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An archaeobotanical study of multiple thirteenth century Mapungubwe era settlements in Limpopo, South Africa

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ABSTRACT

The Middle Iron Age (MIA), c, 900 to 1300 AD, is a period associated with agro-pastoralists, people who practiced agriculture and kept stock animals in north-east South Africa. Most of the studies on the MIA have been concerned with large sites in the Shashe Limpopo Confluence Area (SLCA) such as Mapungubwe. While an increasing number of studies are looking at MIA sites outside the SLCA, little is known about how agriculture was managed or which wild plants were exploited during the MIA.

The limited research that has been undertaken on MIA agriculture has largely been focused on using macrobotanical material which is dependent on fire for preservation. It is unknown whether phytoliths were preserved at MIA sites (Biagetti 2020, *pers. comm*). As such, this dissertation examined three MIA sites Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074) located in the Limpopo Province of South Africa in order to first, ascertain the presence of phytoliths at MIA sites, and second, to determine agricultural practices and third, to determine if there is any differences in wild taxa utilised.

Analysis on phytolith material found that phytoliths were present at each of the three sites. Analysis of macrobotanical material found a wide variety of crop and wild taxa at the sites. It was theorized that two of the sites, Mutamba (MUT) and Vryheid (MNR 04) practiced floodplain and dryland agriculture while the Frampton 1 (MNR 074) was most likely a temporary stock post. A number of wild taxa was also identified at the sites. These taxa held

multiple purposes (food, medicine etc.). Overall, there does not appear to be an overwhelming difference of wild taxa utilised at these three sites.

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Chapter 1

Introduction

The north-east region of southern Africa has long been the focus of research on the rise and development of complex societies (See Fouché 1937; Gardner 1955; Meyer 1998; Calabrese 2005; Huffman 2007). In southern Africa, agro-pastoralists farming communities are associated with the Iron Age period. Of specific interest is the period between c. 900 and 1300 AD, referred to as the Middle Iron Age (MIA). First coined by T Huffman (2007: xi) the MIA is limited to the archaeological record of northern South Africa, southern Zimbabwe and eastern Botswana where there are rapid changes in social stratification, steep population increase, and the development of class-based society at that time.

The MIA settlement known as Mapungubwe (1220 – 1270 AD), is regarded as the capital of the earliest state level society in southern Africa (Huffman 2000, 2007; Meyer 1998). At the height of its power, Mapungubwe is thought to have had a population of at least 5000 (Huffman 2000, 2009). The population increase of the time (1200 to 1250 AD) corresponds to a climatic event, the Medieval Warm Epoch, in which the climate of the period was warm and wet, ideal for agriculture (Huffman 1996; Smith 2005). However, by 1280 AD Mapungubwe is in decline. Huffman (1996, 2008) suggested that a possible cause of the decline can be attributed to an episode of climate change known as the Little Ice Age which left settlement unstable as rainfall decreased to below agriculturally feasible levels. However, more recent research on drylands within the region suggests that communities living in these areas were able to mitigate and maintain food security in the "face of environmental and climatic adversities" via their ability to advantageously adapt and utilize various resources (Nyamushosho *et al*. 2018: 239).

1.1 Archaeobotany of the MIA

The people living during the MIA were agro-pastoralists, i.e., they raised stock and planted crops. However, very little is known about the agriculture practised and the plants used during this time as knowledge of crops cultivated, agricultural systems or plant use, in general, is limited, largely owing to the lack of physical empirical evidence (see Hattingh 2018). The research undertaken herein is focused on agriculture and wild plant use in an area downriver from the SLCA, located in the northern Soutpansberg Mountain and within the Maremani Nature Reserve.

The premise underlying this research is that agriculture played a vital role in many MIA communities. Huffman (2007) asserted that agriculture determined the location and layout of settlements and impacted the surrounding regional vegetation. The rise in population is also thought to have placed a strain on agricultural production. Demographic calculations indicate that agricultural production needed to increase its output to support this burgeoning population and areas chosen for agriculture would need to have held sufficient water for domestic purposes as well as arable soil for crops (*cf.* Du Piesanie 2008; Huffman 2000, 2007; Mitchell 2002; Smith 2005).

Because there is little data currently available on crops, agricultural practices, or wild plant utilisation during the MIA (Smith 2005; Steyn 2018; Uys 2018), little attention has been paid to how agricultural production was managed to meet the increasing demands of a growing population. A few limited attempts have been made to establish potential crop packages and wild plant utilisation at MIA settlements (Steyn 2018, Uys 2018; Steyn & Antonites 2019; Steyn et al. 2024). However, these studies are limited in number and have largely been reliant on macro-botanical material, usually in a carbonised form.

Where macrobotanical material is not present, microbotanical material such as phytoliths can be advantageous in establishing the potential presence of agriculture and plant utilisation at a site (Pearsall 2015; Piperno 2006, Hattingh 2018). Whilst phytolith analysis has been employed in studies internationally to determine the presence of crop and wild taxa (Pearsall & Trimble 1984; Bates *et al*. 2016; Buffington 2019), it has seen limited application within southern African archaeological studies with only the Late Iron Age (*c*. 1300 to 1840 AD), having seen any implementation of this form of analysis (Hattingh 2013, 2018). It is therefore not certain whether phytoliths from the MIA survived preservation in the archaeological record (Biagetti 2020, *pers. comm*). As such, this research will present the archaeobotanical results of analysis undertaken on material excavated from three MIA archaeological sites with a focus on agriculture and wild plant utilisation.

As a result, this research is organized around the following objectives:

- to establish what cultivation strategies were implemented at MIA archaeological settlements.
- to determine whether there is a discernable difference between the wild taxa identified at each of the sites.
- to verify the presence/ survival of phytoliths at MIA sites.

1.2. Dissertation structure

Chapter two provides information regarding the research area from its ecological information to archaeological research undertaken at the sites. Chapter three presents information regarding the archaeological history of the SLCA from its settlement by hunter-gatherers to MIA agro-pastoralists. Chapter four is a review of phytolith theory. Chapter five outlines the methodology employed in the extraction/ retrieval, analysis and identification of macrobotanical and phytolith materials. Chapters six and seven present the results of the macrobotanical and phytolith analysis undertaken on the archaeobotanical materials. The final chapter will discuss agriculture and the wild plants at the three sites and provide concluding remarks.

CHAPTER 2

Research Area

The research area is a combination of two locales located in the Limpopo Province of South Africa. The first locale is the archaeological site of Mutamba (MUT), which is situated on the northern slope of the Soutpansberg Mountain. The second locale has two sites, Vryheid (MNR 04) and Frampton 1 (MNR 074), both within the boundaries of the Maremani Nature Reserve. Mutamba (MUT) is located 120 km south of Mapungubwe whilst Vryheid (MNR 04) and Frampton 1 (MNR 074) are 80 km east of Mapungubwe.

