and his advice on my samples. To Amanda Leon thank you for the wonderful birthday gift and for allowing me to pick your brain on various matters. Belinda thank you for listening. Ruth you're the world's best cheerleader. Annemarie en Sue-marie baie dankie vir soveel dinge, ek wardeer dit. En ma dankie.

## **Abstract**

The focus of this research is on Mutamba, a 13<sup>th</sup> century Middle Iron Age (MIA) settlement situated in the Soutpansberg, South Africa and is the first archaeobotanical study of a MIA settlement. Many communities of this time were agro-pastoralists cultivating crops such as sorghum, millets and legumes. Past research examining human-plant interaction did so through broad topics but few have addressed which plants were used at MIA agro-pastoral settlements. This dissertation seeks to understand which plant taxa were present at Mutamba, their ratios (wild vs domestic) and to identify what their most likely usage could have been. Through the analysis of archaeobotanical material recovered from flotation, eleven species and two genera of both wild and domestic taxa were identified. Domestic taxa account for 74% of archaeobotanical material at Mutamba while wild taxa account for the remainder. The lack of crop processing material and weed seeds in the assemblage are indicative of harvesting and processing methods engaged in. With the aid of ethnographic data it was determined that the most likely uses of these taxa were as a part of food production, brewing activities and cotton cloth production. Within food production the domestic taxa (sorghum, millets and legumes) were most likely used in meals as porridge, gruel, accompaniments or in malted sorghum's instance in beer brewing. Wild taxa was utilised based on seasonal availability to supplement diet and in brewing activities. Additionally evidence for cotton cloth production was found in the form of cotton seeds along with spindle whorls in domestic contexts indicating that cloth production was a household based activity.

The implications of this study have shown that Mutamba has the first recorded archaeological occurrence of potential beer brewing, mung bean and cotton seeds in northern South African Iron Age archaeology. It has expanded on the body of knowledge of the MIA, allowing for a better understanding of a potential crop package, harvesting methods, processing and plant utilisation. Regarding future research it is recommended that additional sites in Mapungubwe's outlying areas be examined for archaeobotanical material and that other forms of archaeobotanical study (i.e. microbotanical analysis) be incorporated as well.

# Table of contents

---

---

<b>Chapter 1: Introduction</b>	1
1.1. Historical sequence of the region	4
1.2. Archaeobotany in MIA agro-pastoral settlements	9
1.3. Structure of the dissertation	10
<b>Chapter 2: Physiography and previous research</b>	11
2.1. Mutamba: Location and natural environment	11
2.2. Previous archaeological research conducted at Mutamba	14
2.2.1. Loubser excavation	14
2.2.2. Antonites excavation	15
2.2.3. Benkwitz archaeobotanical study	18
2.3. Conclusion	18
<b>Chapter 3: Archaeobotany – A brief history</b>	19
3.1. Brief history of archaeobotany – Europe and America	19
3.2. Archaeobotany in Africa – The IWAA	21
3.3. Archaeobotany in South Africa	22
3.4. Conclusion	27
<b>Chapter 4: Deposition, preservation, recovery and interpretation of archaeobotanical material</b>	29
4.1. Sources and deposition	29
4.1.1. Sources of seeds on archaeological sites	30
4.1.2. Deposition of seeds on archaeological sites	31

4.1.3. Post deposition	33
4.1.4. Preservation	34
4.2. Recovery	37
4.2.1. Bulk sampling	37
4.2.2. Scatter sampling	38
4.2.3. Column sampling	38
4.2.4. Blanket sampling	38
4.3. Recovery	39
4.3.1. Flotation	39
4.3.2. Dry screening	40
4.4. Interpretation	41
4.4.1. The use of ethnography in archaeobotany	41
4.4.2. Context and content	44
4.5. Conclusion	46
<b>Chapter 5: Methodology</b>	47
5.1. Archaeobotanical analysis methods	47
5.1.1 Flotation and laboratory analysis	48
5.1.2. Seed identification	51
5.2. Quantification of results	51
5.2.1. Absolute counts	52
5.2.2. Ubiquity	53
5.2.3. Diversity	54
5.2.4. Relative abundance index and seed density index	54
5.3. Conclusion	55

<b>Chapter 6: Results</b>	56
6.1. Poaceae seed parts and their preservation and distortion classification	57
6.1.1. <i>Sorghum bicolor</i>	57
6.1.2. <i>Pennisetum glaucum</i>	63
6.1.3. <i>Eleusine coracana</i> , <i>Brachiaria deflexa</i> and <i>Brachiaria nigropedata</i>	67
6.1.4. Overview of preservation and distortion for the Poaceae taxa	67
6.2. Ubiquity	69
6.2.1. General ubiquity	69
6.2.2. Indigenous taxa	71
6.2.3. Exotic taxa	71
6.2.4. Absence of weed taxa	71
6.3. Diversity	72
6.4. Relative abundance	73
6.5. Seed density	74
6.6. Domestic and wild taxa	75
6.7. Conclusion	76
<b>Chapter 7: Potential uses of the taxa found at Mutamba</b>	78
7.1. <i>Sorghum bicolor</i> (Sorghum)	79
7.2. <i>Pennisetum glaucum</i> (Pearl millet)	80
7.3. <i>Eleusine coracana</i> (Finger millet)	81
7.4. <i>Gossypium herbaceum</i> (Wild cotton)	82
7.5. <i>Adansonia digitata</i> (Baobab)	83
7.6. <i>Brachiaria deflexa</i> (False signal grass)	84
7.7. <i>Brachiaria nigropedata</i> (Spotted signal grass)	85
7.8. <i>Grewia</i> sp.	86
7.9. <i>Ziziphus zeyheriana</i> (Dwarf Buffalo thorn)	87

7.10. <i>Vigna unguiculata</i> (Cowpea)	88
7.11. <i>Vigna radiata</i> (Mung bean)	89
7.12. <i>Sclerocarya birrea</i> (Marula/Moroela)	90
7.13. <i>Acacia</i> sp.	91
7.2. Conclusion	92
<b>Chapter 8: Discussion and conclusion</b>	94
8.1. Food production	95
8.1.1. Food production at Mutamba	96
8.1.2. Food at Mutamba	100
8.2. Brewing at Mutamba	103
8.2.1. Grain-based beer	104
8.2.2. Marula beer	106
8.3. Craft production – Cotton cloth	107
8.3.1. Cotton production at Mutamba	107
8.4. Conclusion	111
<b>References listed</b>	115
<b>Appendix A: Presence and absence in samples</b>	134
<b>Appendix B: Images</b>	146



## List of Figures

---

---

Figure 1.1. Mutamba's location (Antonites 2012: 3)	3
Figure 2.1. Map of Mutamba's location in relation to the Soutpansberg (Antonites 2012: 77)	13
Figure 2.2. Map of Mutamba's excavation areas (Antonites 2012: 84)	16
Figure 3.1. Map of a generalised distribution of archaeobotanical studies in Africa, according to the 2006 IWAA conference (Fuller <i>et al.</i> 2014: 18)	21
Figure 3.2. Excerpt from Eloff (1979: 318) illustrating excavation details concerning botanicals from K2	24
Figure 6.1. Distortion classes represented in the Mutamba <i>Sorghum bicolor</i> (1. No noticeable distortion, 2. Slight puffing of seeds noticeable, 3. Clearly distorted, 4. Gross distortion, 6. Carbonised tarry material exuded from distal end of caryopsis, 8. Sprouting)	61

Figure 6.2. Distortion classes represented in the Mutamba Sorghum bicolor (1. No noticeable distortion, 2. Slight puffing of seeds noticeable, 3. Clearly distorted, 4. Gross distortion, 6. Carbonised tarry material exuded from distal end of caryopsis, 8. Sprouting) 62

Figure 6.3. Distortion classes represented in the Mutamba Pennisetum glaucum (1. No noticeable distortion, 2. Slight puffing of seeds noticeable, 4. Gross distortion) 65

Figure 6.4. Preservation classes represented in the Mutamba Pennisetum glaucum (1. Perfect, 2. Epidermis virtually intact, 3. Epidermis incomplete, 4. Fragments of epidermis remaining, 5. Identifiable by gross morphology only, 6. Clinkered) 66

Figure 6.5. Preservation and distortion classes of Poaceae taxa at Mutamba 69

Figure 6.6. Distinction between wild and domestic species at Mutamba according to MNI 76

## List of tables

---

---

Table 5.1.. Preservation and Distortion classes of cereal grains (From Hubbard & al Azm 1990: 104)	50
Table 6.1. Represented parts of <i>Sorghum bicolor</i>	58
Table 6.2. Represented parts of <i>Pennisetum glaucum</i>	64
Table 6.3. Ubiquity percentage for Mutamba taxa	70
Table 6.4. Shannon-Wiener scores	72
Table 6.5. MNI and abundance percentage of the Mutamba taxa	74
Table 6.6. Seeds per litre for all Mutamba samples	75
Table 6.7. Domestic and wild taxa of Mutamba	75

# Chapter 1

## Introduction

---

The Middle Iron Age (MIA), c. 900 to 1400 AD, was a period noted for the rise in social complexity at Mapungubwe in the Shashe-Limpopo Confluence Area (SLCA). The term Middle Iron Age, first used by Huffman (2007), is applied to the area between northern South Africa, eastern Botswana and Zimbabwe for the period circa. 900 to 1300 AD. Many of the communities of this time were agro-pastoralists or farming communities who practised pastoralism and agriculture (sorghum, millets and legumes), made ceramics and lived in semi-permanent villages (Huffman 2007).

Human-plant interaction of the period has been studied through broad topics such as economics, ritual practise or the environment (Schoeman 2006; 2009, Antonites & Antonites 2014) but few have addressed the matter of which plant species were present and used at these Middle Iron Age settlements. To better understand this, archaeological site of Mutamba will be used as a case study by answering the following research questions: which plant species are present at Mutamba during the 13<sup>th</sup> century, what are the ratios of species present (i.e. are there more wild or domestic taxa) and thirdly what are the potential uses of the species found at Mutamba.

The site is situated roughly 120km away from Mapungubwe, on the northern slope of the Soutpansberg Mountains (Figure 1.1.). Mutamba represents the southern extent of Mapungubwe's political power (Antonites 2012). There is also evidence of interaction between Mutamba and Mapungubwe based on a shared ceramic style found (Antonites 2012).

Past research conducted on the Mapungubwe polity was based on surveys and excavations in the Shashe-Limpopo Confluence Area (SLCA) in northern South Africa and not on any outlying areas (Calabrese 2005; Du Piesanie 2008; Schoeman 2006, 2009). This has resulted in generalisations concerning the SLCA used to explain the region as whole, i.e. outlying areas are treated as a reflection of the SLCA (Antonites 2012).

This dissertation will examine plant use at Mutamba through archaeobotany. Archaeobotany is defined as “the study of plant remains from archaeological contexts” (Ford 1979: 299) and refers specifically to the recovery, identification and analysis of archaeological plant material or as Hastorf and Popper (1988: 2) state: “the data, the methods for collecting and analysing the data, and data interpretation that do not involve human activity”. Paleoethnobotany is defined by Renfrew (1973: 1) as “the study of the remains of plants cultivated or utilized by man in ancient times, which have survived in archaeological contexts”. Archaeobotany’ and ‘paleoethnobotany’ as indicated by current literature are terms used both interchangeably and as well as dissimilarly, which in itself is an echo of the “lack of consensus on the distinction between the terms” (Popper 1988:2). Archaeobotanical

material can refer to carpology (fruits, nuts, seeds and monocotyledons), phytoliths, starch, pollen and charcoal. However for the duration of this dissertation the term archaeobotanical material will refer to only carpological material.

The plant use at Mutamba is studied through the analysis and interpretation of macrobotanical material (i.e. seeds). This allows for a potential determination of which plant taxa were present at the site, their ratios as well as what their most likely usage could have been.

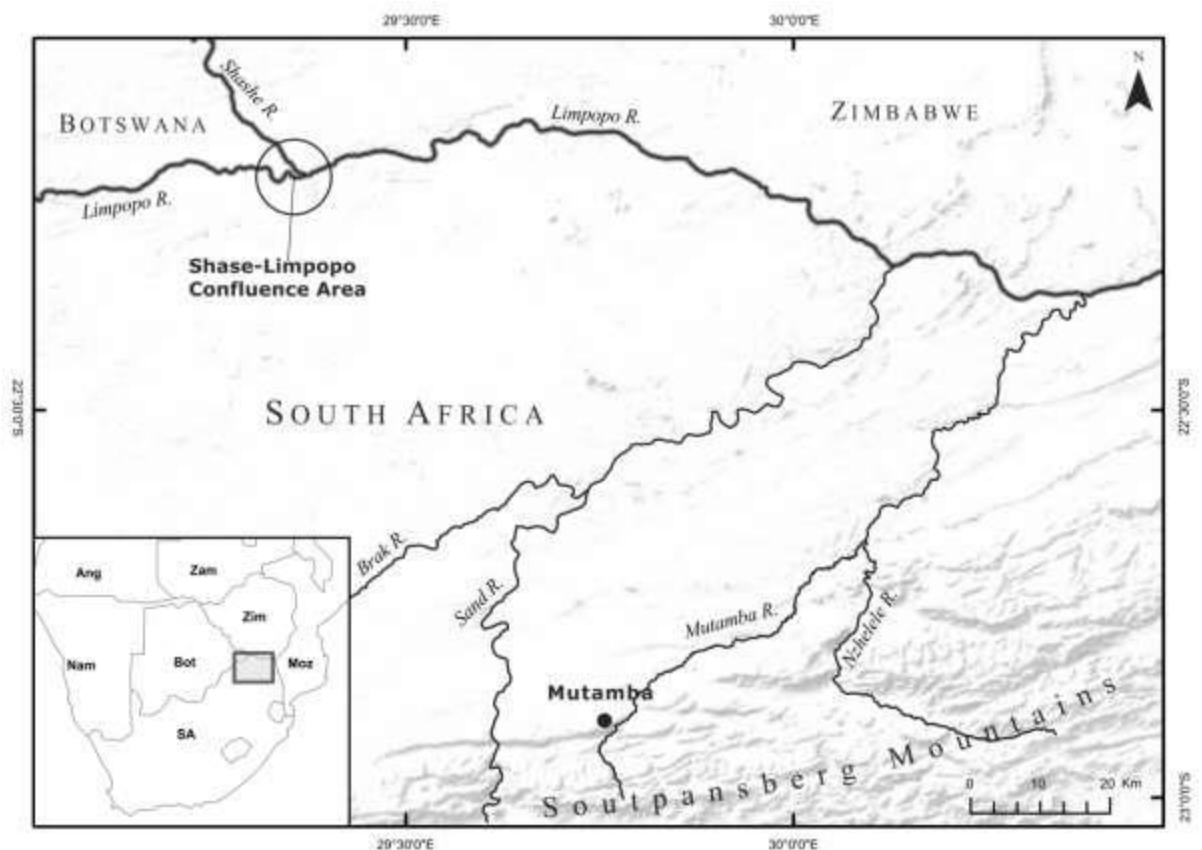


Figure 1.1. Mutamba's location (Antonites 2012: 3)

## 1.1. Historical sequence of the region

Bantu-speaking farming communities first moved into the areas north of the Soutpansberg about 350 to 450 AD, after which the region appears to have been relatively abandoned until approximately 900 AD (Antonites 2014). In the Limpopo Valley this is generally attributed to extremely low rainfall (Huffman 2007, 2008). Despite a continuation of these poor climatic conditions, people associated with Zhizo type ceramics began moving into the SLCA from south-western Zimbabwe by circa 900 AD. This resettlement of the area corresponds to an influx of trade items linked to long distance trade networks (Calabrese 2005, Denbow *et al.* 2008). By approximately 1000 AD a new ceramic style known as Leopard's Kopje can be seen across northern parts of South Africa, southern Zimbabwe and Botswana. The spread of this new style is attributed to the movement of a new group of people into the region (Huffman 1978, 1984, 2007; Calabrese 2005). The number of Zhizo ceramic producing sites decrease and the number of Leopard's Kopje ceramic producing sites increase (Du Piesanie 2008). Calabrese (2005) interprets this as the result of a movement of the political core Zhizo communities to eastern Botswana.

By the 12<sup>th</sup> century Bambandyanalo or K2 becomes the largest Leopard's Kopje site in the region north of the Soutpansberg (Huffman 1982, 2000; Du Piesanie 2008). Based on the extent and quantity of exotic and prestige goods, it is believed that K2 became an important regional political centre (Gardner 1955; Meyer 1998; Huffman 2009; Antonites 2012). The consolidation of K2's political power is linked to cattle and trade (Huffman 2009). Huffman (2009) proposes that K2's society between the 10 and 12<sup>th</sup> centuries was organised based on cattle bride-wealth controlled by lineage

heads. He bases this on the association between archaeological features at the site and ethnographical assumptions such as the role and position of a central cattle kraal (Huffman 2009). This type of settlement pattern is referred to as the Central Cattle Pattern or CCP (Huffman 2009). The CCP can be recognized by large central circular enclosure/s which housed adult cattle with each kraal reflecting the number of cattle owning families (Huffman 2007: 33). The centre of the settlement was the domain of males where disputes and political decisions are attended to and includes the kraal where men and other significant people were buried while the outlying residential area was the domain of women as was organised according to seniority expressed through left and right locations (Huffman 2009: 38, Huffman 2001: 20). At K2 the CCP can be viewed as “product of eastern Bantu-speaking, rank-based societies who share a patrilineal ideology about procreation, a preference for bride-wealth in cattle, hereditary male leadership and positive beliefs about the role of ancestors in daily life.” (Huffman 2009: 39).

The site of K2 had a central homestead complex located in the centre of the valley (Meyer 2000). This central complex is comprised of a large central kraal, a large central court midden, stratified domestic deposits as well as smaller scattered middens (Meyer 2000). By 1150 AD the central kraal was abandoned and overlapped by a large central midden, necessitated a shift of the kraal away from the centre of the settlement (Eloff & Meyer 1981; Meyer 2000; Huffman 2007; Mitchell 2008). Huffman (2007, 2009) views this shift of cattle away from the centre as a movement towards a restriction in cattle ownership and a change in organisation, while Denbow *et al.* (2008) interprets this as a change in herd management strategies with cattle, rather than being centralised, are disseminated across smaller settlements allowing for



more herd mobility. The desertion of the central kraal possibly indicates that cattle were no longer a binding medium for ordinary (Huffman 2009).

Huffman (2009) equated the size central midden to the status of the K2's leader. Since the courts were hierarchically organised in which regional leaders oversaw more cases than local leaders, the increase in importance of the leader led to an increase in usage of the court. Therefore, the more important the leader, the greater the usage of the court. The court area would thus have been subject to a considerable waste material build-up. By 1220 AD the central midden had reached a substantial height of 6m (Fagan 1964; Meyer 1998; Huffman 2007). It is during this period that the majority of the K2 population occupation moves to Mapungubwe (Meyer 1998).

Continuously throughout K2's occupation some of the villagers also resided at the base of Mapungubwe Hill, but in 1220 AD, K2 was ultimately abandoned for the former (Eloff & Meyer 1981; Meyer 1998; Vogel 2000; Phillipson 2008,). The elite settled on the hilltop, as is evident by rich deposits containing exotic goods and extravagant burials, while the commoners settled on the Southern Terrace, on the southern foot of Mapungubwe Hill (Meyer 1998; Huffman 2000). This is significant in southern Africa as it represents the earliest materialisation of class distinction and the start of sacred leadership (Huffman 1996, 2009: 44).

Mapungubwe Hill was only inhabited from 1220 to 1300 AD, i.e. approximately 80 years (Vogel 2000; Huffman 2009), but within the short period of occupation the

settlement organisation underwent pronounced changes such as the stone walling on the summit and base of the hill and climbing hollows cut into the side of the hill which may have supported steps to the summit (Gardner 1963; Eloff & Meyer 1981; Meyer & Cloete 2010). The enclosure on the hill was also believed to have provided ritual isolation for the king, separating him from the rest of society (Huffman 2009: 44).

Smith (2005: 192) suggests that the move to Mapungubwe Hill may have been in reaction to a dry period between 1200 and 1250 AD. While Schoeman (2009) and Murimbika (2006) proposed that the organisation of sacred leadership at Mapungubwe may have been based on rain control. This change from kinship-based leadership to a class-based sacred leadership may be reflected in the leader's control over the rain, whereby he was considered the link between land and God via his ancestors (Murimbika 2006, Huffman 2009). The leader's power therefore became linked to his ability to control rain. Before this rain control rituals were conducted outside the settlement at specific rain control sites (Schoeman 2006), but at Mapungubwe rituals were conducted within the settlement with the back of the palace serving as the rain-making area (Huffman 2009). However, this new arrangement concerning rain making did not replace the older rituals of rain-making as is explained in Huffman (2009: 41) where: "the senior leader performed his duties only once ... involving sorghum beer and the sacrifice of a black bull, before lesser chiefs prayed the same way in their own areas. Later still, other rainmakers continued with the older pattern among the commoners".

The archaeology suggest that control over exotic goods from long distance trade replaced the cattle-based wealth system and aided in the centralisation of both ritual and social power at Mapungubwe (Huffman 1982, 1986, 2007; Meyer 1998). This form of wealth acquisitioning was easier to accumulate, manipulate and store than was previously possible through cattle (Huffman 1982, 1986, 2007, 2009). As Hall (1987: 89) points out, exotic trade goods represented a qualitatively different form of wealth from livestock and that would have provided the elites with means of breaking away from “the chiefly cycle of fusion and fission”. Some of the exotic items imported include large amounts of glass beads, cloth and imported ceramics like celadon (Meyer 1998; Pikirayi 2001) while exported items included gold and various animal products (Pikirayi 2001).

Mapungubwe, along with most of the SLCA, was largely abandoned in 1300 AD. This was originally thought to be as a result of low rainfall (Huffman 1996, O’Conner & Kiker 2004). However it was later proven that the area still received adequate rainfall even after the SLCA was abandoned (Smith 2005; Smith *et al.*2007). The depopulation of the SLCA may have been an amalgamation of rapid population increases, changes in the trade networks or political pressures (Pikirayi 2001; Huffman 2007, 2008; Antonites 2012). After Mapungubwe’s abandonment the SLCA experienced a drop in the number of settlements. However communities living in the Soutpansberg continued to make Mapungubwe ceramics (Antonites 2012; Manyanga 2006).

## 1.2. Archaeobotany in MIA agro-pastoral settlements

Communities of the MIA were largely agro-pastoralists who practised agriculture as well as herding animals. While a great deal of research has focused on animal husbandry aspect of the economy comparatively little is known about the archaeobotanical context. While evidence for botanical material has been found at many Iron Age sites, most notably K2 and Mapungubwe (Fouché 1937; Gardner 1968; Eloff 1979), this material remains to be incorporated into general archaeological thought (Antonites & Antonites 2014).

Agro-pastoralist communities were tied to the agricultural process in a temporal and spatial manner (cf. Fuller *et al.*2010). Huffman (2007) suggests that during the MIA agricultural requirements usually determined settlement location rather than pastoral requirements as natural features and the local climate had to be sufficient in order to allow for crops to reach maturity. Living in semi-permanent villages allowed these communities time and space to cultivate various crops. These crops had specific growth requirements, such as a minimum amount of rainfall and temperatures of above 15°.

To date human-plant interaction of the Iron Age have been examined tangentially (Schoeman 2006; 2009, Antonites & Antonites 2014) and only a few studies have addressed specifically which plants are found at these MIA settlements and what they were used for. The specific taxa found and their uses at these sites may not necessarily have been the same for all settlements. Natural features, local climate and preference

could have influenced species of crops grown as well as wild species exploited. This indicates that the range of taxa found and degree of utilisation could differ from settlement to settlement.

### **1.3. Structure of the dissertation**

Chapter 2 notes the location and flora of the site as well as previous research conducted. Chapter 3 provides a brief history of archaeobotany as a discipline both in Europe and America as well as in South Africa. This is followed by Chapter 4 which discusses issues pertaining to recovery, identification and interpretation in archaeobotany. In Chapter 5 the methodology utilized for the analysis of archaeobotany is outlined and the results will be presented in Chapter 6. Chapter 7 details the potential uses for the taxa found at Mutamba while Chapter 8 discusses how the taxa found at the site were most likely used.

## Chapter 2

### Physiography and previous research

---

---

This chapter presents physiographic location and natural environment of the archaeological site known as Mutamba. The remainder of the chapter then proceeds to detail previous research conducted at the site.

#### 2.1. Mutamba: Location and natural environment

The archaeological site of Mutamba is situated in a saddle on an east-west running ridge that forms a foothill on the northern slope of the Soutpansberg mountains (Antonites 2012). The southern slope of the ridge forms part of the Mutamba River valley with the Mutamba River running 250 m south of the site itself (Antonites 2012). Most of the ridge is bereft of soil but in the areas in which soil does occur it is relatively shallow quartzite and sandstone derivative sand (Antonites 2012: 74-76).

The current surrounding vegetation of Mutamba ascribes to the typical vegetation found on the northern slopes of the Soutpansberg, the Arid Northern Bushveld. The Major Vegetation Type (MVT) is situated along the mountain's rain-shadowed northern ridges. Plant communities in this MVT are adapted to unpredictable rainfall and water-stress conditions (Mostert *et al.* 2008: 41). The vegetation structure is comprised of open woodland and some of the most diagnostic species include

*Adansonia digitata*, *Boscia foetida* subsp. *rehmanniana*, *Cordia monoica*, *Commiphora tenuipetiolata*, *Blepharis diversispina*, *Commiphora glandulosa* and various *Grewia* species (Mostert *et al.* 2008). *Cenrus ciliaris* and *Adansonia digitata* are also found spread across the site.

Though the current climate for Mutamba is moderately arid with periodic droughts, it does fall within the summer rainfall zone for South Africa with temperatures varying based on season, altitude and topography (Mostert 2006: 12). Seasons are warm and wet or cool and dry. The cool and dry season is from May to August with temperatures varying between 12 degrees 22 degrees Celsius and the warm and wet season is from December to February with temperature variation of between 16 degrees and 40 degrees Celsius (Kabanda 2003). The climate during the 13<sup>th</sup> century however was much wetter, with higher rainfall conducive to the practise of agriculture (Smith 2005; Smith *et al.* 2007).

The Shashe-Limpopo region as a whole experiences a combination of high summer temperatures and infrequent low rainfall. However, environmental proxies and archaeological data indicate that the region supported large farming communities in the past (Tyson and Lindsay 1992; Manyanga 2006). The past climate of the region is thought to have undergone a series of major oscillations alternating between cool temperatures and low rainfall and warm temperatures and increased rainfall (Manyanga 2006).

Based on Tyson and Lindesay's (1992) regional paleoenvironmental sequence model the period of 100 to 200 AD was cooler until 250 to 600 AD with warmer conditions prevailing. This was then followed by yet another cooler period which lasted until 900 AD.

A warm wet period, the Medieval Warm Epoch is thought to have taken place from 900 to 1300 AD after which a cooler period, the Little Ice age occurred (Tyson & Lindesay 1992). However, Smith (2005) places the start of the Medieval Warm Epoch later, 1000 AD.

Smith *et al.* (2007) also argued that between the period of 880 to 1320 AD the climate of north-eastern South Africa was both warmer and wetter than present, placing the cool and dry conditions of the Little Ice Age to a much later time, c. 1500 AD. They likewise cautioned the generalizing of external climate data when referring to the Shashe-Limpopo area, citing that the Shashe-Limpopo River Basin (SLRB) lies in the rain shadow of the Soutpansberg which has slightly lower temperatures and considerably higher rainfall than the SLRB (Smith *et al.* 2007: 116). Using data obtained from faunal remains at Mapungubwe, Smith *et al.* (2007) were able to ascertain a pattern of increased annual rainfall of >500 mm, with an episode of lower rainfall between 1200 and 1260 AD (Smith *et al.* 2007: 121-123).



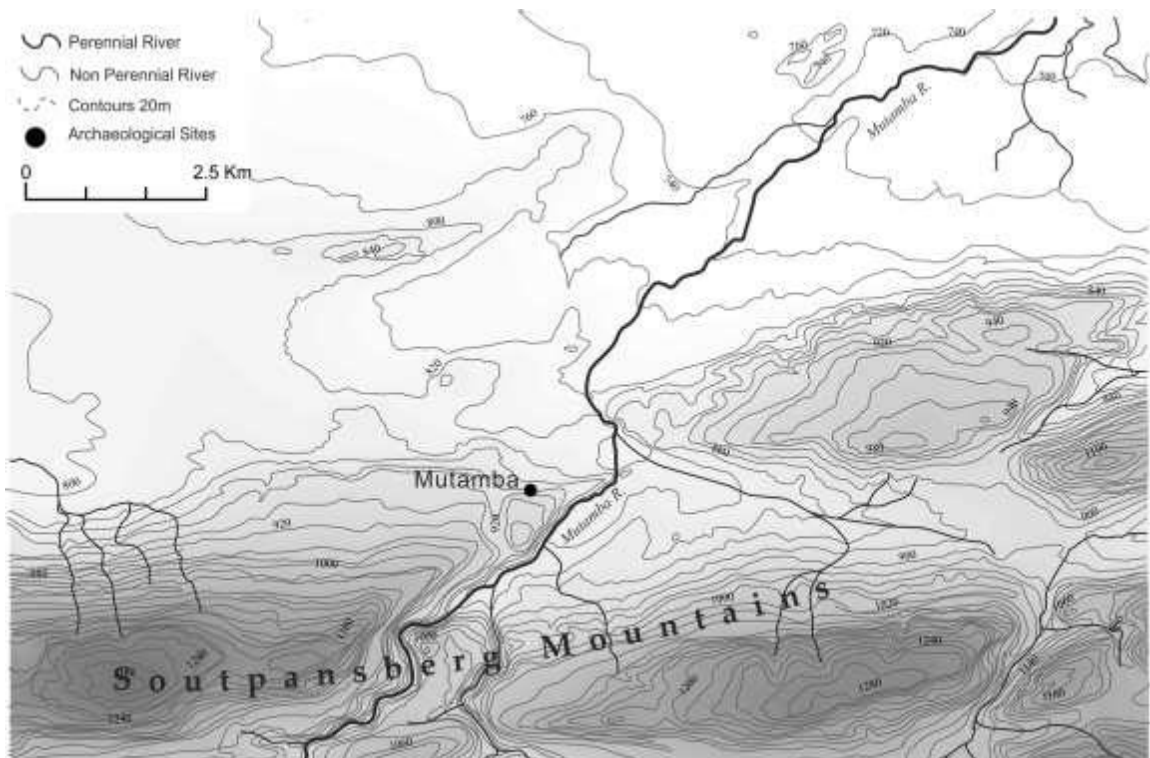


Figure 2.1. Map of Mutamba's location in relation to the Soutpansberg (Antonites 2012: 77)

## 2.2. Previous archaeological research conducted at Mutamba

Mutamba was first briefly excavated by Loubser (1988) and then later re-excavated by Antonites (2012). A sample of the archaeobotanical material excavated by Antonites (2012) was then examined by Benkwitz (2013) for an Honours dissertation.

### 2.2.1. Loubser excavation

Initial excavations were conducted by Loubser (1988) as part of his PhD research on the Venda speakers in the area. While questioning the locals Loubser ascertained that the settlement's occupation could not be ascribed to any one specific group.

He placed a 3x3 metre trench, over an ashy concentration in the hopes of finding features that could elucidate the settlement's layout. This trench, with a depth of 1.3 m, contained a total of five layers. Within these layers Loubser was able to distinguish four ceramic horizons: Mapungubwe (1250 - 1290 AD), Eiland, Moloko and Letaba. The earliest layer was linked to the Mapungubwe ceramics..

Within the Mapungubwe layer two baked floor fragments were found on top of dung and soil mixture. One of these floor fragments was interpreted as containing post impressions and along with an additional overlaying ashy layer with daga Loubser construed this as the remnants of a hut wall and its associated floor. The remaining horizons contained no clear features or discernible patterns, although slag and daga were found through the entirety of the excavation.

### **2.2.2. Antonites excavation**

Mutamba was later re-excavated in 2010 and 2011 by Antonites (2012) as part of his PhD research concerning political and economic interaction in the hinterland of the Mapungubwe polity (Antonites 2012). The research was broken down into two phases. The excavations from the first phase were focused on test units which were then expanded on in the second phase based on identified architectural features.

Over the course of the first phase of excavations Antonites (2012) determined that due to Mutamba's almost featureless surface that entire surface of the site would be treated as a single sampling layer. This identified a sampling unit of 4437 potential units (Antonites 2012: 83). Using random sampling he was then able to decide the

location of the units to be excavated. Five units were excavated from the saddle area, three from the western slope and a further three from the southern slope. These units indicated that occupation of the site was primarily located in the central saddle area, further corroborated by the saddle area along with the western slope displaying a rich concentration of artefacts. The excavation proceeded by excavation of a single locus at a time.

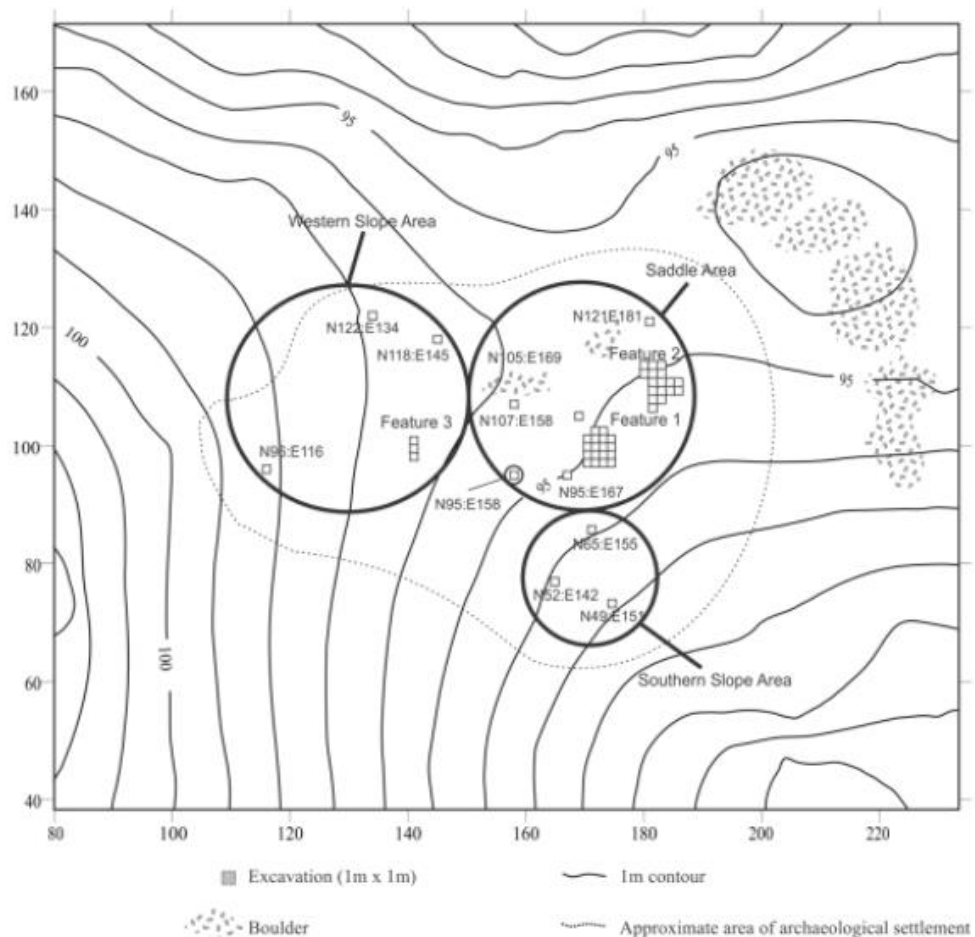
A locus is an archaeological unit created by the manner and order in which a site is excavated (Antonites 2012). Antonites (2012: 82) defined a locus as “the minimum volume of matrix based on cultural or depositional criteria to which artifacts and objects were linked”. All excavated volumes of matrix were assigned unique locus numbers. Antonites additionally differentiated a locus from a layer or a stratigraphic unit as the former is created based on excavation method and sequence while the latter occurs as a result of natural site formation processes (Antonites 2012: 82).

Any architectural features that were uncovered in the excavations of the units were then further expanded upon in the second phase. Two of the features (Features 1 and 2) were in the saddle area and the third (Feature 3) in the western area. Of the three features, the first two were interpreted as domestic contexts.

Feature 1 comprised of five defined layers that contained hut floors and midden deposits. Feature 2 comprised of four defined layers encompassing fragments of a hut floor and daga, while Feature 3 containing three defined layers was interpreted as a

possible cattle kraal. The interpretation of Feature 3 can be ascribed to the feature containing a layer of burnt cattle dung and a pit with human remains and ceramic fragments.

The most notable aspect of these excavations was the routine usage of flotation. Antonites (2012) collected ten litre samples from the centre of each locus which proved invaluable at the recovery of small artefacts such as beads and copious archaeobotanical material.



**Figure 2.2. Map of Mutamba's excavation areas (Antonites 2012: 84)**

### **2.2.3. Benkwitz archaeobotanical study**

Benkwitz (2013) conducted research on macro botanicals from layers 3, 4 and 5 of Feature 1 at Mutamba. His research was concerned with discerning which species were found at the site and what their possible uses were (Benkwitz 2013: 10). He employed the standard methodology of weighing, sieving, sorting and species identification. Benkwitz (2013: 30) identified a total of four species and one genus (*Grewia sp.*, *Sclerocarya birrea*, *Sorghum bicolor*, *Pennisetum glaucum* and *Vigna unguiculata*) of which two were wild and three were domesticates. He attributed their use to primarily culinary (food and drink) and to a lesser extent medicinal in the case of *Grewia sp.* (Benkwitz 2013: 22-29).

### **2.3. Conclusion**

The archaeological site of Mutamba was first excavated by Loubser (1988) and later re-excavated by Antonites (2012). Some archaeobotanical material was retrieved from flotation and analysed by Benkwitz (2013) for his honours project. The site itself is located in a saddle on the northern slope of the Soutpansberg Mountain (Antonites 2012). The surrounding vegetation on the northern slope or the Arid Northern Bushveld MVT is well adapted to water stress conditions and uncertain rainfall (Mostert *et al.* 2008). Climatic data indicate that the environment of both the SLRB and the northern slope of the Soutpansberg Mountain were much wetter during the MIA and would have allowed for agriculture to take place (Smith 2005; Smith *et al.* 2007).

## Chapter 3

### Archaeobotany - A brief history

---

---

The primary source for this section is Pearsall's (2015: 28-31) historical overview of the paleoethnobotanical approach. This chapter provides a brief history of archaeobotany both globally and in southern Africa in order to understand changes in the discipline from its original to its current state. The emphasis is on the value of incorporating archaeobotany within general southern African archaeology.

#### **3.1. Brief history of archaeobotany – Europe and America**

European interest in archaeological plant material first manifested in the 19<sup>th</sup> century with Kunth's 1826 study of desiccated plant material from ancient Egyptian tombs and Heer's 1866 study of waterlogged plant material from lakeside Swiss villages (Pearsall 2015). Once it became established that plant material had the capacity to survive within the archaeological record, studies began to take one of two forms, either a report of specific species found at a site or a study of the evolution of a particular species (Renfrew 1973). By the late 1800s research interests spread to central Europe, culminating in the syntheses of Buschan (1895) and Neuweiler (1905) (Renfrew 1973). The geographical scope of research expanded in the 1950's to include the Near East and by the late 1900s symposiums and workshops were being organised allowing for archaeobotanists previously working in relative isolation to gather and share their work (Renfrew 1973; Pearsall 2015). Traditionally the

emphasis of archaeobotanical research was centred on taxonomy and morphology, but research from the late 1900s and onwards served to both highlight the strengths of taxonomy and morphology and to emphasise the importance of cultural interpretation (Pearsall 2015).

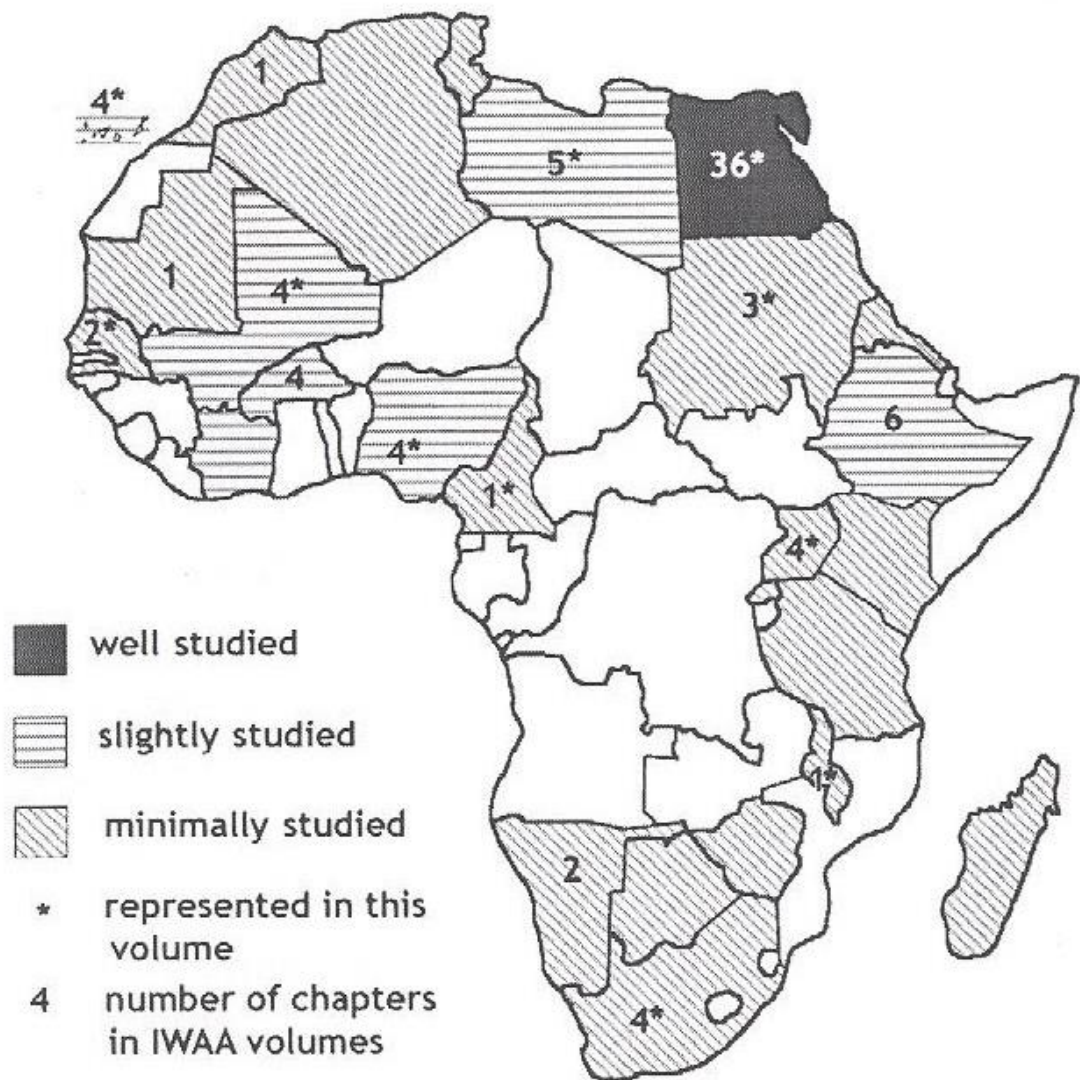
In the New World the earliest archaeobotanical study was conducted by Saffray in the late 19<sup>th</sup> Century on the contents of Peruvian mummy bundles followed by later work in the 20<sup>th</sup> Century by Rochebrune, Harms, Yacovleff, Herrera and Towle among others (Pearsall 2015). American archaeologists only engaged with archaeological plant material after the 1930s. It was the publication of *Excavations at Star Carr* in 1954 that convinced many of the value of biological material in archaeological interpretations (Pearsall 2015: 29). After Struever's description of flotation (1968) in the mid-1900s, increasing emphasis was given to the recovery and analysis of archaeobotanical material. This paved the way for phytolith and starch grain studies in the 1970s and 1980s (Pearsall 2015).

As of the start of the 21<sup>st</sup> century archaeobotanical research has seen considerable growth worldwide. Through a review and synthesis of publications between 2000 and 2013 VanDerwarker *et al.*(2016) evaluated the discipline and found rigorous procedures for recovery, identification, analysis and reporting of material had been adopted and standardised. They attributed this growth of the discipline to the integration of theoretical and methodological perceptions into research with an increasing number of studies incorporating archaeobotanical data (VanDerwarker *et al.* 2016).

### **3.2. Archaeobotany in Africa – The IWAA**

Archaeobotany in Africa is poorly established compared to its European and American counterparts. There are over 50 countries in Africa, yet almost half these have little or no archaeobotanical evidence (Fuller *et al.* 2014: 17), the exception being Egypt where archaeobotanical remains have been studied since Kunth's study in 1826. In an attempt to address this matter the International Workgroup for African Archaeobotany (IWAA) was established in 1994 to promote archaeobotany in Africa. The initial development of the conference was in reaction to encounters with unfamiliar African taxa by European archaeobotanists (Fuller *et al.* 2014). Since its establishment conferences have been held every three years, with the 18<sup>th</sup> conference to be held in 2019 in Lecce, Italy. To date these conferences have contributed to furthering the development of subjects dealing with chronology, methodology and geography as well as attracting papers and numerous datasets dealing with a variety of topics from phytoliths to carpology (Fuller *et al.* 2014).





**Figure 3.1.** Map of a generalised distribution of archaeobotanical studies in Africa, according to the 2006 IWAA conference (Fuller *et al.* 2014: 18).

### 3.3. Archaeobotany in South Africa

The state of archaeobotany in South Africa mirrors that of the rest of Africa, in that it is absent in general archaeological practice to a large extent. Many archaeologists in South Africa have only recently begun including archaeobotanical material in their interpretations (e.g. Scott 2005; Benkwitz 2013; Sievers 2013). Halting its widespread

adoption are the notions that plants did not play integral roles, had limited importance and the belief that plant material does not preserve well (Antonites & Antonites 2014).

One of the earliest mentions of botanical remains from an archaeological context is by Fouché (1937: 31) from the site of Mapungubwe. His report makes only brief mention of seeds found during excavation by simply listing the small number of seeds found during the excavation (Fouché 1937: 31). Mention is also made in Gardner's (1963: 82) report on excavations at Mapungubwe and K2: "I took charcoal, burnt millet, various seeds, and other objects from the ruins, not only from K.2 but from Mapungubwe as well".

Eloff's (1978) study on K2 and Mapungubwe stands in stark contrast to the earlier studies of Fouché (1937) and Gardner (1968). Eloff (1978) provides detailed information on botanical material found at both sites. He dedicates an entire chapter to botanical finds and gives a detailed list of which botanicals were found and where.

TERREIN K2

Opgraving	Blok	Laag	Gedomestikeerde sade				Wilde sade					
			Vigna unguiculata Boontjie sp	Sorghum bicolor Kafferkorin	Pennisetum typhoides Babala	Sclerocarya caffra Maroela	Xanthocercis zambesiaca Nyalabessie	Vangueria infausta Mispel	Citrullus lanatus Tsamma	Syzygium cordatum Waterbessie	Adansonia digitata Kameelart	
Rn 2	C3	1		x								
	B8	2		x								
	C8	2		x								
	C4	2		x								
	E10	2		x		x			x	x		
	D10	2.2							x			x
	D9	3		x					x			
	D10	3		x								
	E10	3		x		x						
	D9	4		x		x			x			
	B7	5		x								
	C4	5		x								
	C7	5		x		x						
Ts 2	B4	1				x						
	A4	2				x						
		3(a)						x				
Ts 3	O1	1		x								
	O2	3				x		x				
	O2	5				x						
	O2	6										
	O2	7		x								
	O2	8		x		x						
	O1	9		x								
O2	9		x		x		x					

Figure 3.2. Excerpt from Eloff (1979: 318) illustrating excavation details concerning botanicals from K2.

Antonites and Antonites (2014) analysed the occurrence of articles containing mention of botanical material from 1980 onwards in three main archaeological journals (*Southern African Humanities*, *Southern African Field Archaeology* and *South African Archaeological Bulletin*). It was found that within the three journals only 12 articles carried an archaeobotanical theme and that the botanical data fell into four broad categories of economic systems, environmental reconstructions, social identity and political complexity (Antonites & Antonites 2014). This survey of literature indicated that an inadequacy regarding botanical sampling and recovery methodologies existed that coupled with theoretical gaps concerning the roles of plants in past communities can be attributed to the previously mentioned perceptions of archaeobotany in South Africa. These perceptions have caused the integration of

archaeobotany into general archaeological practise to be challenging (Antonites & Antonites 2014: 230). However despite these challenges there is an unmistakable growth in archaeobotanical research. In recent years the majority of articles containing archaeobotanical information have largely dealt with Stone Age material. This is especially evident by the number of publication produced regarding the botanical material from Sibudu Cave in Kwazulu-Natal, South Africa (Wintjes & Sievers 2006; Sievers 2006; Sievers & Wadley 2008; Wadley *et al.*2011; Sievers 2011; Sievers & Muasya 2011; Miller & Sievers 2012).

Wintjes and Sievers identified and illustrated the seven most commonly found fruits, nuts and seeds present in the Middle Stone Age (MSA) at Sibudu Cave while in another publication Sievers and Wadley (2006) discussed the results of their experiment whereby they buried various fruits, seeds and nuts at predetermined distances and depths from experimental fires in order to determine whether the botanical material from Sibudu's MSA deposits were carbonized as a part of post depositional processes. Sievers also (2006) aimed to identify possible vegetation changes around Sibudu cave over time, concluding that the Sibudu botanical assemblages offer the first possible sedge usage in southern African MSA contexts while Wadley *et al.*(2011) made use of both archaeobotanical and geoarchaeological evidence to discern changes in domestic practices in the form of plant bedding construction. Extensive research has been done on bedding material at Sibudu. Sedge nutlets are found throughout Sibudu's MSA deposits. The presence of the nutlets was attributed to deliberate human harvesting of sedge culm for bedding (Sievers 2011: 9). Experiments were then conducted (Sivers & Muasya 2011; Miller & Sievers 2012) to identify the sedge *Cladium mariscus* subsp. *jamaicense*. The micromorphological

signatures of contemporary burnt sedges and grass bedding was compared to laminated layers of carbonized material and phytoliths from the MSA deposits in order to clarify whether the layers of bedding were deliberately burnt (Sievers & Muasya 2011: 3039). Although the majority of articles in recent years containing archaeobotanical information have dealt with Stone Age material, there has been some research within the Iron Age, most notably Greenfield *et al.*(2005) and Schoeman (2006, 2009).

In a rare consideration of plant use in Iron Age sites, Greenfield *et al.* (2005) explored the possibilities of the potential locations of Early Iron Age (EIA) - c. 400 to 900 AD-gardens in the Thukela River Basin. From data collected from various EIA excavations in the Thukela River Basin they were able to determine that these excavations produced rich botanical evidence (Greenfield *et al.* 2005: 307-308). Through the use of ethnoarchaeological and archaeological evidence they investigated whether the gardens were located only within the settlements or corresponded to larger crop fields (Greenfield *et al.* 2005: 308). It was concluded that empty spaces within the settlements may have been where EIA farmers' gardens were located (Greenfield *et al.* 2005:325).