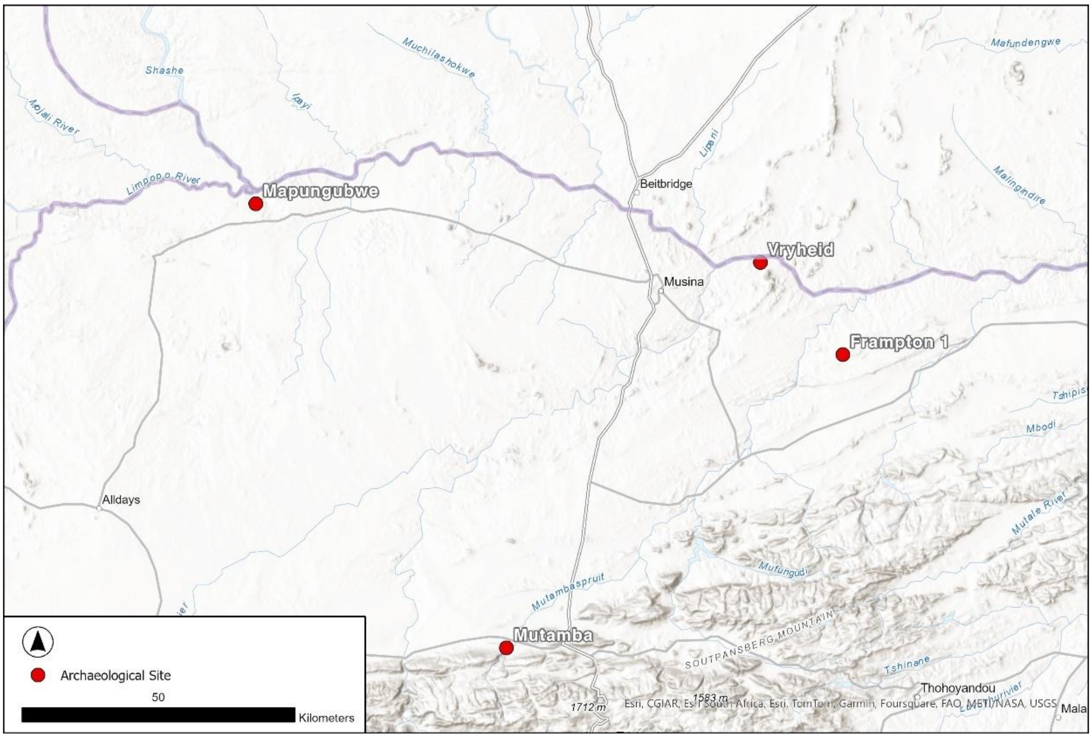


Figure 2.1 Map indicating site locations

2.1. Climate

2.1.1. Frampton 1 (MNR 074) and Vryheid (MNR 04)

The landscape of the Maremani Nature Reserve is characterised by a combination of plains, hills, rocky outcrops, high mountain ranges and several rivers and temporary streams (Van Rooyen 2002). The reserve has a semi-arid environment with annual rainfall rarely exceeding 340 mm (van Rooyen 2002). More than 80 % of the annual rainfall falls during the rainy season which lasts from October to March. The dry season lasts from June to August. The rate of evaporation tends to exceed the amount of rainfall received. Temperatures tend towards the extreme with highs of 43º C in summer and lows of 2ºC in winter (van Rooyen 2002). The area does not experience frost.

2.1.2. Mutamba (MUT)

The site is located on the northern slope of the Soutpansberg Mountain. In general topography, altitude and seasonal circumstances bear an influence on temperatures in the Soutpansberg. Seasons are either warm and wet or cool and dry. The warm and wet season lasts from December to February with a temperature variation of between 16°C and 40°C while the cool and dry season is from May to August with temperatures ranging from 12°C to 22°C (Kabanda 2003). The area falls within southern Africa's summer rainfall zone and has a single cycle of rainfall lasting from October to March, roughly 182 days (Kabanda 2003; Mostert 2006; Mostert *et al*. 2008). The orographic rainfall is primarily due to moisture precipitating against the eastern slope of the Drakensberg Mountain and the southern slope of the Soutpansberg (Hahn 1996; Kabanda 2003; Mostert 2006). This restricted movement of atmospheric moisture results in the Soutpansberg's southern slope receiving an unusually high rainfall of up to 2000mm annually (Kabanda 2003; Mostert 2006). In comparison, the northern slope, where

Mutamba is located, is somewhat arid and intermittently undergoes droughts (Kabanda 2003; Mostert 2006; Hahn 2018). The northern slope experiences a rain-shadow effect due to the high precipitation on the southern slopes.

2.2. Drainage

2.2.1. Frampton 1 (MNR 074) and Vryheid (MNR 04)

Within the reserve there are three drainage systems, these being the Limpopo, the Sand, and the Nzhelele Rivers. The Nzhelele River rises in the Soutpansberg where the upper reaches of its systems are perennial (Lombaard *et al*. 2015). At present, the flow of the river is restricted by the Nzhelele Dam (Barton 2002). The Sand River rises near Mokopane, flowing in a northern direction across the Limpopo Province after which it cuts through the Soutpansberg, via the Waterpoort gorge. Thereafter it meanders across the Lowveld before joining the Limpopo River. Habitation sites along its banks indicate that it was once perennial (Barton 2002). Contemporary damming practices have caused the river to only flow during times of flooding, but a large flood in 2000 destroyed all the dams, which allowed the river to flow naturally again (Barton 2002).

Vryheid (MNR 04) is located 5 km east of the Sand River and 3 km south of the Limpopo while Frampton 1 (MNR 074) is 4.5 km from the Nzhelele. During the rainy season, non-perennial rivers form closer to the sites.

2.2.2. Mutamba (MUT)

All the rivers which flow through the Soutpansberg Mountain are tributaries of the Limpopo River (Hahn 2011). These rivers are the Hout, Mutale, Mutamba, Levhuvu, Ndwanedzi, Sand

and Nzhelele. The Levhuvu River is the largest river that originates from the mountain (Hahn 2011). The closest river to the site is the Mutamba, which is less than 300 m directly below the site. The river then flows north for 12 km before joining the Nzhelele River.

2.3. Vegetation

2.3.1. Frampton 1 (MNR 074) and Vryheid (MNR 04)

The reserve falls within the Mopane Bushveld vegetation type (Low &Rebelo 1998). Seventeen plant communities have been identified in the reserve (Appendix A). These communities are influenced by drainage, topography, previous land use, slope, soil etc (van Rooyen 2002). These plant communities are divided into six primary vegetation types:

1. Rocky outcrops: This vegetation type is characterised by *Ficus tettensis*, *Ficus abutifolia*, *Commiphora marlothii* and *Danthoniopsis dinteri.*
2. Mopane veld: Characterised by *Colophospermum mopane, Terminalia prunioides, Kirkia acuminata, Combretum apiculatum, Gardenia resiniflua* and *D. dinteri.* This vegetation type is further divided into two sub-types: Mopane bushveld and Mopane woodland.
3. Low Mopane bushveld and thickets. Characterised by *C. mopane, Boscia foetida, Rhogozum zambesiacum, Catophractes alexandri, Sesamothamnus lugardii, Salvadora australis, Tetrapogon tenellus* and *Monechma divaricatum.*
4. Mopane thickets and forests (species poor): Found along lowlands, streams, rivers and ravines. Characterised by *C. mopane, T. prunioides* and *Boscia albitrunca.*
5. Disturbed areas: Refers to kraals, old fields, overgrazed veld etc. Characterised by *Vachellia tortilis* and *Dichrostachys cinerea.*

6. Riverine communities: Found along alluvial *floodplains*. Characterised by *Combretum imberbe, Philenoptera violacea, Xanthocercis zambesiaca, Hyphaene coriacea* and *Cyperus sexangularis.*

2.3.2. Mutamba (MUT)

The Soutpansberg Mountain contains several vegetation types, ranging from semi-desert Mopane shrubland in the north to Afro-montane forests in the south (Hahn 2006). Hahn (2006) stated that a delineation of each vegetation type is difficult owing to the seamless and continuous integration of vegetation types. The Soutpansberg supports up to 3000 vascular plant taxa comprised of 1023 genera and 239 families, of which 19 taxa are endemic to the Soutpansberg (Hahn 1994; 2011). Mostert *et al.* (2008) identified eight Major Vegetation Types or MVT's (Table 2.4).