In the Limpopo Valley, Schoeman (2006) explored the manifestation of rain-control and its connection to farming community ideology in the SLCA between 1000 AD and 1250 AD (Schoeman 2006: i). Making use of ethnographical and archaeological data the material culture and the spatial organisation of rain control was examined. Among the material culture excavated were abundant domestic and wild botanical

remains (Schoeman 2006: 269). These species were then examined and an attempt was made to find communality regarding their selection (Schoeman 2006). Using ethno-botanical studies, the functions of the botanical material recovered from the rain-control sites was linked to meteorological occurrences (Schoeman 2006: 269). Note was also made with regards to sacrificial cooking and burning of rain-medicines which create black smoke in order to attract rain clouds (Schoeman 2006: 269). Rock tanks formed part of the rain-making sites in the SLCA and acted as receptacles of materials associated with rain-control (Schoeman 2009: 275). As an association with water was key in the selection of hills for rain-control, many rock tanks contained archaeological deposits such as beads, metals, faunal remains and ash (Schoeman 2009: 281-286).

While the research of Schoeman (2006, 2009) and Greenfield et al. (2005) touched on aspects of Iron Age plant use, there is still a gap in available literature concerning human-plant interaction during the MIA, such as agricultural systems and subsistence strategies (Antonites & Antonites 2014).

### **3.4. Conclusion**

Archaeobotany, the study of plant remains, first began garnering interest in early 19<sup>th</sup> century Europe with desiccated Egyptian material and waterlogged Swiss material. Once it was realised that plant material survived within archaeological contexts studies took the form of either report of species or studied the evolution of a species (Renfrew 1973). In northern America archaeologists engaged with botanical material

at a much later time. However the discipline continued to grow steadily. By the 21<sup>st</sup> century the number of archaeobotanical studies integrating methodological and theoretical issues has allowed for the discipline to become incorporated into generalised archaeological practise. This has not been the case in Africa, with the exception of Egypt. The discipline is less established on the continent (Fuller *et al.* 2014), with a marked absence in general archaeological practise. This absence is mirrored in South African archaeological practise and it is only recently that this has begun to change. More studies are beginning to utilise archaeobotanical data and although the majority of these are concerned with the Stone Age, there is also an increase within Iron Age research as well.

## **Chapter 4**

# **Deposition, preservation, recovery and interpretation of archaeobotanical material**

---

---

The analysis of archaeobotanical material is a three part process: recovery, identification and interpretation. Recovery is often influenced by the environmental conditions of the site, excavation strategies and the types of preservation which in turn are impacted on by natural and cultural processes after deposition (Day 2013; Pearsall 2015). Recovery of archaeobotanical material usually occurs through flotation, in situ recovery or screening; all of which are affected by various physical or analytical issues and deliver different types of botanical remains. Identification then takes place (Refer to Chapter 5). After this the essential stage of interpretation remains. Interpretation is influenced by deposition, preservation, recovery and the type of emphasis that is placed on it. Integrating various types of data such as ethnography and assemblage context with the content of an archaeobotanical assemblage fosters a connection that can assist in addressing archaeological questions (Hastorf 1999).

### **4.1. Sources and deposition**

Archaeobotanical materials from archaeological sites are the results of direct and indirect activities that took place during occupation. The botanical material can become part of a site through a myriad of ways related to the manner of usage: i.e.



they were used directly in cooking, indirectly as a by-product such as grass seeds from roofing material or were a part of the natural background of plants growing on the site. The manner in which the plants were used determine how they would be possibly preserved in the archaeological record (carbonized or desiccated) which in turn is affected by taphonomic and site formation processes

#### **4.1.1. Sources of seeds on archaeological sites**

Manifold processes can account for the presence of botanical material on archaeological sites. Minnis (1981) outlined three sources of archaeological seeds: direct resource usage, indirect resource usage and seed rain.

The first source, direct resource usage, is indicative of seeds that were specifically brought on site to be used, for example such as millet seeds for porridge. These seeds occur at archaeological sites as a result of deliberate collection, processing and use where either the seed itself was selected for processing (*Sorghum bicolor* caryopses) or were resulting waste products of utilized plants (*Sclerocarya birrea* opercules from an endocarp) (Van der Veen 2007; Pearsall 2015). Their presence in the archaeological record is often a result of accidental burning while being processed (Minnis 1981).

The second source, indirect resource usage, refers to seeds that have become a part of the archaeological record through the selection and use of the plant itself with the seeds occurring as resultant by-products (Minnis 1981; Pearsall 2015). Pearsall (2015:

37) illustrates this through with an example of grass seeds falling from roof thatch or through the use of animal dung fuel (Reddy 1998).

The last source mentioned by Minnis (1981), seed rain, refers to seeds that have fallen to the ground because of wind-dispersal. These wind-blown seeds, while not occurring as a result of intentional plant usage, may have become charred if blown into hearths and middens (Minnis 1981).

#### **4.1.2. Deposition of seeds in archaeological sites**

Understanding the manner in which botanical material becomes deposited can be multifaceted at times. Van der Veen's (2007) discussion on the formation processes of desiccated and carbonized plant material presents some of the ways in which plant material could have possibly become deposited. Desiccated and carbonized material possesses similar routes of entry but may contain variations with regards to species represented and parts of those species represented. The composition of carbonized material is often tilted towards a more limited number of species, usually crops and pulses while the composition of desiccated material may contain material not present with carbonization such as complete fruits or fragile tissue. As only two modes of preservation are present at Mutamba, carbonized and desiccated, these two modes will be discussed here.

## **Carbonization**

Van der Veen (2007) and Pearsall (1988) identify a variety of routes of entry by which material can become carbonized. The first two occur due to routine every-day activities and the last three being considered rare events. The five routes of entry are as follows:

1. Plant remains used as fuel, both deliberate and casual.
2. Foods inadvertently burnt during preparation.
3. Stored fodder or foods destroyed by accidental or deliberate fire.
4. Plants destroyed during cleaning out of storage pits using fire.
5. The destruction of diseased or infected crops.

## **Desiccation**

The routes of entry for desiccated plant material are very similar to carbonized plant material. Van der Veen (2007: 979) notes several routes of entry for desiccated material. Some, such as storage would be rare occurrences while others, such as wind-blown deposition, would be more common. The modes of entry that Van der Veen (2007) identifies are as follows:

1. Food preparation and kitchen waste.
2. Stored foods.
3. Table waste and snack foods (e.g. the stones of fruits, nutshells or melon seeds). Table waste would be discarded in batches in specific locations while snack foods may have been discarded casually across the site.
4. Residues of crop processing.

5. Animal dung, fodder or bedding.
6. Roofing material.
7. Hearth sweepings.
8. Wind-blown seeds accidentally blown into refuse deposits or brought in by burrowing insects.

#### **4.1.3. Post deposition**

It must be noted that in addition to the many anthropogenic ways in which plant material may become part of the archaeological record, that there are natural processes that affect post-depositional movement (Pearsall 2015: 40). Faunalturbation, in the form of animal burrows, was frequently noted in Antonites' field notes for Mutamba.

Faunalturbation is the movement of sediment by burrowing animals and insects (Morin 2006). Many species of animals and insects create a complexity of tunnels, usually located within the surface soil, which over the course of the animal's lifetime may either distort the material within the sediment microscopically or severely (Wood & Johnson 1978). Upon disuse the burrows within one sediment horizon is filled with material from another horizon and this results in the translocation of artefacts and a modification of assemblages (Wood & Johnson 1978; Morin 2006). Canti (2003) illustrated how earthworms affected archaeological stratigraphy. They burrow and bring soil up, and depositing it on the surface, causing artefacts to sink whilst taking sand grains and seeds underground (Canti 2003; Pearsall 2015).

#### **4.1.4 Preservation**

Only charred and desiccated material was found preserved at Mutamba and will be discussed here. First carbonized (the most common state) and then briefly desiccated will be examined.

##### **Carbonized (charred) preservation**

Reconstructing human plant interaction is not a simple matter and why and how archaeobotanical material became carbonized is crucial in these reconstructions (Sievers 2008). As Pearsall (2015: 41) states, without a conflagration “not all botanical materials have an equal chance of becoming charred”. Plants that are associated with activities using fire (i.e. parching of grains) are far more likely to become carbonized than plants which are associated with activities that do not make use of fire (i.e. baskets woven from reeds). Carbonization may be deliberate or accidental, however exposure to fire does not in itself lead to equal chance of preservation (Pearsall 2015: 41). Van der Veen (2007) proposes that approximately only 20% or less of the original plant assemblages are preserved in carbonized form. Fruit and seeds that do survive carbonization often do so remarkably well and are often still recognizable (Braadbaart *et al.* 2004). There are many variables to regard in the carbonization processes.

Sievers and Wadley (2008) suggest some variables with regards to the success of the carbonization process such as the fire’s size and temperature, the type and amount of

wood used, the duration of the fire, air temperature, wind and/or wind direction and humidity. Botanical variation include the shape and size of the botanical material, its density, the moisture or oil content, the presence of flesh and possible attachments. The variables regarding the soil matrix in which botanical material is found may also affect carbonization and these may be the size of the soil particles, porosity, moisture content, and inclusion such as bone or stone. Sievers and Wadley (2008) also suggest that the state of the botanical material before carbonization and potential social practices must likewise be taken into consideration as well. The effects of carbonization on botanical material have often been investigated on a variety of taxon (Boardman & Jones 1990; Gustafsson 2000; Gaurino & Sciarrillo 2003; Braadbaart *et al.* 2004; Ferrio *et al.* 2004; Braadbaart *et al.* 2005; Sievers & Wadley 2008). The effects of charring on botanical material found in three of these investigations (Boardman & Jones 1990; Ferrio *et al.* 2004, Gaurino & Sciarrillo 2004) will be briefly noted.

The experiments confirmed that substantial change took place in the morphology and dimensions of the cereal grains. The grains tended to decrease in length but increase in thickness and breadth with temperature (Ferrio *et al.* 2004). It was also determined that the first components lost through charring (i.e. rachis and straw) were those that are the least represented archaeologically and that the seeds from various taxa all carbonized and distorted to various degrees at similar temperatures (Boardman & Jones 1990). Their results showed that the greatest loss of seeds occurred where the seeds were placed on the surface, up to 75% of carbonized cereal grains were lost and 60% each of carbonized legumes were lost as well (Gaurino & Sciarrillo 2004). In hearths seeds were mixed with sand accounted for between 38 % and 60% seed loss

(Gaurino & Sciarrillo 2004). They also noted that the variation in the loss of seeds between the different plant families was “remarkable” and hypothesized that these differences were most likely as a result of the sensitivity of different seed types to heat (Gaurino & Sciarrillo 2004). The authors also noted that cereals were the most sensitive to heat (charring from 200 to 400° C) and legumes the least (charring at 500° C) which was attributed to the heat resistant thick outer seed coat (Gaurino & Sciarrillo 2004).

### **Desiccated preservation**

Desiccated plant material is relatively robust (Van der Veen 2007), and preserve well (Ernst and Jacomet 2005; Van der Veen 2007). Desiccated botanical remains often resemble modern botanical remains in size and colour although they may be darker shades of brown (Van der Veen 2007). Delicate features such as hairs or the lemma and palea can often be preserved; however preservation is dependent on burial conditions (Van der Veen 2007). Desiccation can occur both with artificial heat (Wadley and Sievers 2008) and without. Desiccated deposits can also often be very rich both in species and volume (Van der Veen 2007).

Desiccated assemblages often also contain a high proportion of wild plants, usually weeds but also remnants of wild plants gathered on purpose (Van der Veen 2007). While many studies have been conducted on carbonized botanical material, not as many have been conducted concerning desiccated botanical material. Van der Veen (2007: 969) lists some examples from North Africa and Europe. These examples are

useful as no studies exist concerning southern African specific examples and at Mutamba, a few examples of desiccated *Sclerocarya birrea* endocarps (marula stones) were recovered.

## **4.2. Recovery**

“Archaeological sites vary tremendously in botanical productivity, and each individual situation must be dealt with as an individual sampling problem” (Toll 1988: 36). Sampling is unavoidable (Lennstrom & Hastorf 1995; Orton 2000). Given the size and state of archaeobotanical material, a good sampling strategy is needed for efficient and successful retrieval (Lennstrom & Hastorf 1992). Four sampling strategies are often used in archaeobotany: bulk, scatter, column and blanket sampling (Popper & Hastorf 1988; Lennstrom & Hastorf 1992; Pearsall 2015).

### **4.2.1. Bulk sampling**

Bulk sampling (Orton 2000) or point sampling (Pearsall 2015) is when a sample is taken from a small precise location of a contiguous matrix from as a single location within a locus or a context (Lennstrom & Hastorf 1992). This method is often used when a cultural context has already been defined and is of small extent (Lennstrom & Hastorf 1992). Bulk samples are often subject to flotation.



#### **4.2.2. Scatter sampling**

It comprises several inches' of soil taken throughout a given level, context, feature, etc., until a set amount volume of soil is reached ( Popper and Hastorf 1988, Lennstrom & Hastorf 1992) and is then combined in a single bag (Pearsall 2015). Van der Veen and Fieller (1982: 288) state that while it is the most commonly used method it is also the least satisfactory as there is no way of determining how representative the sample is.

#### **4.2.3. Column sampling**

Column sampling is made up of a series of samples of “small cross-section and greater depth” taken one above another from the side of an excavation (Orton 2000: 155). A standard amount of soil is collected from each level in order provide a chronological sequence. The advantage of column sampling is that samples can be left in place until the excavation has reached completion and each respective layer is visible for precision sampling (Pearsall 2015). A disadvantage of column sampling is that it is not representative of the entire deposit (Hastorf & Popper 1988).

#### **4.2.4. Blanket sampling**

Blanket sampling was the sampling strategy used at Mutamba, whereby samples were taken from each context of the excavation. The aim was to make it a routine practice in order to minimize variations in sample taking among individuals, and, to allow for later analysis. Pearsall (2015) advocates blanket sampling for the following four reasons: easy to carry out in the field, eliminates the problem of predicting where

archaeobotanicals might occur, allows for maximum flexibility for the analyst and allows for the evaluation of various features.

### **4.3. Recovery techniques**

Among the techniques used to separate archaeological material from a site's dirt matrix are flotation and dry screening. The amounts and types of artefacts recovered from flotation are different from dry screening and will also produce different results (Wagner 1988).

#### **4.3.1. Flotation**

Watson (1976: 79) called flotation a technique that amounted to revolution in data recovery. To simplify, flotation is where soil from an archaeological context is added to a body of liquid, usually water, and agitated and anything with a gravity that is less than the liquid, i.e. light fraction, floats to the top and can be scooped or siphoned off (Wagner 1988; Pearsall 2015). Heavy fraction is comprised of things that are heavier than the liquid but larger than the screen at the bottom of the flotation machine or container (Wagner 1988: 19). Flotation is different to wet sieving in that the soil is placed on a screen and sprayed with water. Any soil and artefacts that are smaller than the mesh screen are washed away. With water sieving archaeological material is often lost as only large, hardy artefacts are retained but during flotation archaeological material does not suffer abrasion through removal as the material is suspended in liquid before removal (Wagner 1988). After removal samples should be dried, preferably in a shaded area as rapid drying is detrimental to any

archaeobotanical material as it causes breakages (Pearsall 2015). It must be taken note of that simply using flotation does not warrant the recovery of all archaeobotanical material and that breakages may still occur in carbonized botanical material (Wagner 1988: 23). Pearsall (2015) makes an excellent summary of the various flotation methods and many (Struever 1968; Keeley 1978; Wagner 1988) have tested the effectiveness of these techniques in the recovery of archaeobotanical material.

#### **4.3.2. Dry screening**

Dry screening is among the most common methods of artefact recovery used. Mesh sizes can vary but the most common size used is 6.35 mm but occasionally 12.7 mm or 3.2 mm are used (Wagner 1988). The type of sediment and its moisture content are definitive in how the sieving will proceed and which types of artefact may be recovered. While clay must be pushed through the mesh causing abrasion to artefacts, dry sand easily passes through leaving minimum damage to artefacts (Wagner 1988). Dry screening is not especially suited to archaeobotany as often only artefacts larger than the mesh sizes are retained and carbonized botanical material may become damaged or lost especially if the charcoal and its dirt matrix are still moist (Wagner 1988). Although it may be suitable to catching large desiccated botanical material such as *Sclerocarya birrea* endocarps.

## **4.4. Interpretation**

After analysis and identification of archaeobotanical material has taken place the most challenging aspect, interpretation, remains. Interpretation is often influenced by deposition, preservation and recovery biases. It is also further influenced by where emphasis is placed i.e. ethnography and archaeobotanical assemblage content and context. In Near Eastern and southern African archaeology interpretation has frequently been conducted in conjunction with ethnography in order to discern possible uses and activities. Ethnography provides a connection between the composition of botanical assemblages and the activities that resulted in them regardless of inference of these activities from the archaeological context (Fuller *et al.* 2014; Hastorf 1988). Ethnographic data is most useful in combination with other types of data such as archaeological context and botanical assemblage contents. Studies using archaeobotanical material as part of their interpretations are able to provide a better understanding of past cultural landscape and environments such as in Mutamba's instance where it appears that the types of species found in the archaeological assemblage have not altered drastically from current species found in the physiographic area. However interpretations of this kind are beyond the scope of this dissertation

### **4.4.1. The use of ethnography in archaeobotany**

Ethnography has long been used in archaeology to assist in reconstructions of past cultural patterns and behaviour (Stiles 1977: 87). The aims of ethnography are to make use of information gathered from a historical present that may contain relevant information for the interpretation of specific objects or patterns found within the

archaeological record (essentially asking the questions What is this?, and, What was it used for?) and to develop theories and generalizations concerning relationships between the behaviours of people and the material culture resulting from that behaviour (Stiles 1977; Gould 1982). Ethnography can be derived from several sources such as historical documents, ethnoarchaeological studies, general ethnographic studies and oral accounts.

With regards to the use of ethnography in African archaeology, Schmidt (1983: 63) believes that archaeologists in Africa work and live among people who maintain “viable indigenous belief systems” in which material culture and its special distribution can often be found to be accessible in the symbolic expression of contemporary cultures. Schmidt (1983) stresses the importance of oral traditions and how they contain a plethora of information including social-cultural changes, symbolic allusions, genealogical information and place names among others.

Gould (1982: 373) states that ethnographic analogies have a self-limiting nature as they are grounded on existing behaviours that cannot objectively enlighten archaeologists about past behaviour. While David (1992) considers it is easier to use ethnography to reconstruct taphonomy than to use it to reconstruct past human behaviour due to the inverse observational problems archaeologists are faced with. David (1992: 335-337) states that this is due to the temporal dimensions of archaeological data and that the interpretation thereof must account for continuity and change through time in terms of both processes and mechanisms, of which neither are observable. To Gosselain (2016: 217) as imperative as the use of informative

collected from 'real life' is, the selection and use of analogies is far from obvious and may lead to inconsistent reasoning. He mentions that many researchers seek societies whose image fits the most common representations of past societies and that the oral accounts of individuals are taken as gospel which is extended to an entire society (Gosselain 2016: 218-221). Gosselain (206: 223) also notes that the "formal continuity of assemblages" acquire an incorrect impression of "historical continuity", a circular argument since it assumes that there is positive continuity between "protohistorical, historical and ethnographic contexts".

Davidson (1988) highlights the need to situate ethnographic accounts within a historical framework to avoid misinterpretations from uncritical ethnographic usage. Although as Schoeman (2009: 48) suggests, it is not always possible to place ethnographic material in time as many of these past ethnographic studies were not historically sensitive, making the accounts appear as if they were ever-lasting.

However problematic in nature the use of ethnographic data is, when interpreting plant usage in the archaeological record, it can still provide potentially useful information regarding past plant usage. It must be kept in mind that the ethnography does not necessarily dictate the manner in which plants were used. It is simply used to draw inference as to the possibilities of usage of the plant as the usage may have changed over time as plants were essential within various economic, social, medicinal and ritualistic roles and the interpretation of these is not only, to a lesser extent, dependent on the use of ethnography but also largely dependent on the archaeobotanical assemblage content and context.

#### 4.4.2. Context and content

An archaeological context can be denoted as the position of an archaeological find in time and space or alternatively as an identifiable stratigraphic unit in an excavation (Darvill 2008: 106) and it is essential for interpretation (Sobolik 2003). Dennell (1976) argues for the role of context in determining the economic value of botanical resources through considerations of the resource's context within crop processing activities. He maintains this ensures a means of distinguishing between actual and potential plant resources and allows for evaluation of their importance (Dennell 1976: 229). While Fuller *et al.* (2014) argues against making interpretations based on small scale contexts, suggesting instead that the content of archaeobotanical assemblages are more informative regarding past human-plant related activities due to the nature of the final resting place of archaeobotanical evidence and its fragile link to the activities that produced it. Archaeobotanical evidence is linked to the activities regarding the processing and burning of botanical material. However it also essential to retain awareness of the how the activities are interconnected to a plant's morphological structure, i.e. its edible and inedible parts, and how the process of carbonization impacts these parts, for example the caryopsis is more likely to survive than the more delicate lemma and palea of a sorghum grain (Fuller *et al.* 2014). Fuller *et al.* (2014) also emphasised the manner in which charred botanical material entered the archaeological record by virtue of daily recurrent activities.

Hubbard and Clapham (1992) divided archaeobotanical assemblages into three classes (A, B and C) based on the relationship between context and assemblage. Class A

assemblages have unambiguous origins and are often as a result of catastrophic destruction such as a conflagration (Hubbard & Clapham 1992). Class A assemblages are where the botanical remains were burned in context (Fuller *et al.* 2014). The context within Class A assemblages must exhibit evidence of having burned.

Class B assemblages represent assemblages that have originated from a 'single discrete' burning event which has been moved from the context in which it was burnt to the context from which it was excavated (Fuller *et al.* 2014). The excavated context will not display any evidence of having been burned. Class B assemblages overlap the boundaries between all the assemblage classes in that it is believed to be either a subset of class A or a more sophisticated Class C (Hubbard & Clapham 1992). The interpretation of Class B assemblage contexts elicits awareness that they are the creation of three types of activities. These are activities that created the assemblage before charring (e.g. dung fuel for fire, or the growing, harvesting and processing of crops), activities that involved the burning of the assemblage (e.g. accidental burning of sorghum) and activities complicit in the deposition of the charred waste (Fuller *et al.* 2014). Where the location of the fire is not discerned, attempts are made to deliberate on the connection between the context and contributing activities.

Class C assemblages are considered by Hubbard and Clapham (1992) to be the most pervasive class. Class C assemblages are formed of multiple different charring occasions (Hubbard & Clapham 1992). This class is representative of multiple, different plant related activities, e.g. middens which represent an accumulation of waste from different activities such as food preparation and craft.



## **4.5. Conclusion**

Archaeobotanical material has the ability to convey a great deal of information. The material often enters the archaeological record as a result of various direct or indirect activities. The manner of usage determines the likelihood of preservation. Plants can become preserved in many different ways, however at a site such as Mutamba, botanical material was carbonised and desiccated. These two types of preservation have similar routes of entry into the archaeological record, many of which are anthropogenic. After deposition, the material is often affected by post-depositional processes and can be recovered through the use of appropriate sampling methods and flotation. Interpretation can then take place. This is influenced by the manner of deposition, preservation and recovery of material. It is also affected by where emphasis is placed, e.g. the archaeological context of material or the influence of ethnography.

# Chapter 5

## Methodology

---

---

The advent of flotation in archaeology significantly enhanced the type and amount of material recovered from archaeological sites in particular botanical remains. This proved to be the case at Mutamba as flotation samples were rich in archaeobotanical material (Antonites 2012). Material collected from the Mutamba flotations was then housed at the University of Pretoria's archaeology laboratory. From this collection I selected samples for analysis and this chapter will outline the methods employed.

### 5.1. Archaeobotanical analysis methods

The material came from excavations by Antonites (2012) in 2010/2011. Over the course of excavations flotations were taken from the centre of every locus with each flotation sample bagged individually and processed away from the site. This resulted in over 280 samples. Of the hundreds of flotation samples produced by the Antonites (2012) excavation 100 loci were selected, incorporating and re-analysing those from Benkwitz (2013). The samples were randomly selected with a focus on domestic contexts and ignoring surface layers and loci with high risk of contamination. The samples taken during flotation or selected for analysis therefore represent only a subsample of plant related uses and activities on site (Hastorf 1988, Hubbard & Clapham 1992, Fuller *et al.* 2014).

### **5.1.1. Flotation and laboratory analysis**

Prior to laboratory analysis the material was first floated. The flotation device used was based on a modified SMAP-style machine-assisted flotation machine. The machine comprises a barrel and a rigid screen insert (Refer to Watson 1976: 94 for a schematic). The barrel acts as a water reservoir during which a continuous flow of pressurised water is used to wash soil (Hunter & Gassner 1998; Pearsall 2015: 62-74). The rigid screen insert contains a mesh-bottomed metal tub with an attached sluiceway that enables water and floating material to be carried out of the barrel (Pearsall 2015). Buoyant material is released from the soil and floats on the surface while nonbuoyant material sinks (Pearsall 2015).

In Mutamba's case a modified 200 litre barrel was fitted with 2 mm mesh. Flotation samples collected from each locus was floated individually off-site after Antonites' excavation (2012). Soil from each locus was added to the water-filled machine and agitated by hand. Buoyant material (light fraction) was carried out the sluiceway into a chiffon material bag hanging beneath it. Nonbuoyant material (heavy fraction) sank to the bottom of the insert. After the light fraction containing bags were removed, the insert was taken out of the barrel and its contents placed into a cotton material bag. Both heavy and light fractions were then left to dry.

One hundred samples were selected from the light fraction and sieved using a set of nested geological sieves. This was done in order to facilitate the visibility of any potential archaeobotanical or macrobotanical material. The mesh sizes, in mm, were as follows: 9.5, 5, 2, 1.25, 0.8 and 0.5. Majority of archaeobotanical material was recovered in the 2 mm and in the 1.25 mm sieves. The contents of the sieves were then placed in a petri dish. Each petri

dish was only filled up to a third to facilitate visibility before being examination under microscope of up to 4.5X magnification. An analysis sheet was then created to record the archaeobotanical material; however this was abandoned in favour of entering the data directly into Excel for easier manipulation.

Charred Poaceae macrobotanicals were classified according to the system devised by Hubbard and al Azm (1990) to determine ‘distortion’ and ‘preservation’ in charred cereal grain (See Table 5.1). Distortion here refers to alterations in a seed’s morphology from its original state and preservation refers to the state of decay exhibited by the seed. The scales encompass “the range of conditions seen in archaeological material” (Charles *et al.*2015: 2). Both the ‘preservation’ and ‘distortion’ indices were assigned class numbers delineating a score. The ‘preservation’ index was scored from 1 to 6 i.e. from ‘perfect’ through to ‘clinkered’ (which is a “mass of bubbled endosperm retaining the shape of the seed” (Hubbard & al Azm 1990: 104; Charles *et al.*2015: 2). The 1986-1988 modified ‘distortion’ index was scored from 1 to 7, i.e. ‘no noticeable distortion’ to ‘sprouting’ (Hubbard & al Azm 1990: 104). The 1986-1988 index differs from the 1977 index in that it was re-assessed and contains an additional two classes incorporating further distortion that Hubbard and al Azm discovered (1990). The Hubbard and al Azm scale, however, was applicable to only Poaceae taxa (See Table 5.1.).

**Table 5.1. Preservation and Distortion classes of cereal grains (From Hubbard & al Azm 1990: 104)**

<b>Class</b>	
	<b>Preservation (1977)</b>
1	Perfect
2	Epidermis virtually intact; rachillae observable
3	Epidermis incomplete; rachillae, hairs etc occasionally preserved
4	Fragments of epidermis remaining; other features virtually unobservable
5	Identified by gross morphology only
6	'Clinkered'
	<b>Distortion (1977)</b>
1	No noticeable distortion
2	Slight puffing of seeds noticeable
3	Clearly distorted
4	Gross distortion
5	Seeds fused together in a solid lump, faceted when free
	<b>Distortion- Modified (1986-1988)</b>
1	No noticeable distortion
2	Slight puffing of seeds noticeable
3	Clearly distorted
4	Gross distortion
5	Seeds fused together in a solid lump, faceted when free
6	Carbonized tarry material exuded from distal end of caryopsis
7	Sides of the seed longitudinally wrinkled, partially collapsed and concave
8	Sprouting

### **5.1.2. Seed identification**

Identification of the macrobotanical material was achieved by two means. The first was through use of the reference collections at both the University College London and the University of Pretoria. The second was through the use of various published botanical literature (Reeves 1936; De Wet *et al.* 1971; Brunken *et al.* 1977; Hilu *et al.* 1979; Kay 1979; Ross 1981; Von Teichman *et al.* 1986; Von Teichman & Robbertse 1986; Von Teichman 1988; Neumann *et al.* 1998; Fuller 2006 and Venier *et al.* 2012). The most notable taxa were identified using key characteristics of seed morphology, although intact and/or complete seeds were not found for all taxa.

## **5.2. Quantification of results**

After the macro botanicals were recovered and identified quantification commenced. Due to the limitations and biases present in archaeobotanical data the raw counts of the botanical material was changed in a manner that made the data easier to compare and interpret (Lennstrom & Hastorf 1992: 220).

It must be kept in mind with regards to quantification of archaeobotanical material that no single method of quantifying archaeobotanical material is appropriate or even useful for every archaeobotanical analysis (Popper 1988: 53). The best methods of quantification depends on the types of plant remains recovered (Miller 1988) and that no single quantitative measurement can fix for erroneous nonnumerical criteria (Popper 1988: 60). It was decided that absolute counts, ubiquity, diversity, relative abundance and seed density indices were to be used in the analysis of the Mutamba archaeobotanical data as these methods would each

reveal a different aspect of the data, i.e. raw numbers for each genus as opposed to assemblage level presence.

### **5.2.1. Absolute counts**

Absolute counts refer to the raw numbers of each taxon in a sample (Popper 1988: 60). Cochrane (2003) illustrated that sample size has an essential role on the 'richness' value which increases in conjunction to increases in population. Absolute counts are ideally meant to give accurate reflections of human-plant interactions but are more realistically reflections of samplings strategies, preservation and may other factors. "At the very least, the absolute counts must be standardized (converting them into ratios) to account for differences in sample size" (Popper 1988: 60). In this case a density ratio was used.

The criteria selected for the determination of a single seed was based on number, although weight was also noted. An estimate of the minimum number of individuals (MNI) was necessary due to the fragmentary nature of many seeds. Nomenclature of different types of fragments was adapted from Antolín and Buxó (2010) in defining the fragments that would determine MNI. The MNI was determined by either counting whole or specific represented seed parts (e.g. two *Grewia* sp. lobes represent one seed or two transversal lateral-dorsal fragments represent one *Sorghum bicolor*).

Where seeds were too fragmentary in which morphology could not be ascertained were marked as NQF (Non Quantifiable Fragments). This method for the calculation of MNI was chosen over the use of cumulative weight due to a lack of intact seeds for some of the taxa. All seeds in which morphology was distinct but family, genus or species could not be

established were marked as indeterminate.

### 5.2.2 Ubiquity

Ubiquity or presence analysis (Pearsall 2015) notes presence or absence of taxa (Hubbard 1980) and disregards the absolute count (Popper 1988). This measures at an assemblage level. The absolute count is disregarded as the assumption is that this value is influenced by differential preservation.

To determine ubiquity each taxon is considered “present whether the sample contains 1 remain of the taxon or 100, thereby giving the same weight to 1 or 100” (Popper 1988: 60-61). A frequency score is determined by the number of samples in which the taxon is present and is conveyed as a percentage of the total number of samples in the group. For example if *Sorghum bicolor* is found in 7 of 10 samples then it will receive a score of 70%. The scores of each taxa do not influence one another which allows the individual scores of each taxon to be evaluated independently.

Hubbard (1980) warns that figures that are generated are influenced by raw data quality and that overall trends rather than individual points are significant. He also warns that the frequency score is inherently comparative and while useful for comparison within taxa it should not be used “to compare the absolute importance of different taxa directly” (Hubbard 1980). Popper (1988: 61) further stresses the grouping of samples in that an incorrect grouping can skew results such as having too few samples can greatly inflate the score, for example having only 4 samples indicates a presence of 25% while having samples indicates a



minimum presence of at least 5%. When using ubiquity scores it is important to make explicit the relationship between the score and the information that is being sought after (Popper 1988: 63). Minnis (1985: 104-106) explains that the assumption that charred plant material is primarily the result of accidental burning causes ubiquity to be wont to measure the number of accidents which is itself is related to the degree of utilization. It is assumed that a change in the number of samples in which a taxa is present is an imprecise measurement in the change of the usage of that specific resource. These points of caution were all taken into account in the calculation of the ubiquity of Mutamba's assemblage.

### **5.2.3. Diversity**

A diversity measurement describes the composition of a plant assemblage (Popper 1988: 66). It takes into account both the total number species present in the sample as well as the abundance of each species (Pielou 1969: 221-235 in Pearsall 2015: 159). The Shannon-Wiener index (or Shannon-Weaver) is used here to measure diversity (Spellerberg & Fedor 2003). It is perhaps the most widely used diversity index (Nagendra 2002). Low diversity occurs when the number of species is low or when few species account for most of the population and a high diversity when a significant number of species are evenly distributed (Pearsall 2015: 159).

### **5.2.4. Relative abundance index and seed density index**

A relative abundance index calculates the number of seeds in the soil (Gross 1990: 1080). The number of seeds for each taxon is divided by the total number of seeds in all the samples. The seed density index calculates the number of seeds per litre of soil. The weight of the

seeds, in grams, is converted into millilitre and the volume of the soil sample is divided by the volume of the seeds.

### **5.3. Conclusion**

The research undertaken was collection-based, originating from flotation samples taken during excavation 2010/2011. Once samples were chosen they were sieved, sorted and identified with the aid of two main methods, a botanical literature survey and use of reference collections. The material was then quantified. However generalisations cannot be made regarding the suitability of specific quantitative methods. Some qualitative methods may be better suited to general research questions while other methods may be better suited to more specific questions (Popper 1988). The research question/s and the condition of the botanical material are essential in determining which method to use.

## Chapter 6

### Results

---

---

This chapter presents the results of the analysis on the Mutamba macrobotanical material. It is divided into six sections, each section analysing the data in a different manner. The first section assesses the representation of Poaceae seed parts and classification based on preservation and distortion classes. Next the ubiquity of each taxon within the samples is noted followed by the calculations of diversity, relative abundance and seed density. Finally a contrast is drawn between the dominance of wild or domestic taxa at Mutamba.

For purposes of analysis 100 samples were chosen from flotation material collected during Antonites' 2010/2011 excavations at Mutamba. The samples were chosen from primarily domestic contexts and contained a variety of identified species and genera with majority of the identified material belonging to the Poaceae family. However a number of unidentified taxa, or unknown, and unidentifiable taxa or indeterminate were also recovered. Unknown taxa refer to seeds that have morphological features but could not be identified to family; genus or species while indeterminate refers to fragments of seeds with no morphological features. The identified taxa dealt with in this chapter are *Sorghum bicolor*, *Pennisetum glaucum*, *Brachiaria deflexa*, *Brachiaria nigropedata*, *Eleusine coracana*, *Vigna radiata*, *Vigna unguiculata*, *Acacia* sp., *Gossypium herbaceum*, *Ziziphus zeheriana*, *Grewia* sp., *Adansonia digitata* and *Sclerocarya birrea*.

## **6.1. Poaceae seed parts and their preservation and distortion classification**

The various represented parts of the Poaceae seeds were identified and classified according to Antolín and Buxó's (2011) nomenclature for the represented seed parts (caryopsis, longitudinal ventral etc). This data was used to calculate the Minimum Number of Individuals (MNI) and allows for a more accurate count of individual numbers than can be gained by only counting whole caryopsis. The various represented seed parts were then subject to further assessment according to the system devised by Hubbard and al Azm (1990) determining 'distortion' and 'preservation' in charred cereal grain (Refer to Chapter 4).

### **6.1.1. *Sorghum bicolor***

A total MNI of 173 *Sorghum bicolor* specimens were identified. These were then assessed according to the system devised by Hubbard and al Azm (1990: 104) and assigned a preservation and distortion value. While the preservation classes of sprouted and unspouted will vary regardless of the distortion, the distortion class for unspouted may only vary between 1, ("no noticeable distortion") and 7 ("sides of the seed longitudinally wrinkled, partially collapsed and concave"). The sprouted sorghum's class is indicated as 8 (See Table 5.1.).

Caryopses, sprouted and unsprouted, account for the vast majority of the represented seed parts (90 %) for the taxon whereas the other represented parts make up low percentages. The most represented part after caryopses; longitudinal ventral-dorsal, accounts for 3% and transversal apical only 2%. The remaining represent seed parts (transversal medial, transversal embryonal, longitudinal ventral and longitudinal dorsal) are all 1% each.

**Table 6.1. Represented parts of *Sorghum bicolor***

<b>Represented part</b>	<b>MNI</b>	<b>%</b>
Caryopses	156	90
Transversal apical	4	2
Transversal medial	2	1
Transversal embryonal	2	1
Longitudinal ventral-dorsal	5	3
Longitudinal ventral	2	1
Longitudinal dorsal	2	1
Total	173	

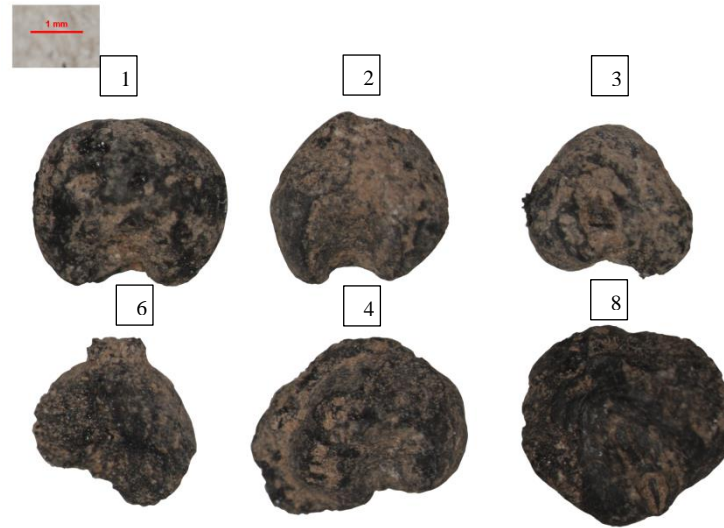
Unsprouted caryopses account for an MNI of 150 while sprouted caryopses only account for 6. The most prevailing preservation class for the un-sprouted Sorghum was 3, corresponding to an incomplete epidermis, while the average distortion class was 3, corresponding to clear distortion of the seeds. This indicates that these seeds were carbonized at temperatures of over 250° C (Braadbaart 2008; Antolín and Buxó 2011: 56)

Sprouted sorghum was most commonly preserved as 2, with the seeds' epidermis being almost wholly intact. The sprouted sorghum appears to be slightly better preserved than the unsprouted. However its distortion was somewhat worse due to its state of being sprouted at the time of carbonization. The distortion of the sprouted sorghum correlates to germination prior to carbonization as during the process of imbibing moisture the seed begins to swell, the seed coat breaks open and a root emerges.

The distortion of the longitudinal ventral-dorsal parts were minimal (class 2), with only a slight puffing. Its preservation (class 4) was relatively poor, indicating that the seeds' epidermis was incomplete, showing a considerable amount of the carbonized interior of the seed. This may indicate that the epidermis may have eroded away as a result of post-depositional processes but it most likely occurred as a result of sampling processing as there was no adhering sediment in the exposed seed interior. The clean uniform fragmentation of the caryopses into 2 parts most likely also occurred as a result of flotation damage (Wright 2005; Antolín and Buxó 2011; VanDerwarker 2016). If the breakages had been irregular or uneven then this would have been indicative of non-human post-depositional processes (Antolín and Buxó 2011).

Transversal apical displayed relatively poor preservation, (class 3) and little distortion (class 2). The fragmentation was again regular, indicative of flotation damage.

The remaining represented seed parts are equally comprised of transversal medial, longitudinal ventral and longitudinal dorsal. Transversal medial displayed poor preservation (class 4) and no discernible distortion (class 1). The poor preservation may be again as a result of the erosion of the seed but the lack of sediment in the exposed seed interior indicates otherwise. Longitudinal ventral and longitudinal dorsal both presented relatively poor preservation (class 3 each) and slight visible puffing in the way of distortion (class 2). As with transversal medial, the incomplete epidermis was most likely a result of flotation damage while the slight distortion may indicate that the seeds might have been exposed to high temperatures to induce slight puffing before carbonizing completely indicating that the seed burnt at very high temperature for a short time period (Braadbaart 2008).



**Figure 6.1. Distortion classes represented in the Mutamba Sorghum bicolor (1. No noticeable distortion, 2. Slight puffing of seeds noticeable, 3. Clearly distorted, 4. Gross distortion, 6. Carbonised tarry material exuded from distal end of caryopsis, 8. Sprouting)**





**Figure 6.2. Preservation classes represented in the Mutamba Sorghum bicolor (2. Epidermis virtually intact, 3. Epidermis incomplete, 4. Fragments of epidermis remaining, 5. Identifiable to gross morphology only)**

### **6.1.2. *Pennisetum glaucum***

A total MNI of 150 *Pennisetum glaucum* was identified. Caryopses account for the majority represented (82%), while various represented parts account for the remainder. The caryopses constitute an MNI of 123 and displayed good preservation (class 2) and little distortion (class 2). The epidermis is mostly intact and the seeds were only slightly puffed. This may indicate that not only were the seeds subject to less exposure to heat or relatively low temperatures evident in the lack of significant puffing but also that they were not adversely affected by flotation as indicated by the mostly intact epidermis.

Longitudinal ventral-dorsal was the most dominant represented seed part after caryopses with an MNI of 10. The preservation was extremely poor (class 4), with only scant fragments of epidermis remaining and most of the other identifiable morphological features virtually unobservable. The clean uniform fragmentation most likely occurred as a result of flotation. Transversal apical was the next most dominant seed part represented with an MNI of 9. The preservation was relatively poor (class 3) while the distortion was nominal (class 1).

Transversal embryonal and longitudinal ventral were next most dominant represented seed parts with an MNI of 3 each. Both represented seed parts displayed no distortion (class 1), however transversal embryonal displayed marginally better preservation (class 2) than longitudinal ventral (class 3). Longitudinal dorsal was the least

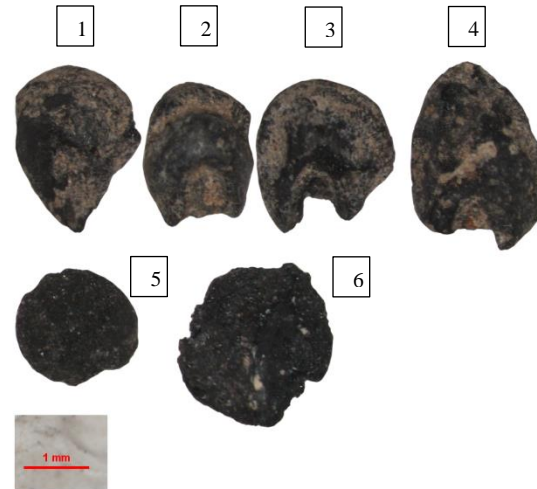
represented seed part with an MNI of 2. Its preservation was relatively poor (class 3) and displayed no distortion (class 1). All three of these represented seed parts displayed clean fracturing, indicating that they likewise were affected by flotation.

**Table 6.2. Represented parts of *Pennisetum glaucum***

<b>Represented part</b>	<b>MNI</b>	<b>%</b>
Caryopses	123	82
Transversal apical	9	6
Transversal embryonal	3	2
Longitudinal ventral-dorsal	10	7
Longitudinal ventral	3	2
Longitudinal dorsal	2	1
Total	150	



**Figure 6.3. Distortion classes represented in the Mutamba Pennisetum glaucum (1. No noticeable distortion, 2. Slight puffing of seeds noticeable, 4. Gross distortion)**



**Figure 6.4. Preservation classes represented in the Mutamba Pennisetum glaucum (1. Perfect, 2. Epidermis virtually intact, 3. Epidermis incomplete, 4. Fragments of epidermis remaining, 5. Identifiable by gross morphology only, 6. Clinkered)**

### **6.1.3. *Eleusine coracana*, *Brachiaria deflexa* and *Brachiaria nigropedata***

*Eleusine coracana* with a MNI of 4, *Brachiaria deflexa* with a MNI of 7 and *Brachiaria nigropedata* with a MNI of 3 were all represented by caryopses. *Eleusine coracana* had moderately good preservation overall (class 2) and no distortion (class 1). Only 1 caryopsis displayed epidermal damage but the irregular fracturing of the epidermis indicates post-depositional processes. Both the *Brachiaria* species displayed excellent preservation (class 1) and no distortion (class 1). This may be as a result of carbonization having occurred at low temperatures below that of 250 °C (Braadbaart 2008, Charles *et al.*2015).

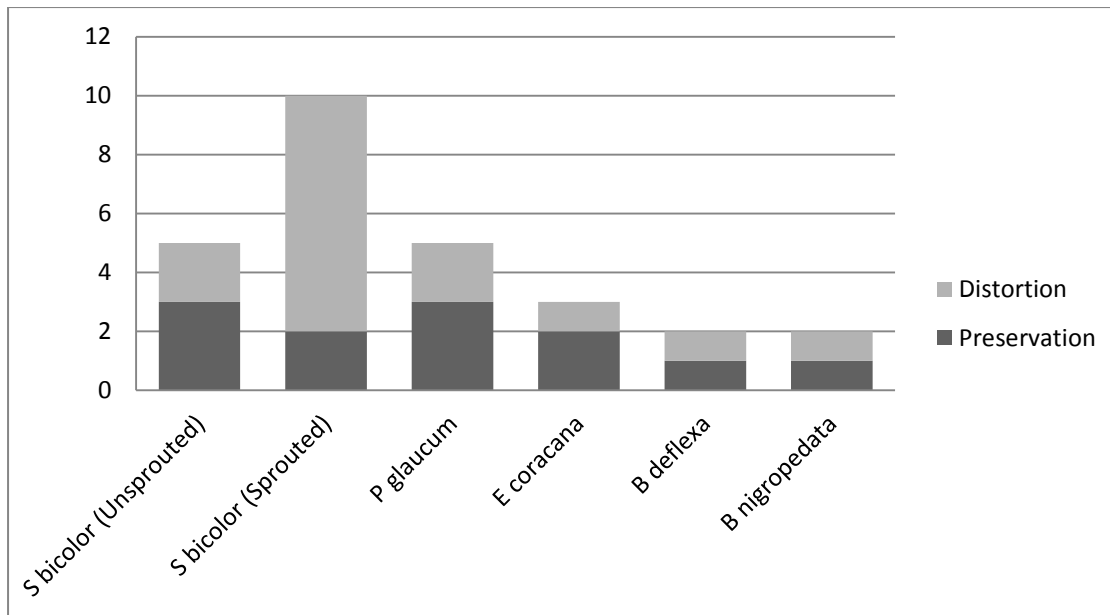
### **6.1.4. Overview of preservation and distortion for the Poaceae taxa**

At Mutamba, charring was the most ubiquitous form of preservation of plant material. This typically transpires wherever people used fire. Well preserved grains with little to no distortion (or 1-2 on the Hubbard and Al Azm scale) were produced at relatively low temperatures of 220-240 °C and grains that are poorly preserved with noticeable distortion (3+ on the Hubbard and Al Azm scale) were produced at higher temperatures (Charles *et al.*2015). A contrast can be drawn between preservation and distortion. Preservation can be linked with post-charring and post-depositional disturbance of the macrobotanical material and subsequent recovery methods employed while distortion can be connected to charring-related morphological changes (Charles *et al.*2015). An example of this can be seen in the overall distortion class (class 2 for both species) for *Sorghum bicolor* and *Pennisetum glaucum*. Both

species exhibited slight puffing, also referred to as the popcorn effect. This occurs when the caryopses bulges and/or bursts from the outpouring of water and gas when exposed to heat. The higher distortion class (8) for sprouted sorghum is to be expected as the caryopsis swells when the seed germinates.

Both *Sorghum bicolor* and *Pennisetum glaucum* displayed relatively poor preservation (class 3 each) which can be attributed to either post-depositional movement and/or flotation damage. Flotation damage here specifically refers to fragmentation as a result of material wetting and drying. Alternatives to flotation that may yield less damage to material are dry sieving or the wash-over technique. The wash-over technique though mainly used in the recovery of waterlogged material protects the material from the abrasion of direct screening (Pearsall 2015). Dry sieving is suitable for sandy soils whereas flotation suits clay soils (Wright 2005; VanDerwarker *et al.* 2016). The soil at Mutamba was sandy and the use of flotation may have led to the fragmentation of the archaeobotanical material.

In contrast the preservation for the remaining Poaceae species *Eleusine coracana* (class 2), *Brachiaria deflexa* (class 1) and *Brachiaria nigropedata* (class 1) were relatively good with virtually no distortion in these taxa. This indicates exposure to low temperatures and little to no flotation damage.



**Figure 6.5. Preservation and distortion classes of Poaceae taxa at Mutamba**

## 6.2. Ubiquity

Presence and absence, or ubiquity, disregards absolute counts such as MNI and instead utilizes the number of samples that each specific taxon appears in with every sample (Popper 1988). The ubiquity score is the number of samples in which a taxon occurs. This is expressed as a percentage of the total number of samples (Popper 1988: 61).

### 6.2.1. General ubiquity

Thirteen taxa in total were identified to either genus or species level. A further eleven seeds were also noted as present but could not be identified to family, genus or species and were marked as unclassified. Three species were predominantly found to be present in the samples. These were *Sclerocarya birrea* (67 samples), *Sorghum*



*bicolor* (48 samples) and *Pennisetum glaucum* (57 samples). Ubiquity scores for remaining taxa were under 20% respectively (Refer to Table 6.3 or to Appendix A for specific samples). It should be noted that these ubiquity scores may be more a reflection of preservation than a reflection of plants utilized at Mutamba.

**Table 6.3. Ubiquity percentage for Mutamba taxa**

<b>Species/ Genera</b>	<b>Ubiquity %</b>
<i>Brachiaria deflexa</i>	2
<i>Brachiaria nigropedata</i>	3
<i>Eleusine coracana</i>	4
<i>Pennisetum glaucum</i>	57
<i>Sorghum bicolor</i>	48
<i>Sclerocarya birrea</i>	67
<i>Acacia</i> sp.	18
<i>Vigna radiata</i>	16
<i>Vigna unguiculata</i>	11
<i>Adansonia digitata</i>	11
<i>Grewia</i> sp.	9
<i>Gossypium herbaceum</i>	6
<i>Ziziphus zeheriana</i>	15
Unknown	11

### **6.2.2. Indigenous taxa**

Of the 13 identified taxa at Mutamba, 12 were indigenous. Of these 2 were identified to genus (*Acacia* sp. and *Grewia* sp.) and 10 to species (*Sorghum bicolor*, *Pennisetum glaucum*, *Eleusine coracana*, *Brachiaria deflexa*, *Brachiaria nigropedata*, *Vigna unguiculata*, *Gossypium herbaceum*, *Adansonia digitata*, *Ziziphus zehariana* and *Sclerocarya birrea*). Five of the taxa are grasses (Poaceae), one is a vine and the remainder are trees or small trees/shrubs.

### **6.2.3. Exotic taxa**

One taxon, *Vigna radiata* was identified as being exotic, i.e. not native to southern Africa. This taxon originates from the Forest-Savannah margins of India (Fuller and Harvey 2006: 220; Fuller 2007). Like *Vigna unguiculata*, it is also a vine. In its native India archaeobotanical evidence attests to widespread cultivation by the third millennium BC where its role as part of the primary protein source is mirrored in pulses being the second most recovered archaeobotanical material after cereals (Fuller & Harvey 2006). Its presence can likely be attributed to Mutamba's engagement in the long distance trade network (Antonites 2012).