Table 2.1. Soutpansberg MVT

Major Vegetation Type	Major Vegetation Species
Blouberg Northern Plains Bushveld	*Eragrostis lehmanniana* var. *lehmanniana–Sclerocarya birrea* subsp. *caffra*
Blouberg Southern Plains Bushveld	*Euclea divinorum–*Vachellia *tortilis*
Blouberg Mountain Bushveld	*Englerophytum magalismontanum–Combretum mole*
Soutpansberg Arid Northern Bushveld	*Adansonia digitata–Senegalia nigrescens*
Soutpansberg Moist Mountain Thickets	*Catha edulis–Flueggia virosa*
Soutpansberg Leached Sandveld	*Diplorhynchus condylocarpon–Burkea africana*
Soutpansberg Mistbelt Vegetation	*Rhus rigida* var. *rigida–Rhus magalismontanum* subsp. *coddii*
Soutpansberg Forrest Vegetation	*Xymalos monospora–Rhus chirendensis*

The vegetation surrounding Mutamba falls within the Soutpansberg Arid Northern Bushveld (Mostert *et al*. 2008; Mostert *et al*. 2009). This MVT is confined to the rain-shadowed northern ridges of the mountain. The majority of vegetation communities in this particular MVT is allied with an assortment of edaphic and topographical conditions with the vast majority adapted to water stress in the form of unreliable rainfall, recurrent drought and exposure to desiccation (Mostert *et al.* 2009). The site itself is surrounded by *Cenchrus cilliaris* grass and *Adansonia digitata* trees. Both taxa are known to grow in hot dry areas (Fish *et al*. 2015; Coates Palgrave 2002).

2.4. Soil and geology

2.4.1. Frampton 1 (MNR 074) and Vryheid (MNR 04)

The soil in and around Frampton 1 (MNR 074) is comprised of miscellaneous shallow soils made of gneiss and quartzite (van Rooyen 2002). The soil of Vryheid (MNR 04) is loamy, sandy soils also composed of quartzite and gneiss (van Rooyen 2002). Frampton 1 (MNR 074) rests on the Gumbu geological formation while Vryheid (MNR 04) rests on the Messina Suite. The Gumbu Formation is a marble-dominated supracrustal rock formation deposited >3GA (Brandl 1981). The Messina Suite or Messina Layered Intrusion is a magmatic complex composed of anorthositic and leucogabbroic gneiss (Jaeckel *et al.* 1997).

2.4.2. Mutamba (MUT)

The ridge on which Mutamba (MUT) sits has a bedrock composed of pink quartzites and sandstone which is a distinguishing attribute of the Wyllies Poort Formation. The formation is comprised of quartzite. A great deal of the ridge on which the site rests has a high rock cover and little to no soil coverage and in places where there is soil, it is either clay rich or acidic, shallow and nutrient poor (Mostert *et al.* 2009; Antonites 2012).

2.5. Previous research and excavations

2.5.1. Vryheid (MNR 04) and Frampton 1 (MNR 074)

The Maremani Nature Reserve (Figure 2.1) was established in 1999 as a nature conservation project under the aegis of the Aage V. Jensen Charity Foundation. The reserve, covering 41 000 ha, has been the subject of a number of studies, ranging from archaeological (Antonites & Ashley 2016; Lippert 2019; Fletcher 2021), ecological (Joubert 2002), geological (Barton 2006; Brandle 1981) to faunal (Thomas & Christen 2002; du Plessis n.d.).

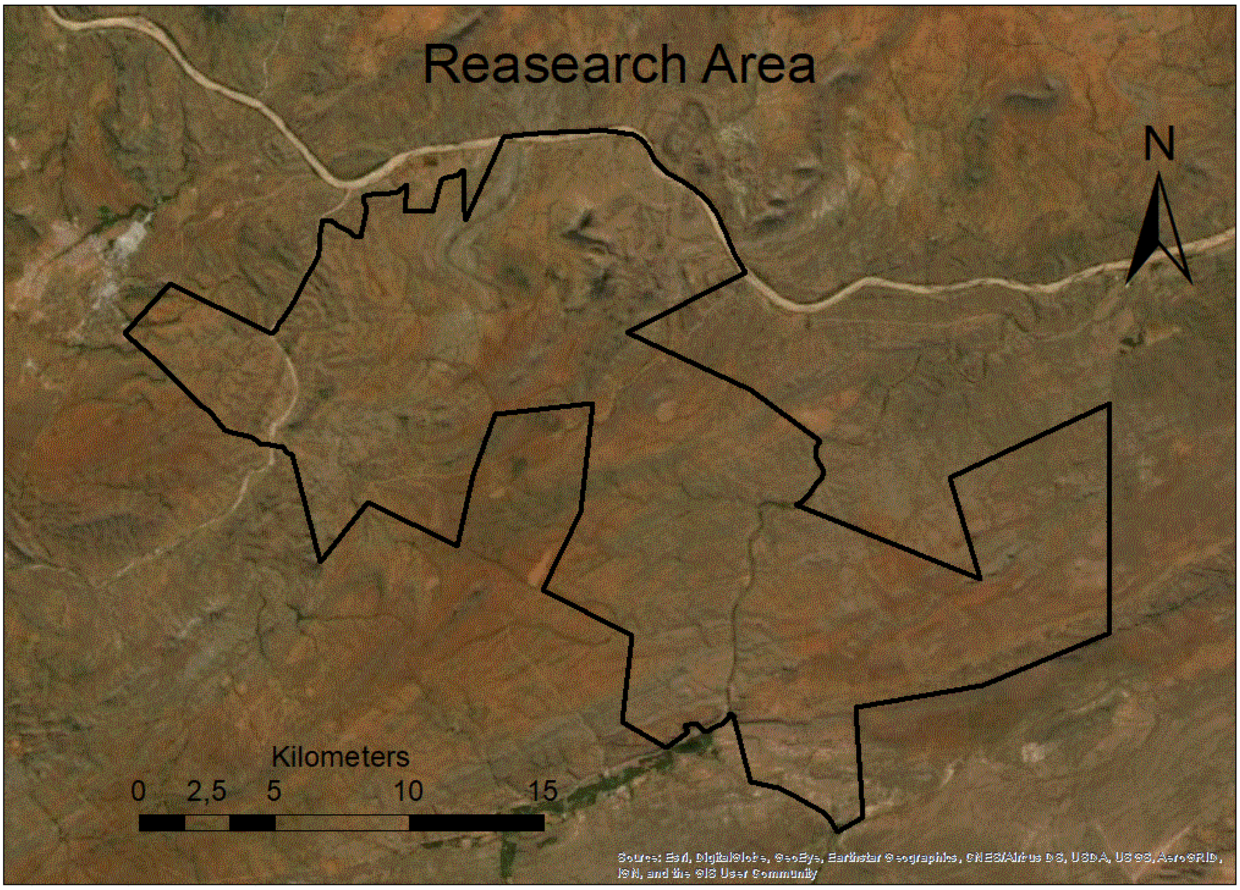


Figure 2.2. Maremani Nature Reserve (Fletcher 2021: 3)

The first archaeological research to take place in the reserve was conducted by Prinsloo, of which the data has since then been lost (Fletcher 2021). Thereafter, a rock art database was compiled for the southern areas of the reserve (Eastwood 1990). In 2004 the south-east part of the reserve was surveyed by N. Kruger as part of an unfinished Masters project and in 2014 a large-scale ongoing umbrella project on Mapungubwe period sites in the reserve was started by X. Antonites and C. Ashley from which several student-based research projects derive (Joubert 2019; Lippert 2019; Fletcher 2021).

Surveys of the reserve (Fletcher 2021) identified numerous archaeological sites ranging from the Stone Age (c. 10 000 BC to 350 AD) to Late Iron Age (1400 to 1950 AD). Of the large number of sites identified, ten were classified as MIA (Fletcher 2021). Amongst the MIA sites was a cluster of five small sites east (MNR 075, MNR 074, MNR 073, MNR 078, MNR 079) situated along a dolerite ridge found on the southern border of the reserve on farm Frampton 72MT.

Frampton 1 (MNR 074) was first recorded by N. Kruger in 2004. It was excavated in 2013 after several large Mapungubwe ceramic sherds were identified on the site in 2012. The ceramics were found trapped amongst large boulders forming a 5m high outcrop on the crest of the dolerite ridge. The entire site (Figure 2.2.), abutting a jagged rock outcrop, is only 30m in diameter and has a shallow deposit with a maximum depth of 10cm.

A permanent datum (N100 E100) was placed in the middle of the site. Thereafter, both test trenches and excavation units were established (See Figure 2.5. Overview of the MNR 074 excavation). Three 1x1m test trenches (TT) were placed along a slight rocky rise and excavated in single spits and all ended on bedrock. The first test trench (TT1), located underneath a boulder overhang had fine light grey ashy soil (Antonites & Ashley 2016). The second (TT2) and third (TT3) are up against rocks and were much shallower than TT1. Two spindle whorls and four glass beads were recovered from the test trenches. Thereafter, five excavation units of 2x2m were positioned along the eastern and northern slopes.

The first unit (N97 E100) located in an ashy area was construed to be a small kraal. The next unit (N100 E98) was excavated in an attempt to expose the northern extent of the kraal. The third unit (N105 E98), north of the kraal, contained homogeneous occupation material. The final two (N115 E93.5 and N115 E97) to the north produced the majority of material culture and are part of a rubbish midden located where the ground slopes downward (Antonites & Ashley 2016).

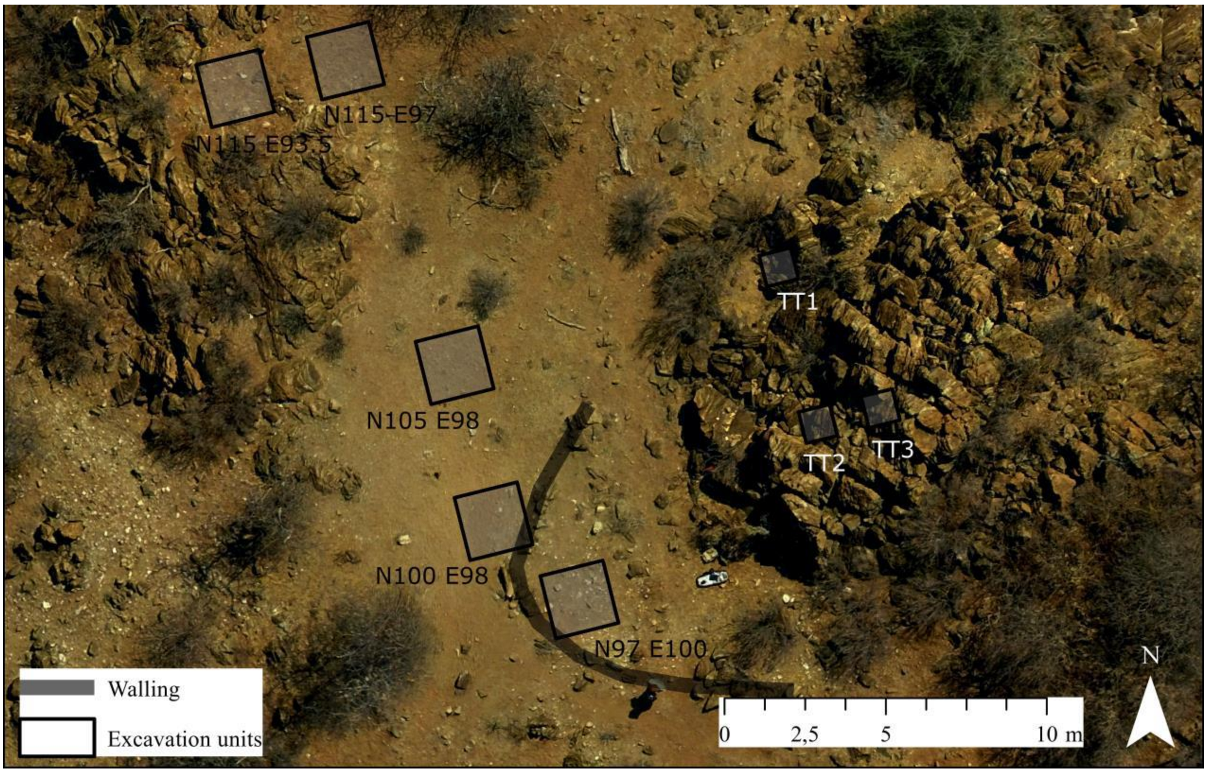


Figure 2.3. Overview of the MNR 074 excavation (Lippert 2019: 50)

An analysis of some of the excavated material was done by Lippert (2019). In her research, Lippert (2019) examined glass and disk beads, spindle whorls and non-utilitarian metal in an attempt to identify activities taking place at the site (Table 2.1.). Her analysis noted that most of the material was excavated from a midden deposit and confirmed based on radiocarbon dating and bead analysis that the site dates to the 13th century. Based on the material culture of the site (Table 2.1.) it was concluded that the site was a temporary occupation.

The results of the faunal analysis have also been published (Antonites *et al.* 2016). The faunal material indicated that the remains of livestock animals outweighed those of wild animals. Small stock animals, i.e. goats and sheep, were found to be more dominant at the site than cattle and the livestock was used for meat and other products like sinew and skin.

Table 2.2. Distribution of small finds at Frampton 1 (MNR 074) (from Lippert 2019)

Context Description	Glass Beads (n)	Disk Beads (n)	Metal Helixes (n)	Metal Other (n)	Slag Weight (g)	Spindle Whorls (n)
General surface	7	6	-	-	-	1
Kraal deposit	-	12	-	-	-	3
Undifferentiated Occupation	5	2	1	-	-	-
Midden	17	16	1	1	12.9	3
Ashy Deposit	4	-	-	-	-	2

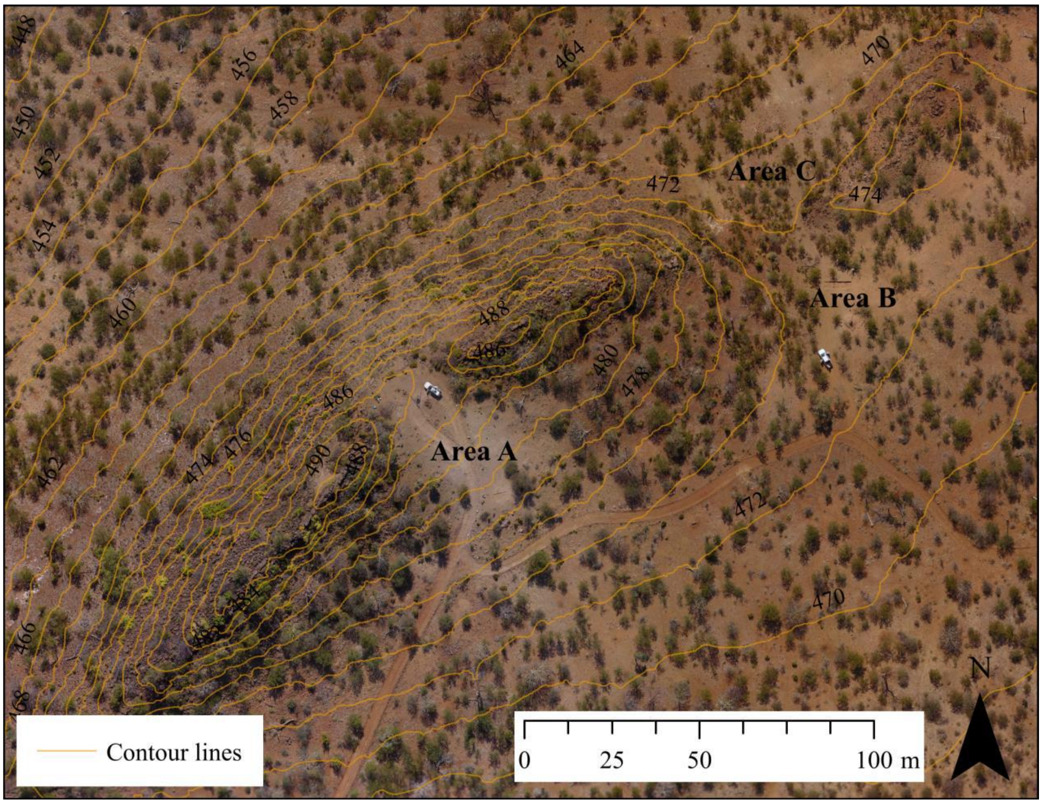
Vryheid (MNR 04) is located on the farm Vryheid 8MT, situated in the reserve's north-east corner and is found on and around a spur on a ridge. The site underwent three seasons of excavation (2014, 2015 and 2018). The extensive diameter of the site called for a division into three areas (Figures 2.3. to 2.6.).