### **6.2.4. Absence of weed taxa**

There is a marked lack of weed taxa within the Mutamba samples. A weed in the case of Mutamba can be considered as a plant which occurs opportunistically on land that has been cultivated where it competes with purposely grown plants for water, nutrition and other resources (Allaby 2012: 534). This absence may be as a result of

harvesting methods such as hand picking (*Vigna radiata* or *Vigna unguiculata*) or cutting off just below the heads (*Sorghum bicolor* and *Pennisetum glaucum*) as opposed to uprooting which would yield weed seeds. It may also be as a result of crop processing (threshing and winnowing) being conducted either in-field or in a location away from the homesteads.

### 6.3. Diversity

Using the PAST statistical software package (Paleontological statistical software V 3.16), the species diversity of Feature 1, Feature 2 and Other (Feature 3 and a combination of test pits) were determined and compared using the Shannon-Wiener diversity index. Features 1 and 2 are both domestic contexts (huts) while Feature 3 is part of a possible cattle kraal (livestock pen). Feature 3 was combined with various test pits as there were not enough samples from this feature to compare with Features 1 and 2.

As a diversity index, Shannon-Wiener designates the composition of a plant assemblage (Popper 1988) and considers both the total number of species present in the sample as well as the abundance of each species (Pielou 1969 in Pearsall 2015: 159).

**Table 6.4. Shannon-Wiener scores.**

	<b>Feature 1</b>	<b>Feature 2</b>	<b>Other</b>
<b>Shannon-Wiener score</b>	0.7646	0.7357	0.4063

The Shannon-Wiener values for Feature 1 and Feature 2 were much higher than the other areas. This suggests that a wider range of species were utilized within household contexts whereas at other parts of the settlement potentially fewer species were either utilized or stood fewer chances of becoming preserved. This was expected as Features 1 and 2 are household contexts and would display the accrued recurrent and repetitive daily activities such as meals whereas Other (a combination of kraal samples and various test pits) would not necessarily display a wide range of species as the botanical material would have a lower chance of preservation.

#### **6.4. Relative abundance**

The abundance of each taxon was calculated according to its MNI divided by the total number of seeds (n=525) within all samples combined, e.g. *Sorghum bicolor* would be  $173/525*100=33.0\%$ .

In terms of frequency the most abundant of the domestic taxa was *Sorghum bicolor* (33%) followed closely by *Pennisetum glaucum* (28.6%) while *Eleusine coracana* (0.8%) was the least abundant of the domestic Poaceae taxa. The domestic legumes, *Vigna radiata* (3.6%) and *Vigna unguiculata* (6.1%) account for the remainder of the domestic taxa (See table 6.5.).

The most abundant wild taxa was *Sclerocarya birrea* (13.5%) while *Grewia* sp. (3.6%), *Ziziphus zeheriana* (3.2%), *Gossypium herbaceum* (1.3%), *Acacia* sp. (1%), *Brachiaria deflexa* (1.3%), *Brachiaria nigropedata* (0.6%) and *Adansonia digitata* (0.2%) make up the remainder of the wild taxa. The large percentage of abundance for *Sclerocarya birrea* as opposed to the rest of the wild taxa is due to the prodigious fruit bearing capabilities of the Marula trees.

**Table 6.5. MNI and abundance percentage of the Mutamba taxa**

Family	Genus	Species	MNI	Abundance %
Anacardiaceae	<i>Sclerocarya</i>	<i>birrea</i>	71	13.5
Fabaceae	<i>Acacia</i>		5	1.0
Fabaceae	<i>Vigna</i>	<i>radiata</i>	19	3.6
Fabaceae	<i>Vigna</i>	<i>unguiculata</i>	32	6.1
Malvaceae	<i>Adansonia</i>	<i>digitata</i>	1	0.2
Malvaceae	<i>Grewia</i>		19	3.6
Malvaceae	<i>Gossypium</i>	<i>herbaceum</i>	11	1.3
Poaceae	<i>Brachiaria</i>	<i>deflexa</i>	7	1.3
Poaceae	<i>Brachiaria</i>	<i>nigropedata</i>	3	0.6
Poaceae	<i>Eleusine</i>	<i>coracana</i>	4	0.8
Poaceae	<i>Pennisetum</i>	<i>glaucum</i>	150	28.6
Poaceae	<i>Sorghum</i>	<i>bicolor</i>	173	33.0
Rhamnaceae	<i>Ziziphus</i>	<i>zeheriana</i>	17	3.2
Unknown	Unknown	unknown	13	2.5

## 6.5. Seed density

The density of each sample was calculated by dividing the total MNI by its flotation volume. The minimum, maximum and average seed density per litre (SPL) was then determined. Three of the samples (2031, 1173/1 and 2043/1) proved to contain less

than a single seed per litre. Respectively these samples contained 0.86, 0.50 and 0.25 SPL.

**Table 6.6. Seeds per litre for all Mutamba samples**

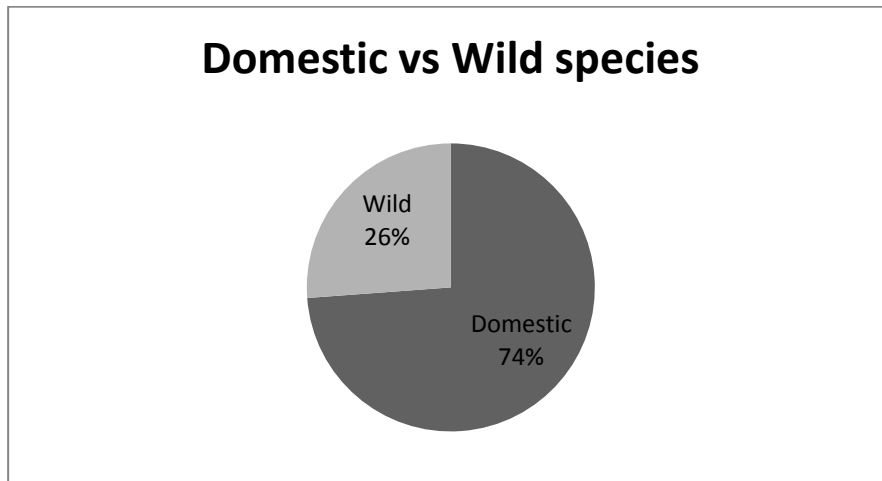
	Seeds per litre
Max	34
Min	0.25
Average	3.9

## 6.6. Domestic and wild taxa

From the total of 13 taxa, five were identified as being domestic and eight as wild (see Table 6.7 below). Raw numbers of each taxa suggests more wild than domestic than domestic being present, however MNI numbers indicate that domestic taxa predominate (74%) with a much lower number than wild taxa (26%). This suggests a heavier reliance on cultivated plants for subsistence than on gathered wild plants. The presence of wild species indicates opportunistic usage of plants when they were available for consumption, which may have been consumed fresh and in some instances such as *Ziziphus zeheriana* did not require much processing (Refer to Chapter 8).

**Table 6.7. Domestic and wild taxa of Mutamba**

Domestic taxa	MNI	Wild taxa	MNI
<i>Sorghum bicolor</i>	173	<i>Brachiaria deflexa</i>	7
<i>Pennisetum glaucum</i>	150	<i>Brachiaria nigropedata</i>	3
<i>Eleusine coracana</i>	4	<i>Gossypium herbaceum</i>	11
<i>Vigna unguiculata</i>	32	<i>Acacia</i> sp.	5
<i>Vigna radiata</i>	19	<i>Adansonia digitata</i>	1
		<i>Grewia</i> sp.	19
		<i>Ziziphus zeheriana</i>	17
		<i>Sclerocarya birrea</i>	71



**Figure 6.6. Distinction between wild and domestic species at Mutamba according to MNI**

### **6.7. Conclusion**

From the Mutamba flotation material 100 samples were chosen (Refer to Chapter 5 concerning the methodology for the selection of samples). These samples yielded 13 identifiable taxa of which 5 were Poaceae (grass). The Poaceae species were first separated into their respective represented seed parts to yield a more exact MNI which were then assessed using Hubbard and al Azm (1990) scale for preservation and distortion. This assessment illustrated that while the seeds did not experience excessive distortion they did experience flotation damage which impacted on their preservation class, prompting a potential need to process sample in a different manner such as with wash-over technique or dry screening.

Next the various taxa were marked present or absent within all of the chosen samples and this illuminated the fact that while the vast majority of taxa within the samples were indigenous, one species was an exotic originating from India and occurred at Mutamba as a result of long distance trade. The diversity of plant use within two domestic features and a collection of other areas at the site (a kraal sample and various test pits) showed that the domestic contexts, Feature 1 and 2, indicated a high diversity of species present that the other parts of the site. However this was expected as the household contexts (such as a house floor or midden) would be representative of daily recurrent activities which would build up over time. These recurrent daily activities, such as meals or craft, made use of both domestic taxa (74%) and wild taxa (26%). The implications are discussed in Chapter 8.



## Chapter 7

### Potential uses of the taxa found at Mutamba

---

---

Historical, ethnographic and archaeological data indicate that plants formed an integral part of past everyday life (Quin 1959; Lestrade 1937; Mabogo 1990 and Balick 1996). As noted in Chapter 6, thirteen taxa were identified. Many of these species had a myriad of usages of which not all have been documented. Various parts of the same plant would have served different purposes and would have been processed and used in different manners.

This chapter will briefly list each taxon found at Mutamba and provide a summary of possible uses based on sources from ethnographical and ethnobotanical texts (Refer to Appendix B for images). These texts assist in providing potentially useful information to enable possible reconstructions on the manner in which plants may have been used (see Chapter 4 regarding ethnography in archaeobotany). It must be noted that the presence at Mutamba of a specific taxon does not denote that usage was identical to that noted in ethnographical data. It does however allow for an indication of potential and in some cases a likely usage of plants in the Middle Iron Age.

## **7.1. *Sorghum bicolor* (Sorghum)**

This species was first domesticated over 2000 years ago in Africa, possibly in what is modern day Ethiopia before spreading to the Near East (De Wet & Harlan 1971; Van Wyk & Gericke 2000). It was a staple foodstuff prior to the introduction of maize in southern Africa (Quin 1959; Lestrade 1937; Mabogo 1990).

*Sorghum bicolor* is an annual multi-stalked plant, which can reach up to 3m in height, produces large branched clusters of grains which are round to oval shaped ( Van Wyk & Gericke 2000: 14; Xaba 2008: 224). It is a drought resistant, frost-sensitive species adaptable to a wide range of ecological conditions and soils. It grows in both high and low rainfall receiving arid areas (National Academy of Sciences 1996: 128-143). The species is usually planted in mid-spring and requires up to 140 frost-free days to grow to maturity as well as warm temperatures (up to 30°C), an annual rainfall of 300 to 750mm (National Academy of Sciences 1996: 128-143; du Plessis 2008:7; Department of Agriculture, Forestry and Fisheries 2010: 6-8).

According to traditional Pedi customs the species is planted separately from other crops, hoed continuously and harvested upon maturity whereby the heads are cut from the stalks and spread on a drying platform made of stamped earth (Quin 1959: 28). The seeds are then threshed with a wooden stick, winnowed and stored in the granaries. These were either clay or made of baskets. Quin (1959) also notes that Pedi communities treat stored seeds with Aloe ash to deter weevils. Non-seed parts of the plant is used for fuel for fires, feed for livestock (Doggett 1976) and thatching for huts

(Van Oudtshoorn 2014) while the grain is traditionally only processed when needed usually for porridge or beer (Lestrade 1962, Mabogo 1990; Van Wyk & Gericke 2000). The grain is pounded, ground and boiled for the use in porridges and gruels and fermented for beer (Quin 1959). A traditional porridge recipe requires that either whole grains or pounded meal is added to boiling water and cooked over a slow fire before being served as part of one of the main meals usually with an accompaniment of sorts (Quin 1959; Lestrade 1962; Mabogo 1990).

## **7.2. *Pennisetum glaucum* (Pearl millet)**

*Pennisetum glaucum* like sorghum was domesticated in Africa. Enzyme similarity datasets indicate that domestication may have taken place in the zone between Mauritania and Sudan (Manning *et al.*2011; Radhouane 2013). Earliest evidence for domestication dates to the Late Stone Age Mali, circa. 2000 BC. However the earliest evidence for southern Africa can be found at the Early Iron Age site of Silver Leaves, circa. 250 to 395 AD (Klapwijk & Huffman 1996; Manning *et al.*2001; Huffman 2007: 123).

Pearl millet is a tall grass (between 3 to 5 m) with numerous culms, each ending in cylindrical spikes containing grains (Van Wyk & Gericke 2000: 12). The species is an annual summer crop which requires an even annually distributed rainfall of 250mm to 700mm, temperatures of up to 30°C and can grow in a variety of soil types but usually grows best in well-drained loam soil and poorly in clay soils (National Academy of Sciences 1996:91; Department of Agriculture, Forestry and Fisheries 2014). The

species reaches maturity 40 days after flowering and is moderately drought resistant and sensitive to frost (National Academy of Sciences 1996:91; Department of Agriculture, Forestry and Fisheries 2014). The seeds ripen over a long period of several weeks, causing it to be susceptible to bird damage (Purseglove 1976; Van Wyk & Gericke 2000). The crop is planted mixed with other crops, hoed continually with harvesting commencing when the heads are matured (Quin 1959). The matured heads are severed from the stalks and spread on an earthen platform to dry after which they are threshed by beating with a wooden threshing stick, winnowed and stored in a granaries (Quin 1959; Van Wyk & Gericke 2000). The grain is used in porridge, gruel and beer while young plants provide a worthwhile fodder for livestock (Purseglove 1976; Van Wyk & Gericke 2000).

### **7.3. *Eleusine coracana* (Finger millet)**

*Eleusine coracana* an African domesticate (De Wet *et al.*1984) a small annual tufted grass with finger like spikes which bear small rounded grains of up 2 mm long (Van Wyk & Gericke 2000; Chandrashekar 2010). The species requires an annual rainfall of 500 to 100mm distributed throughout the entire growth season, temperatures ranging between 18°C and 35°C and grows in a variety of soils (National Academy of Sciences 1996: 39-57). It is not as drought resistant as sorghum and pearl millet, requiring up to 6 months to mature and is work intensive (National Academy of Sciences 1996: 39-57).

The diminutive size makes all stages of growing and handling challenging. The seeds are traditionally planted by broadcasting or hand scattering, requiring well prepared land and meticulous weeding (National Academy of Sciences 1996: 46). The weeding must be meticulous as the major weed accompanying the species resembles the young *Eleusine* plants and thus requires the inspection of each individual plant (National Academy of Sciences 1996: 47). The crop is harvested by hand and stored in the seed head until usage (Van Wyk & Gericke 2000: 10). After reaching maturity the heads are cut leaving some stalk attached and placed in heaps to foster fermentation which eases threshing (National Academy of Sciences 1996: 47).

Today it is widely cultivated throughout Africa and India. It ranks fourth globally in importance of millets and is noted not only for its resistance to diseases and pests but also for its storage longevity (Chandra *et al.*2016). It is considered an excellent famine food due to its storage capabilities of up to ten years (Purseglove 1976). It is used in porridge and as malt for beer (Van Wyk & Gericke 2000; Fish *et al.*2015). It is also noted in India for its medicinal uses vis-à-vis pregnancy, gastrointestinal health, blood pressure and reduction in gallstones etc (Chandra *et al.*2016: 150-153).

#### **7.4. *Gossypium herbaceum* (Wild Cotton)**

The *Gossypium* genus occurs in subtropical areas and is to be found in the Arid Northern Bushveld MVT of the Soutpansberg Mountain in which Mutamba is located (Mostert 2006; Koemoer *et al.* 2014:134). Historically in South Africa it has been grown in the Limpopo, North West, Kwa-Zulu Natal, Mpumalanga and the Northern

Cape (Macaskill 2018). *Gossypium herbaceum* requires high temperatures of over 20°C over the course of a long summer growing period (Theron 2015). The species grows best in sandy loam soils and is sensitive to hail while also being drought resistant (Theron 2015).

Wild cotton is an endemic shrub of up to 1.5 m with hairy stems and large leaves on slim stalks (Van Wyk & Gericke 2000). Its smooth fruit capsules (bolls) rupture open to release several hairy seeds. No attempts were made in the past to cultivate cotton and it was harvested from wild plants. The bolls were collected, cleaned and spun into cloth. Although its usage in southern Africa is in cloth spinning there is evidence of it having medicinal and culinary uses in other parts of the world (Uphof 1959).

### **7.5. *Adansonia digitata* (Baobab)**

*Adansonia digitata* a deciduous frost sensitive tree, occurring at low altitudes in tropical and subtropical areas, reach heights of up to 25 m (Coates Palgrave 2002: 705-706; Moll 2011). The tree, pollinated primarily by fruit bats in spring, carries its indehiscent fruit in autumn, and loses its short-lived leaves in winter (Coates Palgrave 2002: 706; Moll 2011). The fruit, covered in yellowish grey velvety hairs, persists for up to a year and contains white pulp surrounded by kidney-shaped seeds (Kaboré *et al.* 2011; Moll 2011). *Adansonia digitata* is found not only throughout the Mapungubwe landscape but features prominently in the Arid Northern Bushveld MVT of the Soutpansberg Mountain where Mutamba is situated (Mostert 2006; Mostert *et al.* 2008; Mostert *et al.* 2009; Huffman & Woodborne 2016).

The tree is widely used and various parts possess different uses which are processed in a multitude of manners. The leaves, seeds, kernels and fruit pulp hold much nutritional value while the bark possesses medicinal and fibrous value (Kaboré *et al.*2011).

The seeds are nutritious and are sometimes roasted and eaten as nuts (Van Wyk & Gericke 2000) or can be added to the pulp and crushed, which can be mixed with milk or water to form a beverage known as Baobab milk (De Caluwé *et al.*2010). The fruit pulp is primarily medicinal in use and can be mixed with water in the treatment of diarrhoea, fever or prepared as a porridge for insufficient milk after birthing (Van Wyk & Gericke 2000). The bark is a source of fibres for weaving and can also be used in the treatment of malaria or fever. The leaves of young baobabs can be made into a poultice to treat wounds (Kabore *et al.*2011: 832) or the leaves can be used as a foodstuff, dried for use in sauces for porridges and gruel or boiled and eaten as a vegetable (De Caluwé *et al.*2010). The tuberous taproots of young trees can also be eaten in times of famine (Chadare *et al.*2009). The powder from the seed can be used to prepare porridge (Mabogo 1990).

### **7.6. *Brachiaria deflexa* (False signal grass)**

*Brachiaria deflexa* is a loosely tufted annual grass occurring in tropical and sub-tropical Africa (Fish *et al.*2015; Van Oudtshoorn 2014). This grass species is found throughout both the Moist Mountain MVT and the Arid Northern Bushveld MVT of

the Soutpansberg Mountain (Mostert 2006). This species prefers shade and grows in damp sandy or loamy soils in shady open woodland or forest margins (Van Oudtshoorn 2014; Fish *et al.*2015). Flowering occurs from summer to winter (Fish *et al.*2015).

This species is the most restricted of all cereal cultivars and is predominantly regarded as a wild species. However a domesticated race has been found in Fouta Djallon, Guinea (Harlan 1993). The species is a semi-domesticated throughout the African savannah which is ordinarily harvested as a wild cereal and where its incursion in sorghum fields is encouraged by farmers to allow the sorghum to mature without competition (De Wet 1992).

Its presence at Mutamba may possibly be as result of two possibilities. The first possibility is opportunistic harvesting and use in a porridge or gruel. But it more likely that its presence due is due to its occurrence in Mutamba's area. This could indicate its presence in the assemblage is from either seed rain (possibly from a hut's thatch) or as livestock feed whose dung was used as fuel for fires ensuring the preservation of a few caryopses.

### **7.7. *Brachiaria nigropedata* (Spotted signal grass)**

*Brachiaria nigropedata* is a densely tufted, commonly occurring, perennial grass found in bushveld/karoo /grassland/ wetland regions of eastern and southern Africa (Gibbs Russell *et al.*1990; Van Oudtshoorn 2014; Fish *et al.*2015). The species



generally prefers to grow in undisturbed veld with sandy or well-drained soil but in the Soutpansberg Mountain it is found on the highest lying crests and plateaus where it is often exposed to very strong winds (Mostert 2006; Fish *et al.*2015).

Its contemporary usage is as grazing material and fodder for livestock (Gibbs Russell *et al.*1990, Van Oudtshoorn 2014; Fish *et al.*2015). Its presence at Mutamba is most likely as a result of seed rain as the seeds were likely blown down from a high area down onto the floor surfaces (Feature 2) and middens (Feature 1) of Mutamba.

### **7.8. *Grewia* sp.**

The *Grewia* species are small tree or multi-stemmed shrubs possessing hairy greyish green leaves and yellow flowers (Van Wyk & Gericke 2000). Several *Grewia* species are found in the Soutpansberg Mountains, with some such as *Grewia subspathulata*, *Grewia bicolor*, *Grewia flavescens*, *Grewia villosa* and *Grewia hexamita* found in the Arid Northern MVT in which Mutamba is situated (Coates Palgrave 2002: 688-701, Mostert 2006). Many of the species flower in spring and summer but also in winter (*Grewia bicolor*), bearing their fruit chiefly in summer, autumn and winter (Coates Palgrave 2002: 688-701).

*Grewia* sp. produces numerous rounded drupes of which the seed consumes the majority of the drupe's capacity than the thin fleshy layer. Despite the drupe possessing such a thin fleshy layer, *Grewia* sp. is still considered an important plant as pertaining to its multiple uses. Contemporary uses for *Grewia flava*, according to

Van Wyk and Gericke (2000), include use in the construction of hunting bows and arrows from the stems, rope from the fibrous bark and the drupes for beer brewing and food. The bark can also be used in basket weaving and small branches as toothbrushes (Coates Palgrave 2002: 689). The drupes from *Grewia microthyrsa*, *Grewia monticola* and *Grewia villosa* are also used in food and beer brewing and the stems are used for spear handles, fish traps and hut poles. The fruit can be used to flavour porridge and often also dries out well and can be eaten as a snack (Van Wyk & Gericke 2000). The medicinal uses of *Grewia occidentalis* include a decoction for childbirth and bark soaked in warm water for dressing wounds (Coates Palgrave 2002: 694).

### **7.9. *Ziziphus zeyheriana* (Dwarf Buffalo thorn)**

*Ziziphus zeyheriana* is a suffrutex that grows throughout most parts of South Africa (Coates Palgrave 2002: 667; Foden & Potter 2005). The species grows annual stems of up to 60cm high and flowers in spring (Coates Palgrave 2002: 667; Mokgolodi *et al.* 2011.). While there are no records of the species occurring in the Soutpansberg Mountain, it is found in the larger Limpopo area (cf. Foden & Potter 2005; Mostert 2006; Mostert *et al.* 2009 and Mostert *et al.* 2009).

It's flowers and fruit closely resembles those of *Ziziphus mucronata* but its fruit and seeds are more elliptical with very little pulp present (Mokgolodi *et al.* 2011; Coates Palgrave 2002: 667; Latti, n.d.).

*Ziziphus mucronata*'s berries are used to brew beer and its leaves, roots and bark are used to treat coughs, diarrhoea and chest problems (Van Wyk & Gericke 2000). *Ziziphus zeyheriana*, may also have been utilized in a similar manner to its larger counterpart *Ziziphus mucronata* and its presence at Mutamba. It is also very likely that the seeds were brought in to the site by people living at Mutamba as the species does not occur in Mutamba's immediate vicinity but does occur in most of the Limpopo region.

### **7.10. *Vigna unguiculata* (Cowpea)**

*Vigna unguiculata*, like all the domesticated species mentioned, is not native to the Soutpansberg Mountain. It is a tough rain-fed annual creeper which produces pods exhibiting a variety in size, shape, texture and colour. The species is a warm-weather frost-sensitive crop which requires temperatures of between 20°C and 35°C, grows in a range of soil types as well as semi-arid regions with rainfall of up to 600mm annually (Kay 1979). Between 60 days or more are required to produce mature seeds which are often harvested by hand during early mornings, as not only do the pods mature at uneven times, but shatter easily, thus traditional harvesting begins early in the morning as the pods are still damp and pliable (Quin 1959: 41; Kay 1979: 95).

The pods are dried and spread on a threshing floor and beaten with a threshing stick to free the seeds, after which they are treated with Aloe ash to deter weevils and stored in baskets or pots (Quin 1959: 41). Young leaves and immature pods are also harvested as required for cooking (Quin 1959: 41) while immature shoots, leaves and

seeds can also be cooked as a side dish (Maandt & Bhat 2010: 193). Medicinally it is used in the treatment of amenorrhoea, chest or menstruation pain, constipation and snake bites (Van Wyk & Gericke 2000). It was likely grown at Mutamba as a part of the crop package for use in meals.

### **7.11. *Vigna radiata* (Mung bean)**

*Vigna radiata* is a frost-sensitive annual, native to India, which can grow in various soil types, requires temperatures of between 30°C and 35°C and a minimum of 600mm rainfall annually (Kay 1979: 275, (Fuller & Harvey 2006). *Vigna radiata* produce pods that are 5-10 cm x 4-6 mm which contain on average between ten and twenty seeds (Kay 1979: 274).

The species takes between 80 and 120 days to produce mature seeds with a maximum storage time of two years (Kay 1979). Due to the species shattering easily, the Venda collect the mature pods early in the morning while pliable, upon which the time the pods are spread on a packed earth platform and beaten with a threshing stick to separate the seeds which are then treated repeated with Aloe ash to discourage weevils as the species is particularly susceptible to weevils and other pests (Quin 1959). Ethnographically its dietary use is limited to use in stews either with sorghum or on its own (Quin 1959). This species is found at Mutamba due to the settlement's involvement in long distance trade (cf. Antonites 2012).