The first area (A) is situated on the summit of a hill and contains domestic areas and a kraal. The other two areas (B and C) are on the eastern foot of the hill. The two areas are divided by a ridgeline running from the hill. Area B is on the south-western side and Area C is on the northern side. The south-western side is a domestic area with many visible stone grain bins. The northern side contained a kraal and concentrations of fine ashy deposit.

Area A is located between two small peaks on a slight slope. A significant amount of cattle dung was observable on the slope's surface. Three 2x2m units and one 2x4m were placed. The area was excavated to define the scope of the kraal and domestic areas. Three units (N89 E94, N90 E112, N69 E98) were excavated in 2014. N89 E94 was a 2x2m unit in the kraal, N90 E112, a 2x4m, determined its eastern extent while N69 E98, a 4x2m, examined the south area of the kraal. A grain bin was found in the final unit.

Area B, on the south-eastern slope of the hill, was excavated in 2014, 2015 and 2018. The area is encircled by several highly visible grain bins. The area had three excavation units (N96 E216, N99 E222, N104 E230). N96 E216, excavated in 2018, was a 2x8m unit opened on a dark ashy area. This was later interpreted as being part of a kraal. N99 E222, excavated in 2014, was excavated in an ashy area. The third, excavated in 2015, was a 4x8m unit which was opened to investigate the domestic space visible through the grain bin stands.

Area C, is located on the north-east slope of the hill. Only two units were opened in this area. The first unit, N136 E 230, was excavated in 2015 and its purpose was to provide a more detailed examination of the northern area of the slope. The second, N100 E230, was excavated in 2014 and contained midden deposit and ashy inclusions.



2.4. Aerial view of MNR 04 (Lippert 2019: 69)

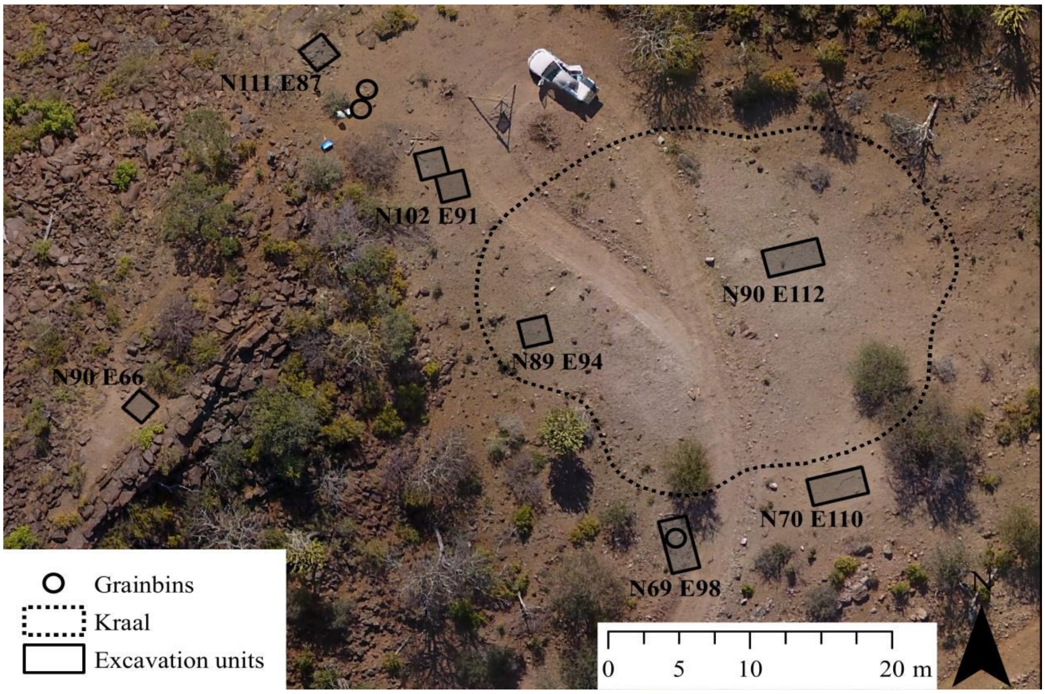


Figure 2.5. Area A units (Lippert 2019: 70)

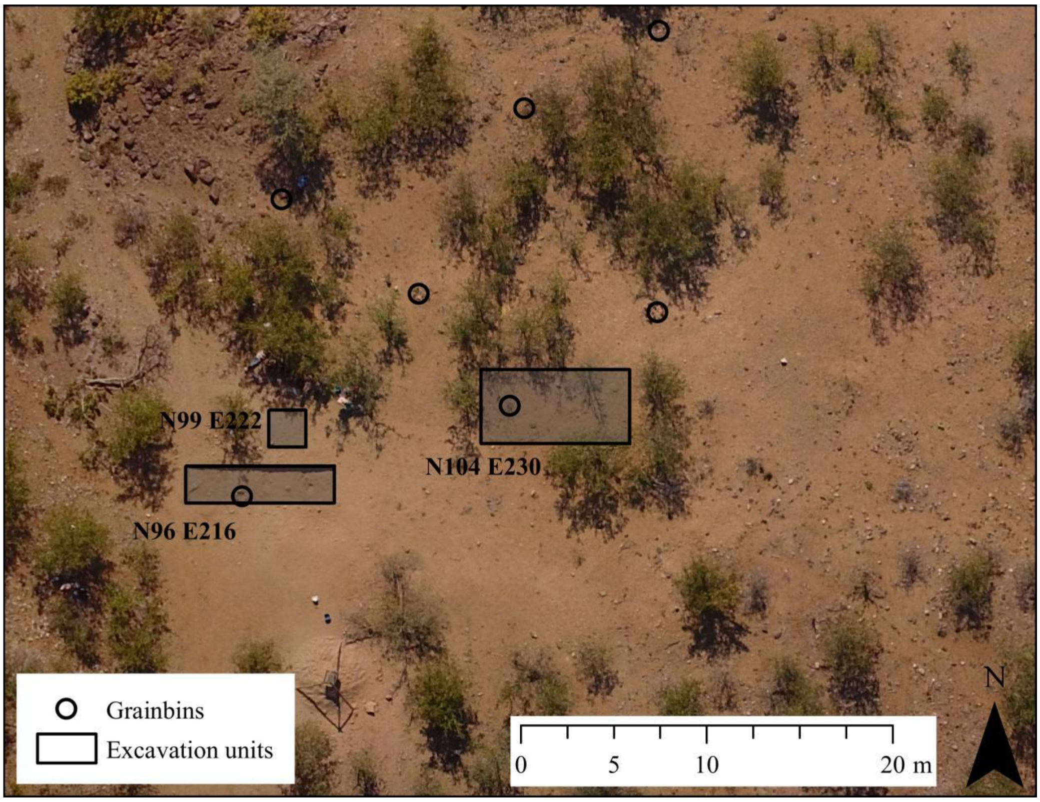


Figure 2.6. Area B units (Lippert 2019: 73)

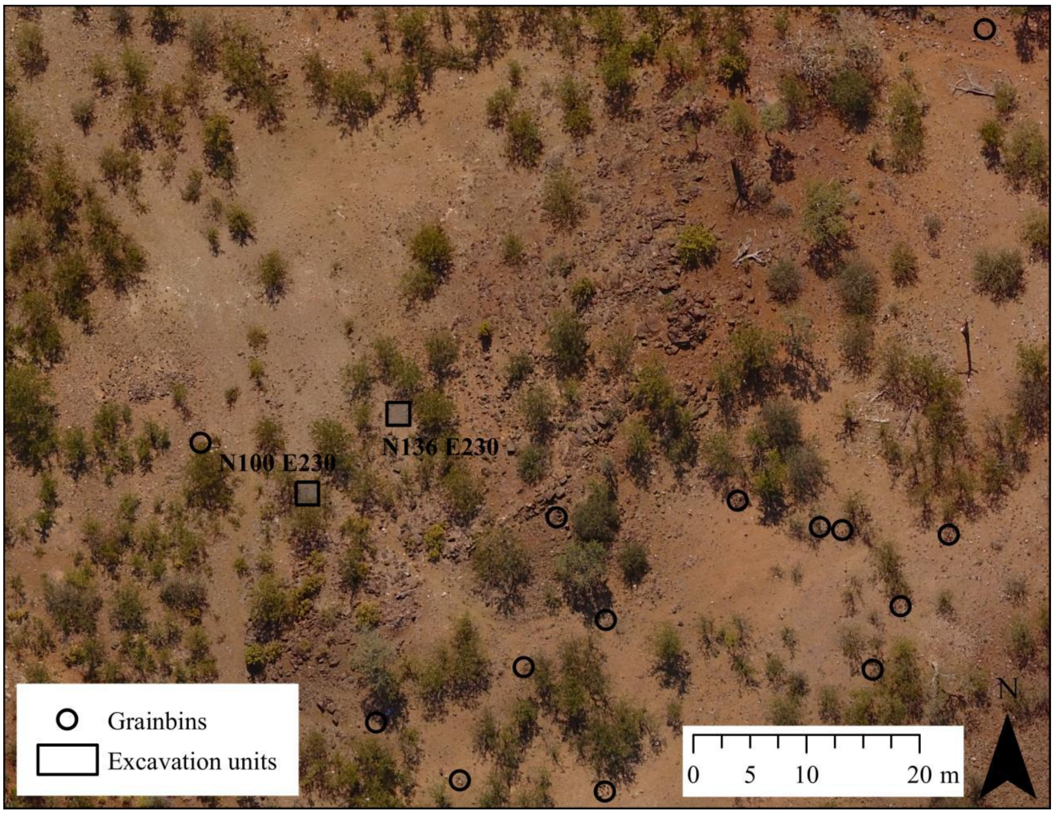


Figure 2.7. Area C units (Lippert 2019: 75)

Lippert (2019) also studied small finds from Vryheid (MNR 04) (Table 2.2.). Her analysis confirmed that the site was occupied from the mid to late 13th Century. She concluded that based on the presence of numerous grain bins at the site, extensive farming likely took place at the site.

Table 2.3. Distribution of small finds at Vryheid (MNR 074) (from Lippert 2019)

Context Description	**Glass Beads (n)**	**Disk Beads (n)**	**Metal Helixes (n)**	**Metal Other (n)**	**Slag Weight (g)**	**Spindle Whorls (n)**
Area A General surface	2	5	-	1	-	1
Kraal	5	6	3	1	229.6	3
Grain bin	2	12	4	1	18.8	1
Slope wash	-	-	-	-	-	-
Area B Surface	-	3	-	1	-	-
Ashy Kraal Deposit	2	1	-	-	-	1
Unconsolidated Wash	-	-	-	-	-	-
Gravel wash	3	3	1	-	-	-
Gravel floor	1	4	1	-	74.6	-

2.5.2. Mutamba (MUT)

Mutamba was first identified and excavated by J.H.N. Loubser (1988) as part of his PhD research. Through the integration of oral traditions, ethnography and archaeology he undertook an assessment of contending hypotheses on the origins of the Venda people. One of the many sites which formed a part of his study was Mutamba.

Whilst investigating the area he noticed many ash and dung concentrations which he deemed to be too indistinct to render a clear site layout. He excavated a 9m^2 trench, (Trench 1), over an area of particularly ashy concentration (See Figures 2.7 and 2.8). The trench yielded five layers of disturbed deposit (Table 2.3.) extending to a depth of 1.2 m. Noticeable features were found in the bottom horizon which contained remnants of two baked floors with one of the floors containing possible post hole impressions and wall fragments in the middle horizon. Loubser was also able to identify at least four ceramic facies present in the trench as well as slag and spindle whorls.

Table 2.4. Loubser's five layers

Layer	Measurement (cm)	Deposit description
1	10-20	Grey silt
2	10-20	Khaki coloured ash
3	15-20	Grey ash
4	15-25	Khaki ash deposited on fragmented floor
5	15-20	Sterile soil and dung mix on bedrock