### **7.12. *Sclerocarya birrea* (Marula/ Moroela)**

*Sclerocarya birrea* is regarded as a multi-purpose tree. It is a large deciduous, single stemmed, medium-sized tree with a large crown and is noted for its prolific fruit yields (Coates Palgrave 2002: 539; Nwonwu 2006: 250). The species occurs in the region of Mutamba and constitutes among the most diagnostic species within the Northern Arid Bushveld MVT (Mostert 2006).

The tree flowers in spring and bears its fruit from summer to autumn, which drop while green and mature on the ground (Coates Palgrave 2002: 540). The fruit is valued for its delicious pulp, high vitamin C content and its nutritious nuts (Van Wyk & Gericke 2000: 114). The fruit is composed of a leathery exocarp which covers a white fleshy fruit pulp and a large hard endocarp containing oleaginous kernels (Nwonwu 2006: 251). The kernels are extracted from the endocarp by the following manner: the endocarp is placed on a large lower grinding stone and while it is being held down, is tapped with a smaller stone until the hard endocarp splits and the kernels are picked out, possibly winnowed to remove the dry covering of the kernels and stored for several days or eaten (Krige 1937: 360; Quin 1959: 90). The *Sclerocarya birrea* from Mutamba show evidence for having been cracked open for the kernels as large quantities of (charred) endocarp fragments of varying sizes were found within the samples.

The fruit is often eaten or fermented to make two kinds of beverages. A fermented drink, *Mukumbi*, is only consumed by adults while non-fermented drink drunk by all

ages (Mabogo 1990; Van Wyk & Gericke 2000; Dlamini & Dube 2008). The nuts, which present difficulties in extraction, are highly nutritious and eaten as a snack and which also produce oil which may be used to preserve meat or used to cook food (Mabogo 1990; Van Wyk & Gericke 2000). The leaves are used in the treatment of heartburn and decoctions made of the bark or roots are used for the treatment of diarrhoea, fever and malaria (Van Wyk & Gericke 2000). The bark also yields a red, brown or mauve dye and the non-splintering wood is used to make eating utensils, furniture etc and is the preferred wood for the firing of ceramic vessels (Mabogo 1990; Van Wyk & Gericke 2000; Nwonu 2006). Krige (1937: 360) notes that the baPhalaborwa burns the skin of the fruit to produce ash that is mixed with ground tobacco to make snuff.

### **7.13. *Acacia* sp.**

*Acacia* species are drought resistant shrubs or trees indigenous to Africa and Australia (Ross 1981). Acacias grow in the Soutpansberg Mountain, with varieties such as *Acacia nilotica* and *Acacia burkei* found in Mutamba's region (Mostert 2006). Acacias occur in various climatic conditions from sand dunes and open bush to woodlands and wooded grasslands (Ross 1981; Coates Palgrave 2002: 275-301). They predominantly flower in spring and summer, bearing their fruit to maturity in autumn (Coates Palgrave 2002: 275-301).

The genus is used for a variety of purposes, dependant on which species is used (Van Wyk *et al.*1997; Van Wyk & Gericke 2000). For example: *Senegalia ataxacantha* is

used in basketry, as firewood, in body cleansing and in male aphrodisiacs (Mabogo 1990; Van Wyk & Gericke 2000; Eghosa 2015) while *Senegalia karroo*'s pods are used as animal feed, its gum and bark for confectionary purposes and in the treatment of mouth ulcers, the bark is a source of fibre and dye, the seeds can be roasted as a coffee substitute and the thorns are used in magical rituals to keep witches and sorcerers from entering homesteads (Mabogo 1990; Van Wyk *et al.* 1997; Van Wyk & Gericke 2000; Coates Palgrave 2002: 285). *Vachelia nilotica* has edible gum and along with *Senegalia nigrescens* are used as firewood and fencing material (Mabogo 1990; Coates Palgrave 2002). *Senegalia caffra* – The leaves and pods are used as animal feed, a bark infusion is used to treat for blood cleansing while the leaves are also used in the treatment of stomach problems (Coates Palgrave 2002: 278). At Mutamba, *Acacia* sp. may have had a variety of uses but it may also have been as a result of seed rain from surrounding trees. The seeds rain is the most likely as there is no concrete evidence for any particular use. The contexts of the seeds (unvitrified dung, pit fill and floor contact) tend to favour a seed rain interpretation rather than a use-based interpretation for the genus at Mutamba.

## **7.2. Conclusion**

Plants are integral to existence, both today and in the past. They have innumerable uses, of which not all are known or documented. Different parts of plants are used for different purposes, i.e. grain is used for food while stalks serve as fodder. Through ethnobotany and ethnography the most likely uses of plants can be inferred although these inferences do not necessarily equate to definitive uses of the plants found at Mutamba. At the site a total of 13 taxa were identified. The taxa encompassing both

wild and domesticated species possess multiple uses. Some species such as sorghum and the millets were mostly used for dietary purposes while others such as *Acacia* sp. were more useful for medicinal or manufacturing purposes.



## Chapter 8

### Discussion and conclusion

---

---

Many communities of the MIA were agro-pastoralists, herding animals and growing crops. Apart from a scant handful of known species very little is known about the range of plants used or the purpose of their usage. Nonetheless within southern African archaeological research botanical material is often overlooked in favour of more visible forms of material culture and are as a result poorly studied. Archaeobotany has the potential to expand on existing knowledge of the MIA as well as provide new information on a variety of topics from food to craft.

Research at Mutamba attempts to understand which species were present at the site and their most likely usage. This will be achieved through a combination of archaeobotanical material recovered from the site and ethnographic data on traditional plant usage. From the analysis of the archaeobotanical material (See Chapter 6) it would seem that the community at Mutamba made use of a variety of taxa both wild and domestic. The most probable uses for these taxa appear to have been as a part of food, drink and craft production. This chapter will focus on food production before moving onto beer brewing and ending with cotton cloth production.

## 8.1. Food production

It is well established that communities in the MIA were agropastoralists, growing crops such as sorghum, millets and legumes. This is most evident in the form of archaeobotanical remains, granaries, hoes and grinding stones (Badenhorst 2010; Huffman 1996, 2007; Bradfield & Antonites 2018). For agropastoralists the provisioning of food i.e. cultivating of plants was a vital part of their lives (cf. Samuel 1996; Mintz & Du Bois 2002). The food production process tied them to the temporal and spatial rhythms of cultivation, i.e. where cultivation took place and the growth cycle of the plants (cf. Fuller *et al.*2010).

Food is inherently transient in nature; it is made to be consumed soon after preparation and perhaps stored for only relatively brief periods (Van der Veen 2003, Samuel 1996). While the primary purpose of food is nutrition, the raw materials, i.e. seeds/fruit / vegetables undergo several stages of manipulation in order to become a meal. Although the state of food within the archaeological record is ephemeral, its social context can be identified through the stages of procurement, distribution, preparation, consumption and disposal (Goody 1982; Samuel 1996; Van der Veen 2003).

The first stage of food production is procurement, which refers to primary production, i.e. the process of collecting and growing of the raw material, the spatial and social organisation and the technology utilised during this stage of production (Goody 1982;

Samuel 1996). Distribution is a reference to the allocation or storage of the by-product of procurement and is most evident in the form of storage receptacles (Samuel 1996). Preparation denotes to the cooking process and includes division of labour, spatial location of food consumption and the technology used in the preparation of the food (Samuel 1996), while the final stage of food production, disposal, refers to the discard of food remains

### **8.1.1. Food production at Mutamba**

At Mutamba hundreds of wild and domestic species of macrobotanical remains were recovered from the domestic contexts at Mutamba (Features 1 and 2). Much of the plant-based food at Mutamba was from agriculture. The botanical assemblage was dominated by domesticated taxa however wild taxa was also utilized. The wild taxa provided not only variety in the diet but also acted as additional means of nutrition. The mixed utilization of both domestic and wild plants within Mutamba's diet is to be expected as agriculture alone may not have provided a wholly sufficient base for subsistence. Wild species contributed products and uses that the domestic crop species may not have been able to yield, such as fibres for cloth from *Gossypium herbaceum* (cf. Krige and Krige 1980: 34). Some of the wild taxa such as *Grewia* sp., *Adansonia digitata* and *Sclerocarya birrea* bore fruit during the seasons (autumn and winter) when domesticates were not cultivated. The combination of domestic and wild plants for subsistence is best summarised by Krige and Krige (1980: 34): "They eat the fruits and roots of the plants, depend for their relishes upon leaves and soft stems, and in dozens of other ways nourish themselves upon the natural products of the soil. Not

agriculture and animal husbandry alone, but these, together with wild fruits, woods, and other products of nature are the bases of subsistence’.

While a combination of wild and domestic taxa were utilised for subsistence, agriculture especially would have constituted a large part of the subsistence strategy at Mutamba. The cultivation process (clearing, tilling, planting, hoeing, manuring, weeding and harvesting) would have been labour and time consuming (Quin 1959; Schapera & Goodwin 1962; Stayt 1968; Fuller *et al.* 2010). Ethnographically cultivation took place in small gardens in and around the village (Stayt 1968; cf. Greenfield *et al.* 2005). This lends support to the supposition that the location of Mutamba’s cultivation occurred in and around the settlement as it is located in a saddle on a narrow ridge (Antonites 2012). Ethnographic and ethnobotanical literature also indicates these small gardens may have made use of an arrangement of Acacia branches as fencing material (Schapera & Goodwin 1962; Coates Palgrave 2002: 293; Greenfield *et al.* 2005,). This could possibly explain the presence of the Acacia seeds in the assemblage. Acacia trees are known to occur in the Soutpansberg Mountain (Mostert 2006). The possibility does exist that the presence of the seeds may have occurred through other means such as through the use of the trees as firewood or as resultant by-products from the extraction of *Sclerocarya birrea* kernels with Acacia thorns (Cunningham 1988).

While there is no direct evidence for the agricultural process itself at Mutamba, ethnographic literature indicates that land clearing for fields took place before the cutting, burning and preparation of ground for tillage. After the soil was prepared the

remaining process of planting, weeding, hoeing and harvesting commenced (Quin 1959; Goodwin & Schapera 1962; Stayt 1968). The planting was planned to coincide with the first rains (Goodwin & Schapera 1962; Stayt 1968). It is probable that the cultivation processes at Mutamba took place between spring and summer or early autumn. This is due to the growing requirements. If the cereals and legumes were grown together they would have required a minimum of 350 mm of rain with constant temperatures of above 15° C (Purseglove 1976; Doggett 1976; Huffman 2007).

Dryland rain-fed hoe agriculture was likely to have been practised at Mutamba. The crops would have been largely dependent on the summer rains owing to Mutamba's location on a narrow ridge as well as the position of the nearest river 250 m south of the settlement. Both the location of Mutamba as well as the nearest water source would have restricted using water from the river, forcing a dependency on seasonal rainfall.

Sorghum, millets (pearl and finger millet) and two species of legumes (cowpea and mung bean) appear to have been the preferred crops grown, although this may be due to preservation and not a totality of crops grown. Sorghum accounts for the majority of domestic species recovered from the site. Almost half of the total domestic crop species identified at Mutamba were *Sorghum bicolor* (Refer to Table 6.7 in Chapter 6 for domestic crop MNI).

Lack of crop by-products and weed seeds are indicative of the harvesting and processing methods employed by the inhabitants of Mutamba. The thick stalks of *Sorghum bicolor*, *Eleusine coracana* and *Pennisetum glaucum* routinely provided for selection against the inclusion of weeds during harvest as only a few plants could be harvested at a time (cf. Reddy 1997). The method of harvesting for cereals would be done by cutting either just below the seed-bearing ears or cutting at the stalk while for legumes it would have been to hand-pick the pods.

All crops would then have been subject to threshing and winnowing. The threshing would have released the seeds and their attached appendages from the plant itself while the winnowing would have separated the seed from the stalks, pods etc (Reddy 1997). The absence of by-products indicated that these non- seed parts were potentially used as fodder or fuel or that processing took place away from the huts and thus would not have left indications of their presence in the archaeological record at Mutamba.

The processed seeds would then most likely have been transferred to household storage receptacles (Van der Waal 1977). Although no direct evidence of grain storage receptacles were found at Mutamba, inference can be drawn from other Mapungubwe-era settlements where grain bins stands and stone platforms were found that may have supported grain baskets (Meyer 1998; Huffman 2007; Meyer & Cloete 2010).

### 8.1.2. Food at Mutamba

Historically, porridge forms the main component in meals (Quin 1959; Lestrade 1962, Stayt 1968; Mabogo 1990; Harlan 1993). The grains of sorghum and millets may most likely have been eaten as a porridge or possibly to a lesser extent as a gruel (Quin 1959; Lestrade 1962; Stayt 1968; Mabogo 1990; Harlan 1993). This porridge may have been eaten with various accompaniments made from meat, berries (such as *Ziziphus zeyheriana* or *Grewia* sp.), various fruits (such as *Sclerocarya birrea* or *Adansonia digitata*), soured milk, legumes (such *Vigna radiata* or *Vigna unguiculata*) or greens (Quin 1959; Mabogo 1990).

In his ethnographic text on feeding habits of the Pedi, Quin (1959: 148-149) states that porridge is considered the only dish that ranks as food and that any other kinds of foodstuffs only hold value as additives to porridge, as pre-main meal snacks or as substitutes during lean months. While Krige and Krige (1980: 36) highlights that porridge was a foodstuff that held supremacy within the diet due to its filling nature.

The large numbers of sorghum and millet grains (See Table 6.7) at Mutamba appear to correlate with ethnographies on their use within meals as the main components of porridge. Likewise there are accounts of *Brachiaria* used in meals (De Wet 1992; Harlan 1993). However there is no ethnographic record of its use as a foodstuff in southern Africa and it is more likely it entered the archaeological record at Mutamba through other means such as indirect usage or seed rain. This especially seems to be the most likely explanation for the presence of *Brachiaria nigropedata*. This species

was recovered from a midden and floor surfaces and its presence can most likely be attributed to having blown in from the higher areas on the mountain where it grows (cf. Mostert 2006).

The semi-whole and whole states of the sorghum and millet grains suggest that the main method of porridge preparation at Mutamba was to boil the grains whole. It may also be that the carbonised seeds are from processing. The presence of upper grinding stones in Feature 2 also suggest that some of the grains were pounded and ground for a smoother porridge (Van Wyk & Gericke 2000). Relishes made from legumes, nuts or vegetables are served with porridges (Quin 1959; Lestrade 1962; Krige & Krige 1980; Mabogo 1990). Many cotyledons of the two *Vigna* species from Mutamba are also in a fragmentary state. This supports the manner of their preparation and usage as a bean relish to accompany porridge in ethnography whereby the beans were soaked, crushed, cooked or roasted. While the non-seed parts of the taxa used in porridge preparation did not preserve in the archaeological record at Mutamba ethnography indicates that the leaves of *Vigna radiata* and *Vigna unguiculata* could have constituted a major component of relishes along with many other species of vegetables or fruit such as *Grewia* sp. and *Ziziphus zeheriana* (Krige 1937; Quin 1959; Krige & Krige 1980).

The kernels from *Sclerocarya birrea* are also used within traditional dishes as a relish, in which the extracted kernels are ground into a pulp and either cooked on its own or with other vegetables (Mabogo 1990: 145). The kernels from *Sclerocarya birrea* are difficult to extract and may have additionally been eaten raw. The kernels are usually



extracted either by placing the endocarp on a lower grinding stone and tapping until it splits to release them (Krige 1937; Quin 1959) or by using a thorn from an *Acacia* to extract them (Cunningham 1988). The first method of extraction is more likely to have been used at Mutamba, as is indicated by the numerous broken endocarp fragments recovered.

An *Adansonia digitata* (n=1) was also recovered from Mutamba. These seeds are traditionally roasted and eaten as snacks or are ground into a powder that added to meals (Ware 2018). It is possible that the seeds were consumed in both manners at Mutamba. The mode of preservation of the single seed (charred) suggests roasting but the numerous miniscule fragments found also suggest that the seeds were ground.

The domestic contexts are defined by Twiss (2007: 52) as the primary unit of domestic meal consumption and indications are that food was processed and cooked either in the courtyard or inside the huts themselves at Mutamba. This is supported by the archaeological evidence. Within the domestic contexts (Feature 1 and Feature 2) middens, hearths and two upper grinding stones were found along with charred and desiccated macrobotanical material. This indicates that food preparation, cooking and disposal most likely took place within or very near to these contexts.

As agro-pastoralists the inhabitants of Mutamba would have been closely involved in the entire cycle of food production, from the growing thereof to the preparation, consumption and disposal. Ethnographically women may have been more closely

involved in the food cycle than men as ethnographically, they attended to the growing and preparation of the food (Quin 1959; Stayt 1968). Additionally the women would also have been responsible for the gathering of wild edible plants eaten in meals (Schapera & Goodwin 1962: 151).

## **8.2. Brewing at Mutamba**

Possible evidence for grain and fruit based brewing activities was found at Mutamba. Evidence for grain-based beer can be inferred from several malted *Sorghum bicolor* caryopses while a fruit-based beer can be inferred from the presence of *Sclerocarya birrea* endocarps/ opercules. And although the alcohol at Mutamba appears to have been primarily grain-based, it is also probable that a fruit-based Marula drink was also brewed, as ethnographically this accounts for among the most notable uses of *Sclerocarya birrea*. The drink called Marula beer is technically a wine as it is fruit based but will be referred to here as a beer as this how the drink is referred to in ethnography (Dlamini & Dube 2008).

The beer brewed at Mutamba may have resembled a gruel-like opaque beer and could have served as both food and drink to the inhabitants of Mutamba (Quin 1959; Lestrade 1962; Schapera & Goodwin 1962; Van Warmelo 1960; Stayt 1968; Mabogo 1990; Haaland 2007).

It can be considered a source of food due to the gruel-like consistency as the beer would have been a thinner version of the porridge consumed at Mutamba, with added “psychoactive properties” occurring as a result of biochemical processes (Haaland

2007; Van Wolputte & Fumanti 2010:3; Dietler 2012: 219). In addition where food can be considered a medium for the maintenance of social relations, beer is a binding agent and serves as a reinforcement of daily and ritualistic life (Quin 1959; Van Warmelo 1960, Lestrade 1962; Schapera & Goodwin 1962; Stayt 1968; Mabogo 1990, Haaland 2007). It would have been intricately involved with the entire social system at Mutamba, “the first essential in all festivities, the one incentive to labour, the first thought in dispensing hospitality, the favourite tribute of subjects to their chief, and almost the only votive offering dedicated to their spirits” (Schapera & Goodwin 1962: 133).

### **8.2.1. Grain-based beer**

Ethnographically the nutrient rich grain-based beer was prepared by women following a simple brewing process (Quin 1959; Lestrade 1962: 124; Owuama 1999: 23, Luoma 2009; Lyumugabe *et al.*2012: 510). The traditional process of grain-based beer brewing took place within domestic contexts and involves steeping, malting, mashing and straining.

The first step steeping refers to soaking the grains in water in order to induce specific biochemical and physical changes, such as swelling of the grains or the removal of micro-organisms, and is the most essential stage of the brewing process (Owuama 1999: 26; Lyumugabe *et al.*2012: 510). The grains would have been soaked in water between ten and twenty-four hours at an ambient temperature and periodically drained and aerated (Lyumugabe *et al.*2012: 510). This process is reflected in Van Warmelo’s

work (1960: 201) on traditional Venda beer brewing: ‘‘We commence by soaking ... Next day it is taken out of the water. It is put in a suitable place in a hut, and covered with leaves of the *muunguri* tree, and left to sprout’’.

Next, germination, also referred to as malting, takes place. Germination involves the outgrowth of the plumule and radicle of a seedling until sufficient production of enzymes for malting has occurred (Owuama 1999). The seedlings would then have been spread out, kept covered and turned over (Lyumugabe *et al.*2012: 511-512). Germinated grain would then be dried under the sun and stored at night to avoid rehydration (Lyumugabe *et al.*2012: 513). This process would take up to three days to complete before the next step, mashing, can ensue.

The mashing would have been achieved by decoction and infusion whereby the mash is boiled and then separated, usually by decantation producing wort, a liquid that becomes beer post-fermentation (Van Warmelo 1960: 202; Owuama 1999: 30; Luoma 2009; Lyumugabe *et al.*2012: 514). The liquid can be consumed at this stage and holds no alcoholic properties as it is the stage of brewing prior to fermentation (Van Warmelo 1960). The wort would then have been boiled and mixed with a leaven made of *Eleusine coracana* flour (Van Warmelo 1960). Fermentation would have taken between ten and twenty-four hours (Lyumugabe *et al.*2012).

Finally, the beer would be strained in wide-necked vessels with a final product possessing a consistency similar to thin gruel (Van Warmelo 1960; Rampedi 2010).

“Thereupon the woman who made the beer fills a little calabash and take sit to her father-in-law who says “The beer may be announced”, and then they summon their friends” (Van Warmelo 1960: 203).

### **8.2.2. Marula beer**

The brewing process for Marula beer is a very simple one. The drink consists of the juice of the fruit mixed with water (Krige 1937). The inhabitants of Mutamba may have followed the ethnographically noted examples of Marula beer brewing which involves collecting the fruits and rolling them to soften the flesh (Dlamini & Dube 2008; Rampedi 2010).

The flesh would then be cut and the resultant juice pressed into a ceramic vessel and diluted with water, agitated and pips removed (Dlamini & Dube 2008). The ceramic vessel may have been covered with a basket or leaves and sealed with cow dung (Stayt 1968). The contents are then left to ferment. Within twenty-four hours a white scum would floated to the surface and be skimmed off. Within this initial period a sweet liquid similar to an ordinary non-intoxicant beverage would have resulted (Krige 1937; Mabogo 1990). However after a fermentation period of several days an intoxicating liquid, Marula beer, would be ready for consumption (Stayt 1968; Dlamini & Dube 2008). Whether the beer consumed was grain-based or fruit-based, it played social, ceremonial and gender roles. (See Van Warmelo 1960; Lestrade 1962; Schapera & Goodwin 1962; Eiselen & Schapera 1962: 254-255 and Stayt 1968 for examples).

### **8.3. Craft production – Cotton cloth**

Craft production is portrayed within prestige goods models as central to the formation and preservation of a society's elite's identity (Friedman & Rowlands 1977; Schortman & Urban 2004; Plourde 2008). The model theorises that the production of prestige goods was organised, directed or carried out by elites. However this model does not adequately elucidate the production or exchange of objects not associated with elites. Goods produced outside of direct elite control, such as at hinterland sites like Mutamba, may have served to raise the producers' material circumstances above fundamental subsistence requirements (Schortman & Urban 2004). The term craft is defined by Costin (2007: 146) as "hand-made, utilitarian objects fashioned by anonymous individuals working within the confines of traditional techniques and culturally defined expectations for these objects' form and style". This term is often extended by archaeologists to refer to textiles; ceramics and basketry, all activities synthesising skill, aesthetics and cultural meanings. Evidence of craft production in the form of cotton weaving was engaged in at Mutamba.

#### **8.3.1 Cotton production at Mutamba**

The spinning of cloth at Mutamba may have formed part an important local spinning industry in the Soutpansberg (Antonites 2012: 226). Cloth production, most likely introduced from Southeast Asia, would have been part of extensive trade network within southern Africa as well as part of the Indian Ocean trade network (Huffman 1971; Picton & Mack 1989:17; Stayt 1968: 59). Evidence for cloth production in the

SLCA first appear in the 12<sup>th</sup> Century in the form of spindle whorls (Huffman 1971) and by the thirteenth century cotton cloth production was generally engaged in on a small scale which consequently grew in later periods (Antonites 2012: 226). Often these spindle whorls are the only indicators of cloth production in the Iron Age, as fabrics rarely survive in the archaeological record (Huffman 1971; Davies & Harries 1980).

At Mutamba 187 spindle whorls as well as 11 *Gossypium herbaceum* seeds were found in domestic contexts. Both the number of spindle whorls and the domestic contexts suggests that cotton cloth production not only outstripped the number of households but in addition indicates that numerous members of a family were involved in the production (Antonites 2012: 246). This involvement of multiple members of each household in producing cloth that outstripped the needs of the households indicated that northern Soutpansberg communities, like Mutamba, were producing spun fibres on “a scale that suggests participation in an economy beyond the single village” (Antonites 2012: 246-247).

Local cloth production at Mutamba was also most likely augmented by cloth imported via the Indian Ocean trade networks as is briefly illuminated in Barbosa’s early 16<sup>th</sup> Century description of the coast of East Africa and Malabar, whereby he states: “And the mode of their trade is that they come by sea in small barks which they call zanbucs (sambuk), from the kingdoms of Quiloa, and Mombaza, and Melindi; and they bring much cotton cloth of many colours, and white and blue, and some of silk ... which come to the said kingdoms in other larger ships from the great kingdom of Cambay,

which merchandise these Moors buy and collect from other Moors who bring them there, and they pay for them in gold by weight, and for a price which satisfies them; and the said Moors keep them and sell these cloths to the Gentiles of the kingdom of Benamatapa who come there laden with gold, which gold they give in exchange for the before mentioned cloths without weighing, and so much in quantity that these Moors usually gain one hundred for one” (Barbosa 1866: 5).

Other than for trade purposes, the cotton cloth would have also been used for the inhabitants of Mutamba’s own clothing or for ritual purposes (Van Warmelo 1960, Davison & Harries 1980). Ethnographic examples (e.g. Stayt 1968: 22) illustrate that often the first clothing-like items a child wears are cotton-based: “Soon after birth a string of wild cotton is tied around the baby’s waist ... which serves as a belt. Similar strings are also tied around its wrists, ankles, and neck. This is all the child wears until it begins to walk”. According to Davison and Harries (1980: 182) both men and women were responsible for the spinning while weaving was carried out by men. Stayt (1968: 59) also mentions that small pieces of the cotton cloth are retained as heirlooms and regarded as sacred and valuable by contemporary societies, so much so that “A MuVenda, on being asked to sell a small dirty valueless bit of *masila* cloth, which lies useless and apparently neglected in his hut, is indignant at the very suggestion that he should part with this last relic of the genius of his ancestors (Stayt 1968: 249).

Antonites (2012) was able to determine that production at Mutamba of cotton cloth included part-time and household production that was unconstrained by the Mapungubwe elite. This would have allowed the artisans to create goods that fulfilled



an unspecified demand which was modified according to social, political and economic circumstances (cf. Brumfield and Earle 1987: 5; Costin 2000). The cotton cloth production process would have been a time and labour intensive process (cf. Davison & Harries 1980) and if the cloth produced at Mutamba was similar to ethnographic accounts of cotton cloth production (Crowfoot 1931; Davison & Harries 1980; Picton & Mack 1989) it may have been produced in a similar fashion, as described below, where the cloth was ginned and woven.

Ethnographic evidence suggests that the first step in changing the cotton harvested into cloth began with ginning, or the separation of the fibres from the seed. A few bolls would be placed on either a flat rock or a wooden block and the seeds squeezed out by rolling a wooden or iron rod over them (Davison & Harries 1980: 179; Picton & Mack 1989: 31). The fibres would then be untangled either by hand or by bowing whereby the fibre are put on the string of a bow which is then plucked until the fibres were opened up and ready to be spun (Davison & Harries 1980: 179; Picton & Mack 1989: 31).

Picton and Mack (1989: 31-32) described spinning as the cotton being held in one hand while with the other hand the spinner spins, draws down and controls the twisting of the fibres, while Crowfoot (1931) identified six methods of spinning used in the past based on ethnographic work on spinning in Egypt and Sudan:

Although the account given by Gamitto (1960: 82-83) of early 19<sup>th</sup> Century spinning in the kingdom of Kazembe may shed illumination on the exact method used: “They cultivate and prepare cotton from which they make rough cloth ... To twist the cotton,

they sit on the ground, tie it to their feet and securing one end to the hook on the spindle ... and draw out a piece three spans long. Then with the palm of the right hand, and on the right thigh they impart rapid movement of the spindle, holding it in the air, and at the same time they hold the cotton between the thumb and index finger of the left hand controlling it and drawing it out where it shows some unevenness. When the thread is well twisted they roll it round the spindle near the top plate''. This method of spinning is also further corroborated by more contemporary sources (See: Stayt 1968; Huffman 1971; Picton & Mack 1989 and Davison & Harries 1980).

The resulting cloth would have been course and white and possibly dyed with plant-based dyes, such as those produced by *Sclerocarya birrea* (Barbosa 1866: 359; Erkskine 1875: 95; Van Wyk & Gericke 2000: 258).

#### **8.4. Conclusion**

The research undertaken here was in an attempt to examine which plant taxa were present at Mutamba, a 13<sup>th</sup> MIA settlement in the Soutpansberg, as well as to identify the most likely potential uses of those taxa. Many MIA communities like Mutamba were agro-pastoralist or farming communities. Yet archaeobotanical material has largely been overlooked in favour of more visible material culture in general archaeological practise in South Africa.

At Mutamba hundreds of macrobotanical were recovered from flotation and analysed. Within the taxa present at the site eleven were identified to species and two to genus. The taxa appear to have formed a part of food production, brewing activities and cotton cloth production at the site. Domestic grains and legumes constituted a

substantial number of archaeobotanical material found. These domestic crops were most likely grown in and around the settlement (Greenfield *et al.* 2005). Additionally the lack of weed taxa serves to indicate that crops were harvested by handpicking (legumes) or by cutting just below the ear (grains). Absence of crop processing associated material point to these activities having taken place away from the domestic contexts or that their non-seed parts were perhaps used as animal fodder. The wild taxa were most likely picked when seasonally available to supplement diet.

Ethnographic indications are that these grains and legumes were used in the preparation of porridge or gruel. Evidence for potential brewing was also found for both grain based and fruit based brewing in the form of malted sorghum and marula remains. Finally evidence for cotton cloth production was found at Mutamba. The presence of both cotton seeds and spindle whorls within household contexts points to the production of cotton cloth as household based (Antonites 2012).

This study is the first archaeobotanical study of an Iron Age in the MIA. As such it has created a baseline of knowledge of plant use during this period, in which it is known that many communities were largely agro-pastoralists (Huffman 2007). Emphasis has generally been focused on pastoral aspects and not the agricultural. However archaeobotanical material from Mutamba points to a potential crop package comprised of millets, sorghum and legumes. Most notably Mutamba contains the first evidence of the legume *Vigna radiata* (mung bean) grown as a part of the crop package in the MIA of northern South Africa.

While it is hypothesized that agriculture during the MIA was hoe-based (Bradfield & Antonites 2018) the location of cultivation and processing as well as harvesting methods employed are unknown. Mutamba's location on a narrow ridge tentatively confirms the area of cultivation was most likely in or near the settlement and that these crops were hand harvested with processing occurring away from the households. This is, as previously mentioned, corroborated by the lack of crop processing residue and by the lack of weed seeds in the assemblage. The archaeobotanical material from Mutamba also serves to highlight potential uses of plants in the MIA. No previous studies have attempted to examine what botanical material from this time may have been utilised for. Mutamba serves to illustrate the MIA communities were most likely using plants for various purposes, such as food, beer and craft.

As agro-pastoralists many MIA communities were in all likelihood tied to the temporal and spatial rhythms of cultivation. The crops cultivated could have represented an essential facet of subsistence. The archaeobotany at the site indicates that many different species were made use of, both wild and domestic. The taxa recovered at Mutamba appear to indicate that domestic crop species potentially formed a significant portion of food consumed, supplemented by wild taxa such as *Sclerocarya birrea*, *Grewia* sp., *Ziziphus zeheriana* or *Adansonia digitata*. The first probable indicator of brewing in the MIA was found at Mutamba in the form of malted sorghum grains. Additionally one of the wild species, *Sclerocarya birrea*, could likewise have been used in brewing activities.

While many plants could have been used in subsistence, some such as *Gossypium herbaceum* (wild cotton) were almost certainly a part of craft activities. Both spindle whorls and cotton seeds were found together in domestic contexts at Mutamba, providing the first palpable evidence of cotton cloth production that is not based solely on the presence of spindle whorls. As cloth rarely survives in the archaeological record spindle whorls were generally the only evidence for cloth production (Huffman 1971; Davies & Harries 1980).

Mutamba is a MIA settlement situated in northern South Africa at the southernmost reach of Mapungubwe's political power (Antonites 2012). It was occupied during a time when many communities were agro-pastoralists and it is hoped that the data generated will be incorporated into a wider body of knowledge of the MIA. Archaeobotany has the potential to expand on knowledge of the MIA and it is recommended that future research incorporate additional sites in Mapungubwe's outlying areas. It is also suggested other forms of archaeobotany such as phytolith and starch analysis (i.e. microbotanical analysis) be incorporated as well.

## References listed

---

---

Allaby, M. 2012. *Oxford dictionary of plant sciences*. Oxford: Oxford University Press.

Antolín, F. & Buxó, R. 2011. Proposal for the systematic description and taphonomic study of carbonized cereal grain assemblages: A case study of an early Neolithic funerary context in the cave of Can Sadurní (Begues, Barcelona province, Spain). *Vegetation History and Archaeobotany* 20(1): 53-66.

Antonites, A. 2012. *Political and Economic Interactions in the Hinterland of the Mapungubwe Polity, c. AD 1200- 1300, South Africa*. Unpublished PhD Dissertation. New Haven: Yale University.

Antonites, A and Antonites, A.R. 2014. The Archaeobotany of Farming Communities in South Africa. In (eds) Stevens, C. J., Nixon, S., Murray, M. A., Fuller ,D. *Archaeology of African Plant Use*: 225-232. Walnut Creek: Left Coast Press Inc.

Badenhorst, S. 2010. Descent of Iron Age farmers in southern Africa during the last 2000 years. *The African Archaeological Review* 27(2): 87-106.

Bahn, P. 2004. (ed.). *The New Penguin Dictionary of Archaeology*. London: Penguin.

Balick, M.J. & Cox, P.A. 1996. *Plants, People, and Culture: The Science of Ethnobotany*. New York: Scientific American Library.

Barbosa, D. 1866. *A description of the Coasts of East Africa and Malabar: In the beginning of the sixteenth century*. London: Printed for the Hakluyt Society.

Bawaya,M. 2007. Curation in crises. *Science* 317(5841): 1025-1026.

Benkwitz, K. 2013. *Macro analysis of botanical remains found at Mutamba, 12<sup>th</sup> to 13<sup>th</sup> century AD*. Unpublished Honours dissertation. Pretoria: University of Pretoria.

Boardman, S. & Jones, G. 1990. Experiments on the effects of changes in cereal plant components. *Journal of Archaeological Science* 17(1): 1-11.

Braadbaart, F. 2008. Carbonisation and morphological changes in modern dehusked and husked *Triticum dicoccum* and *Triticum aestivum* grains. *Veget Hist Archaeobot* 17: 155-166.

Braadbaart, F. 2008. Carbonization and morphological changes in modern dehusked and husked *Triticum dicoccum* and *Triticum aestivum* grains. *Vegetation History and Archaeobotany* 17: 155-166.

Braadbaart, F., Bakels, C.C., Boon, J.J. & van Bergen, P.F. 2005. Heating experiments under anoxic conditions on varieties of wheat. *Archaeometry* 47 (1): 103-114.

Braadbaart, F., Boon, J.J., Veld, H & Van Bergen, P.F. 2004. Laboratory simulations of the transformations of peas as a result of heat treatment: Changes of the physical and chemical properties. *Journal of Archaeological Science* 31: 821-833.

Braadbaart, F., Boon, J.J., Veld, H., David, P. & van Bergen, P.F. Laboratory simulations of the transformation of peas as a result of heat treatment: changes of the physical and chemical properties. *Journal of Archaeological Science* 31: 821-833.

Bradfield, J. & Antonites, A.R. 2018. Bone hoes from the Middle Iron Age, Limpopo, South Africa. *Quaternary International* 472: 126-134.

Brandl, G. 2003. Geology. In (eds) Berger, K, Crafford, J.E., Gaigher, I., Gaigher, M.J., Hahn, N. & Macdonald, H.I. *A first synthesis of the environmental, biological and cultural assets of the Soutpansberg: 7-9*. Louis Trichardt: Leach Printers and Signs.

Brunken, J., de Wet, J.M.J., Harlan, J.R. 1977. The morphology and domestication of Pearl Millet. *Economic Botany* 31 (2): 163-174.

Calabrese, J.A. 2005. *The emergence of social and political complexity in the Shashi-Limpopo Valley of southern Africa, AD 900 to 1300: Ethnicity, class and polity*. Unpublished PhD Dissertation. University of Witwatersrand.

Canti, M.G. 2003. Earthworm Activity and Archaeological Stratigraphy: A Review of Products and Processes. *Journal of Archaeological Science* 30: 135-148.

Chadore, F.J., Linnemann, A.R., Hounhouigan, J.D., Nout, M.J.R.. & Van Boekel, M.A.J.S. 2009. Baobab food products: A review on their composition and nutritional value. *Critical Reviews in Food Science and Nutrition* 54: 254-274.

Chandra, D., Chandra, S. & Pallavi Sharma, A.K. 2016. Review of Finger millet (*Eleusine corcana* (L.) Gaerth): A power house of health benefitting nutrients. *Food Science and Human Wellness* 5: 149-155.

Chandrashekar, A. 2010. Finger millet: *Eleusine coracana*. *Advances in Food and Nutrition Research* 59: 215-262.

Charles, M., Forster, E., Wallace, M. & Jones, G. “Nor ever lightning thy grain”: Establishing archaeologically relevant charring conditions and their effect on glume wheat grain morphology. *Science and Technology of Archaeological Research* 1 (1): 1-16.

Coates Palgrave, K. 2002. *Keith Coates Palgrave Trees of southern Africa*. Century City: Penguin Random House (Pty).

Cochrane, G.W.G. 2003. Artefact attribute richness and sample size adequacy. *Journal of Archaeological Sciences* 30: 837-848.

Darvill, T. 2008. *The Oxford Concise Dictionary of Archaeology*. Oxford: Oxford University Press.

David, N. 1992. Integrating ethnoarchaeology: A subtle realist perspective. *Journal of Anthropological Archaeology* 11: 330-359.

Davidson, P. 1988. The social use of space in a Mpondo homestead. *The South African Archaeological Bulletin* XLII (148): 100-108.



Davison, P. & Harries, P. 1980. "Cotton weaving in South-East Africa: Its history and technology" in *Textile History* 10 (11): 175-192.

Day, J. 2013. Botany meets archaeology: people and plants in the past. *Journal of Experimental Botany* 64 (1): 1-12.

De Caluwé, E., Halamová, K., Van Damme, P. 2010. *Adansonia digitata* L. – A review of traditional uses, phytochemistry and pharmacology. *Afrika Focus* 23(1): 11-51.

De Wet, J.M.J & Harlan, J.R. 1971. The origin and domestication of *Sorghum bicolor*. *Economic Botany* 25(2): 128-135.

De Wet, J.M.J. 1992. The three phases of cereal domestication. In (ed) G.P. Chapman *Grass evolution and domestication*: 176-198. Cambridge: Cambridge University Press.

De Wet, J.M.J., Prasada Rao, K.E., Brink, D.E. & Mengesha, M.H. 1984. Systematics and evolution of *Eleusine coracana* (Gramineae). *American Journal of Botany* 71(4): 550-557.

Deacon, H.J. 1993. Planting an idea: Archaeology of Stone Age gatherers in South Africa. *The South African Archaeological Bulletin* 48 (158): 86-93.

Denbow, J., Smith, J., Ndobochani, N.M., Atwood, K. and Miller, D. 2008. Archaeological excavations at Botsutswe, Botswana: Cultural chronology, paleoecology and economy. *Journal of Archaeological Sciences* 35: 451-480.

Dennell, R.W. 1976. The economic importance of plant resources represented on archaeological sites. *Journal of Archaeological Science* 3: 229-247.

Department of Agriculture, Forestry and Fisheries. 2010. *Sorghum: Production guidelines*. Department of Agriculture, Forestry and Fisheries: Pretoria.

Dietler, M. 2012. Culinary encounters: Food, identity, and colonialism. In (ed) Twiss, K.C. *The archaeology of food and identity*: 218-242. Illinois: Southern Illinois University.

Dlamini, N.R. & Dube, S. 2008. Studies on the physic-chemical, nutritional and microbiological changes during the traditional preparation of Marula wine in Gwanda, Zimbabwe. *Nutrition and Food Science* 38(1): 61-69.

Doggett, H. 1976. Sorghum. In (ed) Simmonds, N.W. *Evolution of crop plants*: 112-116. London: Longman.

Du Piesanie, J. 2008. *Understanding the socio-political status of Leokwe society during the Middle Iron Age in the Shashe-Limpopo Basin through a landscape approach*. Unpublished MSc Dissertation. University of Witwatersrand.

du Plessis, J. 2008. *Sorghum production*. Department of Agriculture: Pretoria.

Eghosa, U.S. 2015. *An assessment of household energy use, emissions and deforestation in the Thulamela Local Municipality*. Unpublished MES Dissertation. Thohoyandou: University of Venda.

Eiselen, W.M. & Schapera, I. 1962. Religious beliefs and practices. In (ed). Schapera, I. *The Bantu Speaking Tribes of South Africa*: 247-270. London: George Routledge & Sons.

Eloff, J.F. 1979. *Die kulture van Greefswald: 'n argeologiese studie van die yster-tydperkkulture op die plaas Greefswald, Deel III*. Pretoria. (Unpublished report).

Eloff, J.F. and Meyer, A. 1981. The Greefswald sites. In (ed) Voight, T. *Guide to archaeological sites of the northern and eastern Transvaal* : 7-22. Pretoria: Transvaal Museum.

Erksine, V. 1875. Journey to Umzila's South-East Africa, in 1871 to 1872. *Journal of the Royal Geographic Society of London* 45: 45-128.

Ernst, M. & Jacomet, S. 2005. The value of the archaeobotanical analysis of desiccated plant remains from old buildings: methodological aspects and interpretation of crop weed assemblages. *Vegetation History and Archaeobotany* 15: 45-56.

Fagan, B. 1964. The Greefswald sequence: Bambandyanalo and Mapungubwe. *The Journal of African History* 5(3): 337-363.

Ferrio, J.P., Alonso, N., Voltas, J. & Araus, J.L. 2004. Estimating grain weight in archaeological cereal crops: A quantitative approach for comparison with current conditions. *Journal of Archaeological Science* 31: 1635-1642.

Fish, L., Mashau, A.C., Moeaha, M.J. & Nembudani, M.T. 2015. *Identification guide to southern African grasses: An identification manual with keys, descriptions and distributions*. Pretoria: South African National Biodiversity Institute.

Ford, R.I. 1979. Paleoethnobotany in American archaeology. *Advances in archaeological method and theory* 2: 285-336.

Fouché, L. 1937. *Mapungubwe ancient Bantu civilization on the Limpopo: Report on excavations at Mapungubwe (Northern Transvaal) from February 1933 to June 1935*. Cambridge: Cambridge University Press.

Fuller, D. Q., Stevens, C, and McClatchie, M. (eds). 2014. Routine activities, tertiary refuse, and labour organization: Social inferences from everyday archaeobotany. In (eds) Madella, M., Lancelotti, C. & Savard, M. *Ancient plants and people: Contemporary trends in archaeobotany*: 176-217. Tucson: The University of Arizona Press.

Fuller, D.Q. & Harvey, M.L. 2006. The archaeobotany of Indian pulses: Identification, processing and evidence for cultivation. *Environmental Archaeology* 11(2): 219-246.

Fuller, D.Q. 2006. *A Millet Atlas: Some Identification Guidance*. London: University College London (Unpublished).

Fuller, D.Q. 2007. Contrasting patterns in crop domestication and domestication rates: Recent archaeobotanical insights from the Old World. *Annals of Botany* 100: 903-924.

Fuller, D.Q., Allaby, R.G. & Stevens, C. 2010. Domestication as innovation: the entanglement of techniques, technology and chance in the domestication of cereal grains. *World Archaeology* 42(1): 13-28.

Fuller, D.Q., Nixon, S., Stevens, C.J. & Murray, M.A. 2014. African Archaeobotany Expanding: An Editorial In (eds) Stevens, C. J., Nixon, S., Murray, M. A., Fuller ,D. *Archaeology of African Plant Use*: 17-24. Walnut Creek: Left Coast Press Inc.

Gamitto, A.C.P. 1960. *King kazembe and the marave, cheva, bisa, bemba, lunda, and other peoples of southern africa: being the diary of the portuguese expedition to that potentate in the years 1831 and 1832*. Lisboa: Junta de investigações do Ultramar, Centro de estudo políticos e sociais (Estudos de ciências políticas e sociais, 42).

Gardner, C.A. 1963. *Mapungubwe Volume II: Report on Excavations at Mapungubwe and Bambandyanalo in Northern Transvaal from 1935 to 1940*. Pretoria: J.L. Van Schaik Limited.

Gardner, G.A. 1968. *Mapungubwe Volume 2: Report on excavations at Mapungubwe and Bambandyanalo in Northern Transvaal from 1935 to 1940*. Pretoria. Van Schaik.

Gibbs Russell, G.E., Watson, L., Koekemoer, L., Smook, N.P., Anderson, H.M. & Dallwitz, M.J. 1990. *Grasses of Southern Africa: an identification manual with keys, descriptions, distributions, classification, and automated identification and information retrieval from computerized data*. Pretoria: National Botanic Gardens/Botanical Research Institute.

Gosselain, O.P. 2016. To hell with ethnoarchaeology!. *Archaeological Dialogues* 23(2): 215-228.

Gould, R.A. 1982. A dialogue on the meaning and use of analogy in ethnoarchaeological reasoning. *Journal of Anthropological Archaeology* 1: 355-381.

Greenfield, H.J., Fowler, K.D., & van Schalkwyk, L.O. 2005. Where are the gardens? Early Iron Age horticulture in the Thukela River Basin of South Africa. *World Archaeology* 37(2): 307-328.

Gross, K. L. 1990. A comparison of methods for estimating seed numbers in the soil. *Journal of Ecology* 78(4): 1079–1093.

Guarino, C. and Sciarrillo, R. 2004 Carbonized seeds in a protohistoric house: results of hearth and house experiments. *Vegetation History and Archaeobotany* 13: 65-70.

Gumerman IV, G. 1997. Food and Complex Societies. *Journal of Archaeological Method and Theory* 4(2): 105-139.

Gustaffson, S. 2000. Carbonized cereal grains and weed seeds in prehistoric houses – an experimental perspective. *Journal of Archaeological Science* 27: 65-70.

Hahn, N. 2002. *Endemic Flora of the Soutpansberg*. MSc Dissertation. Pietermaritzburg: University of Natal.

Hahn, N. 2006. *Floristic diversity of the Soutpansberg, Limpopo Province, South Africa*. PhD Dissertation. Pretoria: University of Pretoria.

Hahn, N. 2011. Refinement of the Soutpansberg Geomorphic Province, Limpopo, South Africa. *Transactions of the Royal Society of South Africa* 66(1): 32-40.

Harlan, J.R. 1993. The tropical African cereals. In (eds) Shaw, I., Sinclair, P., Andah, B. & Okpoko, A. *The archaeology of Africa: Food, metals and towns*: 53-60. London: Routledge.

Hastorf, C.A. 1988. The use of paleoethnobotanical data in prehistoric studies of crop production, processing, and consumption. In (eds.) Hastorf, C.A. & Popper, V.S. *Current paleoethnobotany: Analytical methods and cultural interpretations of archaeological plant remains*: 119-144. Chicago: The University of Chicago Press.

Hastorf, C.A. 1999. Recent Research in Paleoethnobotany. *Journal of Archaeological Sciences* 7 (1): 55-103.

Hilu, K.W., de Wet, J.M.J. & Harlan, J.R. 1979. Archaeobotanical studies of *Eleusine coracana* ssp. *Coracana* (Finger millet). *American Journal of Botany* 66(3): 330-333.

Hubbard, R.N.L.B. & al Azm, A. Quantifying preservation and distortion in carbonized seeds; and investigating the history of friké production. *Journal of Archaeological Science* 17 (1): 103-106.

Hubbard, R.N.L.B. & Clapham, A. 1992. Quantifying macroscopic plant remains. *Review of Palaeobotany and Palynology* 73: 117-132.

Hubbard, R.N.L.B. 1980 Development of Agriculture in Europe and the near East: Evidence from Quantitative Studies. *Economic Botany* 34(1): 51-67.

Huffman, T.N. 1971. Cloth from the Iron Age in Rhodesia. *Arnoldia* 5(14): 1-19.

Huffman, T.N. 1978. The origins of Leopard's Kopje: An 11<sup>th</sup> century difaquane. *Arnoldia* 8(23): 1-23.

Huffman, T.N. 1982. Archaeology and Ethnohistory of the African Iron Age. *Annual Review of Anthropology* 11(1): 133-150.

Huffman, T.N. 1984. Leopard's Kopje and the nature of the Iron Age in Bantu Africa. *Zimbabwea* 1: 28-35.

Huffman, T.N. 1986. Iron Age settlements and the origins of class distinction in southern Africa. *Advances in World Archaeology* 5: 291-331.

Huffman, T.N. 1996. Archaeological evidence for climate change during the last 2000 years in southern Africa. *Quaternary International* 33: 55-60.

Huffman, T.N. 2000. Mapungubwe and the origins of the Zimbabwe Culture. *Goodwin Series* 8: 14-29.

Huffman, T.N. 2001. The Central Cattle Pattern and interpreting the past. *Southern African Humanities* 13: 19-35.

Huffman, T.N. 2007. *Handbook to the Iron Age: The archaeology of pre-colonial farming societies in southern Africa*. University of Kwazulu-Natal Press: Johannesburg.

Huffman, T.N. 2008. Climate change during the Iron Age in the Shashe-Limpopo Basin, southern Africa. *Journal of Archaeological Science* 35: 2032-2047.

Huffman, T.N. 2009. Mapungubwe and Great Zimbabwe: The origin and spread of social complexity in southern Africa. *Journal of Anthropological Archaeology* 28(1): 37-54.

Huffman, T.N. 2010. Mapungubwe and the origins of the Zimbabwe culture *Goodwin Series* 8: 14-29.

Huffman, T.N. & Woodborne, S. 2016. Archaeology, Baobabs and drought: Cultural proxies and environmental data from the Mapungubwe landscape, southern Africa. *The Holocene* 26(3): 464 – 470.

Hunter, A.A. & Gassner, B.R. 1998. Evaluation of the Flote-Tech Machine-Assisted flotation system. *American Antiquity* 63(1): 143-156.

Kabanda, T.A. Climate. In (eds) Berger, K, Crafford, J.E., Gaigher, I., Gaigher, M.J., Hahn, N. & Macdonald, H.I. 2003. *A first synthesis of the environmental, biological and cultural assets of the Soutpansberg*: 10-11. Louis Trichardt: Leach Printers and Signs.

Kaboré, D., Sawadogo-Lingani, H., Diawara, B., Compaoré, C.S., Dicko, & Jakobsen, M. 2011. A review of baobab (*Adansonia digitata*) products: Effects of processing techniques, medicinal properties and uses. *African Journal of Food Science* 5(16): 833-844.

Kay, D.E. 1979. *Crop and Product Digest No. 3 - Food legumes*. Tropical Products Institute: London.

Keeley, H.C.M. 1978. The cost-effectiveness of certain methods of recovering macroscopic organic remains from archaeological deposits. *Journal of Archaeological Science* 5: 179-183.

Klapwijk, M. & Huffman, T.N. 1996. Excavations at Silver Leaves: A final report. *South African Archaeological Bulletin* 51: 84-93.