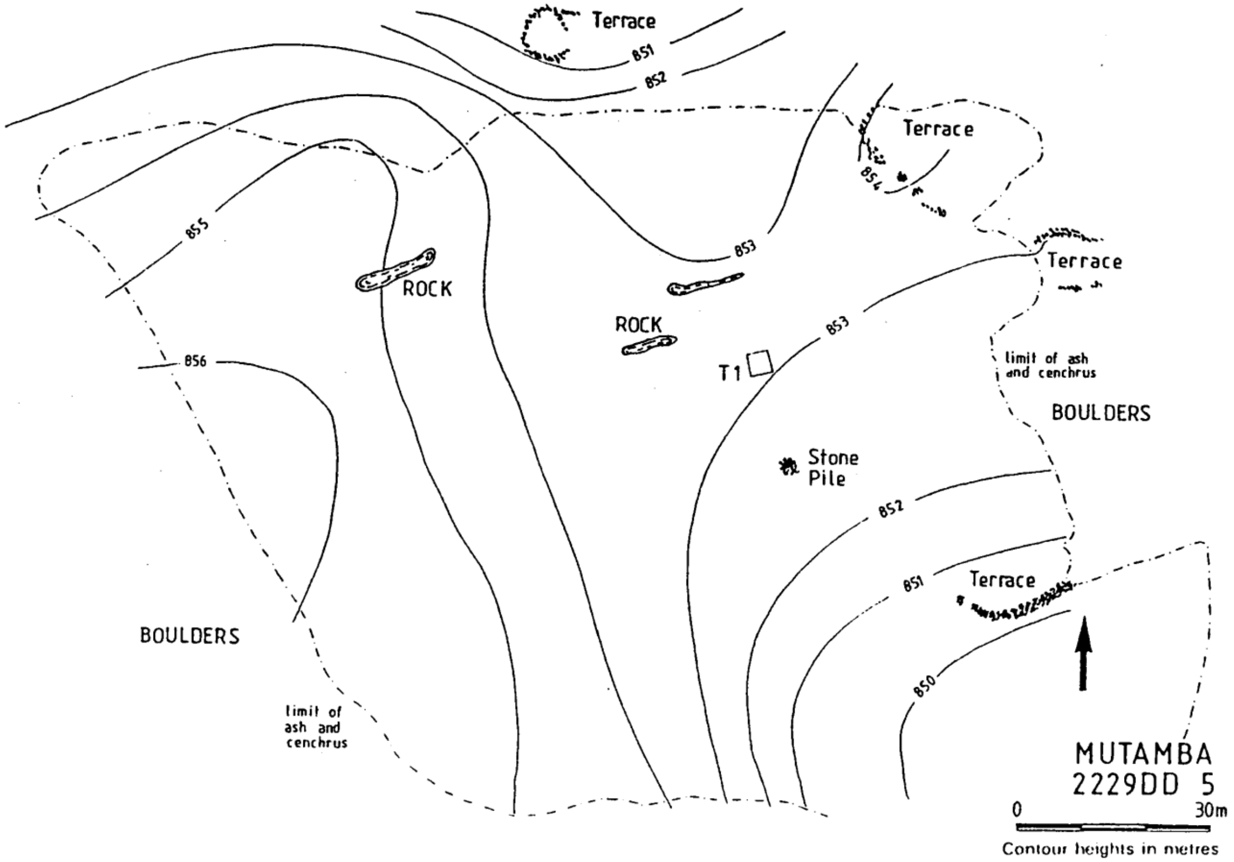


Figure 2.8. Loubser's map of Mutamba (Loubser 1988: 118)

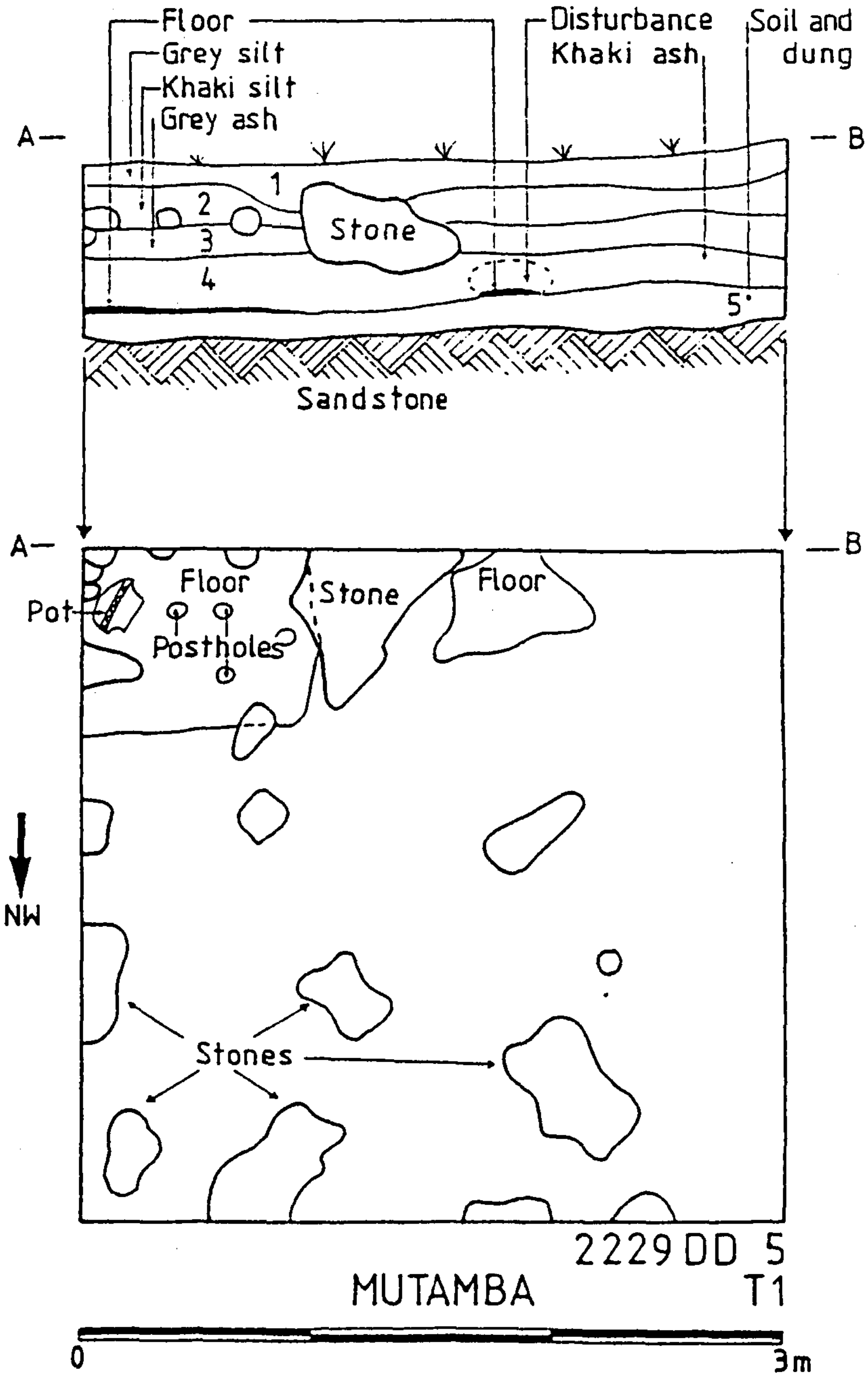


Figure 2.9. Trench 1 (Loubser 1988: 119)

Excavations at the site were then continued by X. Antonites in 2010 and 2011 (Antonites 2012). In the first field season, the foremost objective of the test units (Figure 2.9) was to procure a representative sample of archaeological material from Mutamba (Antonites 2012: 83). This resulted in the utilization of a random stratified sampling method in the decision regarding the units' placement. While mapping Mutamba, Antonites (2012) was able to define the relative parameters of the archaeological deposits and owing to the site's largely featureless surface chose to treat its entirety as a single sampling stratum. This led to a potential sampling continuum of over 4000 units, and to provide sufficiently random samples, each was given a distinctive number and arbitrarily chosen from a list (Antonites 2012). The units were located on the central saddle area and the southern and western slope areas of the site. Antonites (2012: 90) determined that based on material culture from these test units the occupation of the site was concentrated in the central saddle area. In the second field season specific features, identified in the first field season, were investigated through larger excavations (Antonites 2012).