Koekemoer, M., Steyn, H.M. & Bester, S.P. 2014. *Guide to plant families of southern Africa*. South African National Biodiversity Institute: Pretoria.

Krige, E.J. 1937. Note on the Phalaborwa and their Morula complex. *Bantu Studies* 11(1): 357-366.

Lee, G. 2004. Sample-Size Estimation and Interassemblage Quantification in Archaeobotany. In (eds) Madella, M., Lancelotti, C and Savard, M. *Ancient Plants and People*: 9-25. Arizona: The University of Arizona Press.

Lennstrom, H.A. & Hastorf, C.A. 1992. Testing Old Wives' Tales in Paleoethnobotany: A Comparison of Bulk and Scatter Sampling Schemes from Pancán, Peru. *Journal of Archaeological Sciences* 19: 205-229.

Lennstrom, H.A. & Hastorf, C.A. 1995. Interpretation in context: Sampling and analysis in Paleoethnobotany. *American Antiquity* 60 (4): 701-721.

Lestrade, G.P. 1937. Domestic and communal life. In (ed). Schapera, I. *The Bantu Speaking Tribes of South Africa*: 119-130. London: George Routledge & Sons.

Loubser, J.N.H. 1988. *Archaeological Contributions to Venda Ethnohistory*. Unpublished PhD Dissertation. Johannesburg: University of Witwatersrand.

Loubser, J.N.H. 1988. *Archaeological contributions to Venda Ethnohistory*. Unpublished PhD dissertation. Johannesburg: University of Witwatersrand.



Lyumugabe, F., Gros, J., Nzungize, J., Baljyana, E., & Thonart, P. 2012. Characteristics of African traditional beers brewed with sorghum malt: A review. *Biotechnology, Agronomy, Society and Environment Journal* 16(4): 509-530.

Maanda, M.Q. & Bhat, R.B. 2010. Wild vegetable use by the Vhavenda in the Venda region of Limpopo Province, South Africa. *International Journal of Experimental Botany* 79: 189-197.

Mabogo, D.E.N. 1990. *The Ethobotany of the Vhavenda*. Unpublished Masters Dissertation. Pretoria: University of Pretoria.

Maggs, T. 1984. The Iron Age south of the Zambezi. In (ed) Klein, R.G. *Southern African Prehistory and Paleoenvironments*: 329-360. Balkema: Francis & Taylor.

Manning, K., Pelling, R., Higham, T., Schwenniger, J., & Fuller, D.Q. 2011. 4500-Year old domesticated pearl millet (*Pennisetum glaucum*) from the Tilemsi Valley, Mali: New insights into an alternative cereal domestication pathway. *Journal of Archaeological Science* 38: 312-322.

Manyanga, M. 2006. *Resilient landscapes: Socio-environmental dynamics in the Shashi-Limpopo Basin, southern Zimbabwe c. AD 800 to the present*. Unpublished PhD Dissertation. Uppsala University.

Meyer, A. 1998. *The archaeological sites of Greefswald: Stratigraphy and chronology of the sites and a history of investigations*. Pretoria. University of Pretoria.

Meyer, A. 2000. K2 and Mapungubwe. *Goodwin Series* 8: 4-13.

Meyer, A. and Cloete, C.E. 2010. Architectural traditions of Mapungubwe and Bambandyanalo (K2). *The Journal of Transdisciplinary Research in Southern Africa* 6(1): 241-270.

Miller, C.E. & Sievers, C. 2012. An experimental micromorphological investigation of bedding construction in the Middle Stone Age of Sibudu, South Africa. *Journal of Archaeological Science* 39: 3039–3051.

Miller, N.F. Ratios in Paleoethnobotanical Analysis.. In (eds) C.A. Hastorf, and V.S. Popper. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*: 72-85. Chicago: The University of Chicago Press.

Minnis, P. E. 1985. *Social adaptation to food stress: A prehistoric southwestern example*. Chicago: University of Chicago Press.

Minnis, P.E. 1981. Seeds in Archaeological Sites: Sources and Some Interpretive Problems. *American Antiquity* 46 (1): 143-152.

Mitchell, P. 2010. *The archaeology of southern Africa*. Cambridge University Press: Cape Town.

Mokgolodi, N.C. 2011. *Ziziphus mucronata*: An underutilized traditional medicinal plant in Africa. *Forestry Studies in China* 13(3): 163-173.

Moll, E. 2011. *What's that tree?: A starter's guide to trees of southern Africa*. Cape Town: Struik Nature.

Morin, E. Beyond stratigraphic noise: Unravelling the evolution of stratified assemblages in faunal-turbated sites. *Geoarchaeology: An International Journal* 21(6): 541-565.

Mostert, H.C., Bredenkamp, G.J., and Mostert, R.E. 2009. Plant communities of the Soutpansberg Arid Northern Bushveld. *KOEDOE* 51 (1): 1-11.

Mostert, T.H.C. 2006. *Vegetation ecology of the Soutpansberg and Blouberg in the Limpopo Province*. Unpublished PhD Dissertation. Pretoria: University of Pretoria.

Mostert, T.H.C., Bredenkamp, G.J., Klopper, H.L., Verway, G., Mostert, R.E. & Hahn, N. 2008. Major Vegetation Types of the Soutpansberg Conservancy and the Blouberg Nature Reserve, South Africa. *Koedoe* 50(1): 32-48.

Mostert, T.H.C., Bredenkamp, G.J. & Mostert, R.E. 2009. Plant communities of the Soutpansberg Arid Northern Bushveld. *Koedoe* 51(1): 1-11.

Murimbika, M. 2006. *Sacred powers and rituals of transformation: An*

*ethnoarchaeological study of rainmaking rituals and agricultural productivity during the evolution of the Mapungubwe state, AD 1000 to AD 1300.* Unpublished PhD Dissertation. University of Witwatersrand.

Nagendra, I.F. 2002. Opposite trends in response for the Shannon and Simpson indices of landscape diversity. *Applied Geography* 22: 175-186.

National Academy of Sciences. 1996. *Lost crops of Africa: Volume 1 Grains.* Washington, D.C.: National Academy Press.

Neumann, K, Kahlheber, S. & Uebel, D. 1998. Remains of woody plants from Saouga, a medieval west African village. *Vegetation History and Archaeobotany* 7: 57-77.

Nwonwu, F.O.C. 2006. The socio-cultural and economic relevance of the Marula tree in South Africa. *Africa Insight* 36(3 & 4): 249-265.

O'Connor, T.G. and Kiker, G.A. 2004. Collapse of the Mapungubwe society: Vulnerability of pastoralism to increasing aridity. *Climate Change* 66: 49-66.

Orton, C. 2000. *Sampling in Archaeology.* Cambridge: Cambridge University Press.

Owuama, C. 1999. Brewing beer with Sorghum. *Journal of the Institute of Brewing* 105(1): 23-34.

Palmer, C. and Van der Veen, M. 2002. Archaeobotany and the social context of food. *Acta Paleobotanica* 42(2): 195-202.

Pearsall, D.M. 1988. Interpreting the meaning of macroremain abundance: The impact of source and context. In (eds) Hastorf, C.A. & Popper, V.S. *Current Paleoethnobotany: Analytical methods and cultural interpretations of archaeological plant remains:* 97-118. Chicago: The University of Chicago Press.

Pearsall, D.M. 2015. *Paleoethnobotany: A Handbook of Procedures.* Walnut Creek: Left Coast Press.

Phillipson, D.W. 2008. *African Archaeology.* Cape Town: Cambridge University Press.

Picton, J. and Mack, J. 1989. *African textiles.* Hong Kong: Harper & Row.

Pikirayi, I. 2001. *The Zimbabwe Culture: Origins and decline of southern Zambezi states.* Walnut Creek: AltaMira Press.

Popper, V., Hastorf, A. Introduction. In (eds) Hastorf, C.A. & V.S. Popper. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*: 1-16. Chicago: The University of Chicago Press.

Popper, V.D. 1988. Selecting Quantitative Measurements in Paleoethnobotany. In (eds) Hastorf, C.A. & V.S. Popper. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*: 53-71. Chicago: The University of Chicago Press.

Purseglove, J.W. 1976. Millets. In (ed) Simmonds, N.W. *Evolution of crop plants*: 91-92. London: Longman.

Quin, P.J. 1959. *Foods and Feeding Habits of the Pedi*. PhD Dissertation. Johannesburg: University of Witwatersrand.

Radhouane, L. 2013. The evolutionary of *Pennisetum glaucum*. *Nyame Akuma* 80: 115-123.

Rampedi, I.T. 2010. *Indigenous plants in the Limpopo Province: Potential for their commercial beverage production*. Unpublished PhD. Pretoria: University of Pretoria.

Reddy, S.N. 1998. Fuelling the hearths in India: the role of dung in paleoethnobotanical interpretation. *Paléorient* 24(2): 61-69.

Reeves, R.G. 1936. Comparative Anatomy of the Seeds of Cottons and Other Malvaceous Plants. II. Hibisceae. *American Journal of Botany* 23 (6): 394-405.

Reid, A. & Young, R. 2000. Pottery abrasion and the preparation of African grains. *Antiquity* 74: 101-111.

Renfrew, J.M. 1973. *Paleoethnobotany: The prehistoric food plants of the Near East and Europe*. New York: Columbia University Press.

Ross, J.H. 1981. An analysis of the African *Acacia* species: Their distribution, possible origins and relationships. *Bothalia* 13(3 & 4): 389-413.

Schapera, I. and Goodwin, A.J.H. 1962. Work and wealth. In (ed) Schapera, I. *The Bantu Speaking Tribes of South Africa*: 131-171. London: George Routledge & Sons.

Schmidt, P.R. 1983. An alternative to a strictly materialistic perspective: A review of historical archaeology, ethnoarchaeology, and symbolic approaches in African. *American Antiquity* 48(1): 62-79.

Schoeman, M.H. 2006. *Clouding power?: Rain-control, space, landscapes and*

*ideology in Shashe-Limpopo state formation*. Unpublished PhD Dissertation. University of Witwatersrand.

Schoeman, M.H. 2009. Excavating the ‘waterpits in the mountain’: The archaeology of Shashe Limpopo Confluence Area rain-hill rock tanks. *Southern African Humanities* 21: 275-298.

Schortman, E.M. & Urban, P.A. 2004. Modelling the roles of craft production in ancient political economies. *Journal of Archaeological Research* 12(2): 185-226.

Scott, C. 2005. *Analysis and Interpretation of Botanical Remains from Sibudu Cave, Kwazulu-Natal*. Unpublished PhD Dissertation. Johannesburg: University of Witwatersrand.

Sievers, C. & Muasya, A.M. 2011. Identification of the sedge *Cladium mariscus* subsp. *jamaicense* and its possible use in the Middle Stone Age at Sibudu, KwaZulu-Natal. *Southern African Humanities* 23: 77–86.

Sievers, C. & Wadley, L. 2008. Going underground: experimental carbonization of fruiting structures under hearths. *Journal of Archaeological Science* 35: 2909–2917.

Sievers, C. 2006. Seeds from the Middle Stone Age layers at Sibudu Cave. *Southern African Humanities* 18(1): 203–222.

Sievers, C. 2011. Sedges from Sibudu, South Africa: evidence for their use. In (eds) Fahmy, A.G., Kahlheber, S. & D’Andrea, A.C. *Windows on the African Past: Current Approaches to African Archaeobotany*: 225-241. Frankfurt: Africa Magna Verlag.

Sievers, C. 2013. *Sedges as bedding in Middle Stone Age Sibudu*. Unpublished PhD Dissertation. Johannesburg: University of Witwatersrand.

Smith, J., Lee-Thorp, J. and Hall, S. 2007. Climate change and agropastoralist settlement in the Shashe-Limpopo River Basin, southern Africa: AD 880 to 1700. *The South African Archaeological Bulletin* 62(186): 115-125.

Smith, J. 2005. *Climate Change and Agropastoral Sustainability in the Shashe/Limpopo River Basin*. Unpublished PhD Dissertation. Johannesburg: University of Witwatersrand.

Sobolik, K.D. 2003. *Archaeobiology*. Walnut Creek: AltaMira Press.

Spellerberg, I.F. & Fedor, P.J. 2003. A tribute to Claude Shannon (1916-2001) and a plea for more rigorous use of species richness, species diversity and the ‘Shannon-Wiener’ index. *Global Ecology and Biogeography* 12: 177-179.

Stayt, .A. 1968. *The Bavenda*. London: Frank Cass & Co.

Stiles, D. 1977. Ethnoarchaeology: A discussion of the methods and applications. *Man* 12(1): 87-103.

Struever, S. 1968. Flotation techniques for the recovery of small-scale archaeological remains. *American Antiquity* 33: 353-362.

Tarboton, W. 2003. Dragonflies. In (eds) Berger, K, Crafford, J.E., Gaigher, I., Gaigher, M.J., Hahn, N. & Macdonald, H.I. *A first synthesis of the environmental, biological and cultural assets of the Soutpansberg*: 43-44. Louis Trichardt: Leach Printers and Signs.

Toll, M. S. 1988. Flotation sampling: Problems and some solutions, with examples from the American Southwest. In (eds) Hastorf, C.A. & V.S. Popper. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*: 36-51. Chicago: The University of Chicago Press.

Twiss, K.C. Home is where the hearth is: Food and identity in Neolithic Levant. In (ed)Twiss, K. C. *The archaeology of food and identity*: 50-68. Illinois: Southern Illinois University.

Tyson, P.D. and Lindsay, J.A. 1992. The climate of the last 2000 years in southern Africa. *The Holocene* 2: 271-278.

Uphof, J.C. 1959. *Dictionary of economic plants*. New York: Hafner Publishing Co.

Van der Veen, M. & Fieller, N. 1982. Sampling seeds. *Journal of Archaeological Science* 9: 287-298.

Van der Veen, M. 2007. Formation processes of desiccated and carbonized plant remains – the identification of routine practise. *Journal of Archaeological Science* 34: 968-990.

Van der Waal, C.S. 1977. *Die woning en woonwyse onder die Venda*. Unpublished MA dissertation. Pretoria: University of Pretoria.

Van Oudtshoorn, F. 2014. *Guide to grasses of southern Africa*. Pretoria: Briza Publications.

Van Warmelo, N.J. 1960. *Contributions towards Venda history, religion and tribal ritual*. Pretoria: Government Printer.

Van Wolputte, S. & Fumanti, M. 2010. Beer and the making of boundaries. In (eds) Van Wolputte, S & Funati, M. *Beer in Africa: Drinking spaces, states and selves*: 1-

27. Münster: LIT Verlag.

Van Wyk, B., Van Oudtshoorn, B. & Gericke, N. *Medicinal plants of South Africa*. Pretoria: Briza Publications.

Van Wyk, B. & Gericke, N. 2000. *People's Plants*. Pretoria: Briza Publications.

VanDerwarker, A.M., Bardolph, D.N., Hoppa, K.M., Thakar, H.B. Martin, L.S., Joqua, A.L, Biwer, M.E. & Gill, K.M. 2016. New World paleoethnobotany in the new millennium (2000 – 2013). *Journal of Archaeological Science* 24(2): 125-177.

Venier, P., Carrizo García, C., Cabido & M., Funes, G. 2012. Survival and germination of three hard-seeded *Acacia* species after simulated cattle ingestion: The importance of the seed coat structure. *South African Journal of Botany* 79: 19-24.

Vogel, J.C. 2000. Radiocarbon dating of the Iron Age sequence in the Limpopo Valley. *Goodwin Series* 8: 51-57.

Von Teichman, I. & Robbertse, P.J. 1980. Development and Structure of the Drupe in *Sclerocarya birrea* (Richard) Hochst. Subsp. *caffra* Kokwaro (Anacardiaceae), with special reference to the pericarp and the operculum. *Botanical Journal of the Linnean Society* 92: 303-3223.

Von Teichman, I., Small, J.G.C. & Robbertse, P. 1986. A preliminary study on the germination of *Sclerocarya birrea* subsp. *caffra*. *South African Journal of Botany* 52 (2): 145-148.

Von Teichman, I. 1988. Notes on the Ontogeny and Structure of the Seed-Coat of *Sclerocarya birrea* (Richard) Hochst. Subsp. *caffra* (Sonder) Kokwaro (Anacardiaceae). *Botanical Society of the Linnean Society* 98: 153-158.

Wadley, L., Sievers, C., Bamford, M., Goldberg, P., Berna, F., & Miller, C. 2011. Middle Stone Age bedding construction and settlement patterns at Sibudu, South Africa. *Science* 334: 1388–1391.

Wagner, G.E. 1988. Comparability among recovery techniques. In (eds) Hastorf, C.A. & V.S. Popper. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*: 17-35. Chicago: The University of Chicago Press.

Watson, P.J. 1976. In pursuit of prehistoric subsistence: A comparative account of some contemporary flotation techniques. *Midcontinental Journal of Archaeology* 1(1): 77-100.

Willis, J. 2002. *Potent brews: A social history of alcohol in East Africa 1850 – 1990*. Woolnough: British Institute in Eastern Africa.

Wintjes, J. & Sievers, C. 2006. Seeing Sibudu seeds: an illustrated text of the more frequent Middle Stone Age stones, nuts and seeds. *Southern African Humanities* 18(1): 223–233.

Wood, W.R. & Johnson, D.L. 1978. A survey of disturbance processes in archaeological site formation. In M.B. Schiffer. *Advances in archaeological method and theory: Volume 1*: 315-381. Tucson: Academic Press.

Wright, P.J. 2005. Flotation samples and some paleoethnobotanical implications. *Journal of Archaeological Science* 32: 19-26.

Xaba, P. 2008. Sorghum. *Veld and Flora*: 224-225.

## Sites used

---

---

Foden, W. & Potter, L. 2005. *Ziziphus zeyheriana* Sond. National Assessment: Red List of South African Plants. Viewed October 2018, from <http://redlist.sanbi.org/species.php?species=4058-8>

Latti, I. No date. *Ziziphus zeyheriana*. Viewed October 2018, from <https://www.operationwildflower.org.za/index.php/albums/genera-q-z/ziziphus/ziziphus-zeyheriana-il-7-5404?fbclid=IwAR17DpI6pcNrNf3-Zrcq0EXKJvKfF4R8Qxwtk3JQy-jXdu8bshEzYNGxktU>

Macaskill, C. 2018. Cotton. Viewed October 2018, from <http://www.agrihandbook.co.za/index.php/book/forestry-industrial-crops/cotton?showall=1&limitstart=>

Theron, C.G. 2015. Needs of the Cotton plant, Viewed January 2018, from <http://cottonsa.org.za/2015/12/02/needs-of-the-cotton-plant/>

Ware, M. 2018. Health and nutritional benefits of baobab, Viewed July 2018, from



## Appendix A: Presence and absence in samples

Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon														
						1	2	3	4	4	6	7	8	9	10	11	12	13	14	
1	2013	110/185	2	IV	Floor contact (material on floor surface)	*	*					*	*	*	*				*	
2	2170	102/173	1	III	Midden, general	*	*													
3	2111/1	99/172	1	IV	Midden, general		*					*							*	
4	2037/1	100/172	1	IV	Midden, general	*	*						*	*					*	*
5	2089/1	101/171	1	III	Midden, general	*	*				*									
6	2002/1	111/184	2	III	General		*	*												
7	2178	103/173	1	IV	Pit fill - ash		*							*				*		



14	2194/1	100/173	1	V	Hearth (in-situ burnt area with well-defined limits)	*												*		*	
15	1066/1	99/158	12	I	Excavated surface collection														*	*	
16	2173	103/173	1	III	Pit fill - ash															*	
17	1175/1	112/182	2	IV	Burnt hut remains	*															
18	2118	111/184	2	IV	Floor contact (material on floor surface)	*	*				*	*								*	
19	1178/12	111/183	2	IV	Floor contact (material on floor surface)									*							
20	2176/1	103/173	1	IV	Pit fill - ash	*	*											*	*	*	

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified

Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon													
						1	2	3	4	4	6	7	8	9	10	11	12	13	14
21	2113/1	99/173	1	V	Unvitrified dung and ash		*										*	*	
22	1178/1	111/183	2	IV	Floor contact (material on floor surface)	*	*			*		*	*					*	*
23	2077	110/182	2	IV	Burnt hut remains	*	*		*		*	*	*		*			*	*
24	2175	103/173	1	IV	Floor contact (material on floor surface)											*	*	*	
25	2028	102/172	1	III	Surface outside structure	*					*	*			*		*	*	
26	1008/1	122/134	4	III	Midden, general													*	
27	2096/1	101/171	1	III	Gravel floor	*	*												
28	2117/1	100/172	1	V	Unvitrified dung and ash							*						*	



36	2189/1	102/172	1	V	Unvitrified dung and ash													*
37	2025/1	100/174	1	III	Midden, general	*												
38	1173/1	113/182	2	IV	Floor contact (material on floor surface)	*												*
39	2041/1	101/174	1	V	Floor contact (material on floor surface)	*	*											
40	2015/8	110/184	2	IV	Burnt hut remains		*					*						*

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified

Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon													
						1	2	3	4	4	6	7	8	9	10	11	12	13	14
41	2027/1	99/173	1	III	General	*	*												
42	2115/1	100/174	1	V	Unvitrified dung and ash	*	*												

43	2090	101/172	1	II	Midden, general	*													*	
44	2108	101/141	3	III	Unvitrified dung and ash		*												*	
45	1172	111/183	2	III	Midden, general														*	
46	1174/1	112/183	2	IV	Burnt hut remains		*												*	
47	2191/1	101/172	1	V	Unvitrified dung and ash		*												*	
48	2082/1	108/182	2	IV	Rocky fill (purposeful)	*														
49	1026/1	52/142	7	III	Midden, general														*	
50	2162/1	102/171	1	II	Midden, general	*	*											*	*	*

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified

Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon														
						1	2	3	4	4	6	7	8	9	10	11	12	13	14	
51	1119/1	105/169	13	II	Midden, general														*	

52	2163/1	100/172	1	I	Excavated surface collection														*
53	2083	108/182	2	IV	Burnt hut remains														*
54	2100	102/173	1	III	Gravel floor	*	*					*			*			*	*
55	2148	109/183	2	IV	Floor contact (material on floor surface)							*							
56	2003/1	111/184	2	III	Midden, general		*					*							*
57	2007	111/184	2	IV	Floor contact (material on floor surface)	*	*	*				*	*	*			*	*	*
58	2010/1	111/185	2	II	General	*	*					*	*	*				*	*
59	2019	199/174	1	I	Excavated surface collection														*
60	2167/4	101/173	1	III	Midden, general	*	*					*	*					*	*

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified



Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon														
						1	2	3	4	4	6	7	8	9	10	11	12	13	14	
71	1156	113/181	2	IV	Floor contact (material on floor surface)														*	
72	2186/1	99/171	1	IV	Midden, general										*					
73	2043/1	110/184	2	IV	Burnt hut remains		*													
74	1036	103/172	1	I	Excavated surface collection														*	
75	2101	102/172	1	III	Gravel floor											*				
76	2042	101/173	2	V	Floor contact (material on floor surface)															*
77	2081	108/182	2	III	Midden, general							*								
78	2182/1	101/171	1	IV	Midden, general		*												*	
79	2193/1	100/171	1	V	Unvitrified dung and ash		*												*	



88	2030	101/172	1	I	Excavated surface collection	*	*				*						*	
89	2026/1	99/174	1	III	Midden, general	*	*			*							*	
90	2086/1	99/171	1	II	Midden, general		*					*	*				*	

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified

Sample no.	Corresponding locus	North/ East	Feature/ Test pit	Level	Description	+Taxon														
						1	2	3	4	4	6	7	8	9	10	11	12	13	14	
91	2166/1	101/172	1	III	Midden, general	*	*								*	*			*	*
92	2092/1	100/171	1	II	Midden, general	*	*						*	*	*					
93	2035/1	101/174	1	IV	Midden, general	*							*						*	
94	2190/1	102/171	1	V	Unvitrified dung and ash	*	*					*							*	
95	2014/4	111/185	2	III	Midden, general	*	*					*	*	*						
96	2114/1	99/174	1	V	Unvitrified dung and ash	*	*								*		*	*		

97	2169/1	103/173	1	II	Floor contact (material on floor surface)	*	*									*	*	*	
98	2099	99/173	1	II	Midden, general													*	
99	2029	102/173	1	III	Floor contact (material on floor surface)	*	*											*	
100	2168/1	103/173	1	II	Midden, general		*						*	*				*	

+Taxon: 1. *Sorghum bicolor*, 2. *Pennisetum glaucum*, 3. *Eleusine coracana*, 4. *Brachiaria deflexa*, 5. *Brachiaria nigropedata*, 6. *Gossypium herbaceum*, 7. *Acacia* sp., 8. *Vigna radiata*, 9. *Vigna unguiculata*, 10. *Adansonia digitata*, 11. *Grewia* sp., 12. *Ziziphus zeyheriana*, 13. *Sclerocarya birrea*, 14. Unclassified

## Appendix B: Images

---

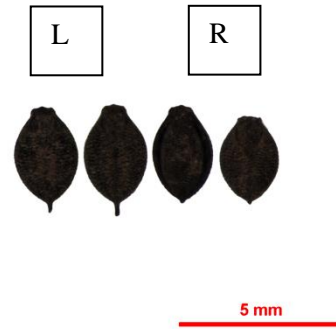
*Adansonia digitata*



*Acacia* sp.



*Brachiaria deflexa* (L) and *Brachiaria nigropedata* (R)



*Eleusine coracana*



1 mm

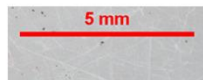


*Gossypium herbaceum*

5 mm



*Grewia* sp.



*Sclerocarya birrea* (L. Desiccated endocarp, R. Carbonised opercules)

L



5 mm



R



5 mm

*Vigna radiata*



*Vigna unguiculata*



5 mm

*Ziziphus zeyheriana*



5 mm

*Pennisetum glaucum*





*Sorghum bicolor*