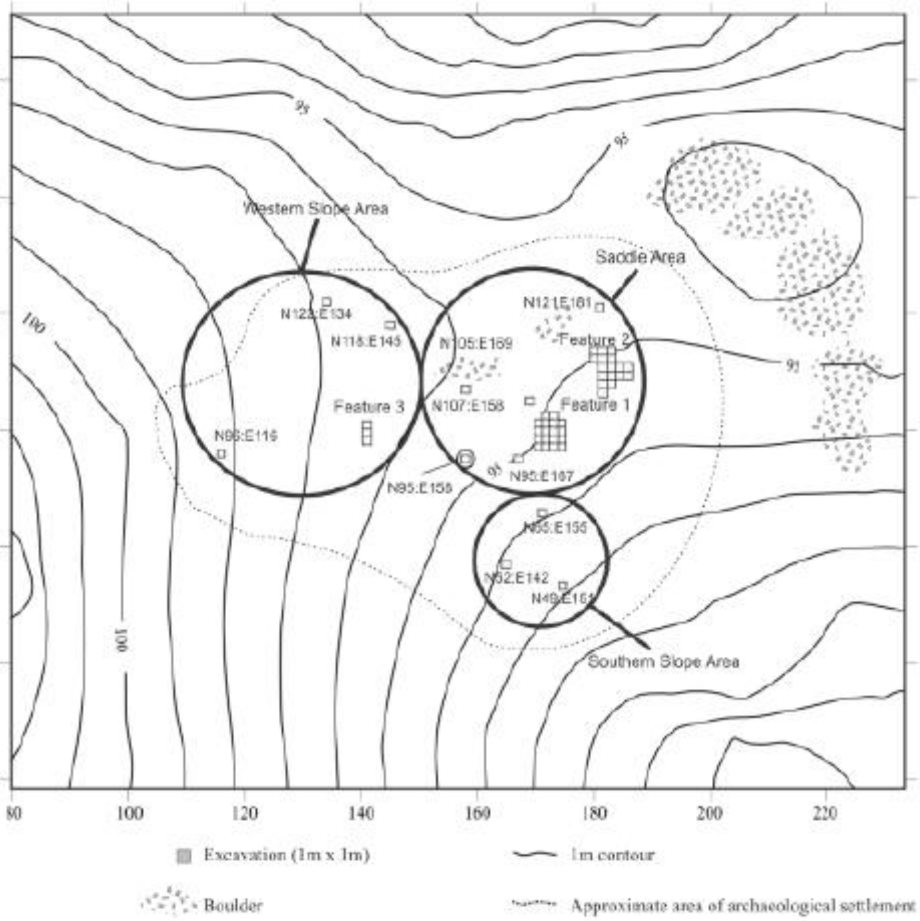


Figure 2.10. Location of test units (Antonites 2012: 84)

Antonites' (2012, 2019) excavation yielded a large variety of material: ceramics, >300 glass beads, >500 shell beads, a gold bead, almost 200 spindle whorls, faunal material, botanical material, over a kilogram of slag, worked iron objects and copper. The faunal material from the site was analysed by Abatino (2021) for a PhD dissertation. In her dissertation, she was able to provide an invaluable synthesis and interpretation of faunal remains at the site. The archaeobotanical material from the site was also analysed by Benkwitz (2013) and later re-analysed and expanded upon by Steyn (2018). Benkwitz (2013) undertook a brief study on the macrobotanicals that were present in layers three to five from Feature 1. The focus of his research was on the identification of taxa. His methodology involved the sieving, sorting, weighing and identification of archaeobotanical material. Benkwitz (2013: 30) was able to identify *Grewia* sp., *Sclerocarya birrea*, *Sorghum bicolor*, *Pennisetum glaucum* and *Vigna unguiculata* (Benkwitz 2013: 22-29). Steyn (2018) analysed over 100 randomly selected flotation samples. Several taxa were identified at the site. Domestic taxa were found to be preponderant. The domestic taxa found provided evidence for a possible crop package composed of *Vigna unguiculata*, *Vigna radiata*, *Sorghum bicolor*, *Pennisetum glaucum* and *Eleusine coracana* (Steyn 2018). Steyn (2018) proposed that a lack of weed species and crop processing debris may have been indicative of harvesting as well as processing methods that may have been engaged in. Moreover, it was interpreted that crop processing took place away from the huts. With the use of ethnography, it was determined the most feasible usage of the plants was for food, beer and cloth production. Steyn (2018) also found the earliest documented occurrence of *V. radiata* and probable malted sorghum grains in South Africa (Steyn & Antonites 2019).

2.6. Conclusion

The Soutpansberg Mountain and the Maremani Nature Reserve are located in the Limpopo Province of South Africa. They have diverse environments in which, based on archaeological research, MIA communities chose to settle. Their environmental features could have influenced the human-plant interaction and agricultural practices of MIA communities who chose to settle in these areas.

Chapter 3

Archaeological background

MIA research in the Limpopo Valley has largely focused on sites located within the SLCA, such as Mapungubwe which is thought to be the earliest state level society in southern Africa, displaying evidence for social stratification and the use of sacred leadership (Huffman 2000, 2007). Archaeological evidence indicates that the SLCA has seen centuries of human occupation, first by hunter-gatherers then later by agro-pastoralists (Huffman 2007; van Doornum 2008). Published data available on smaller sites further afield from Mapungubwe is limited (Loubser 1991; Calabrese 2007).

3.1. The Early Iron Age (350 to 900 AD)

The first inhabitants of the SLCA were hunter-gatherers. Archaeological material documents the occupation of rock shelters in the valley as early as 1220 BC (van Doornum 2005). Between 1220 BC and 100 AD the number of hunter-gatherer settlements increased. These settlements are generally categorized as either small satellite sites occupied seasonally or short-term occupations or larger possibly permanent sites which serve as aggregation camps (van Doornum 2008). Until 900 AD hunter-gatherers largely had the SLCA to themselves and the number of settlements increased and spread across the landscape. This could be as a result of agro-pastoralists occupying arable land surrounding the south side of Soutpansberg (Prinsloo 1974; Hanisch 1980; Hall & Smith 2000; van Doornum 2008). Ceramic evidence of the Happy

Rest period in the Soutpansber[i]g (350 – 600 AD), places early farmer settlements here during this period (Prinsloo 1974; Huffman 2002).

By 900 AD agro-pastoralists began to permanently settle in the SLCA and as a result, interaction and emerging power dynamics between the two groups underwent substantial changes. Initially, hunter-gatherers and agro-pastoralists co-existed alongside each other until the 13th century but by the 14th century hunter-gatherer sites disappeared from the SLCA landscape (Hall & Smith 2000; Schoeman 2006a, 2006b; Forssman 2011).

Interaction between the groups impacted the hunter-gatherers in different manners, for instance their traditional settlement patterns, demography and economic systems altered (Moore 1985). Interaction occurred at different levels, vacillating from abandonment of the area by hunter-gatherer, occasional contact and formal extended contact (Alexander 1984; van Doornum 2000, 2005, 2008). Any additions of farmers into the area, even a miniscule number, impacted the access of hunter-gatherers to resources and the space which they could occupy (Moore 1985, van Doornum 2000). In the early stages of interaction, the hunter-gatherers met the arrival of the farmers with mixed responses (van Doornum 2000, 2005).

In the SLCA the hunter-gatherers selected sites for settlement based on their responses to the agro-pastoralists and how they wished to interact with them (van Doornum 2005). Some hunter-gatherer groups left the area while others stayed (van Doornum 2005). For instance, at the Little Muck shelter, situated along the southern bank of the Limpopo River, the hunter-gatherers probably chose to settle near the farmers located 1km away at Leokwe Hill which eventually evolved from a hunter-gatherer camp during the Happy Rest ceramic phase to a hunter-gatherer workshop/camp during Zhizo times to ultimately being appropriated as an agro-pastoralist space (van Doornum 2000; Hall & Smith 2000). In contrast, Balerno Shelter 3, where no agro-pastoralist settlements were located, indicated that some hunter-gatherers chose to move away from agro-pastoralist settlements (van Doornum 2000). Interpretations of the relationship between the two groups have changed over time. Early views disregarded the agency of the hunter-gatherers and saw them as being either displaced or absorbed into the farmer groups (Denbow 1990). Hall and Smith (2000) have suggested an alternative in that hunter-gatherers were actively involved in the production of goods supplied to the farmers, such as skins and ostrich eggshell beads. This may have afforded the hunter-gatherers some status within the farmer communities (Forssman 2017).

Between 500 – 700 AD agro-pastoralist joined hunter-gatherers in the SLCA, marked by one of the earliest ceramic facies the Happy Rest ceramics. However, agro-pastoralists retreated from the area until 900 AD due to unfavourable climatic conditions not conducive to agriculture (Huffman 1996). According Tyson and Lindesay (1992) between 900 and 1300 AD the climate was cool, and rainfall poor. These conditions made large-scale agriculture unfeasible. Thus, farmers who were identified by Huffman as being associated with the Happy Rest ceramics (2008) left the area.

3.2. The Middle Iron Age (900 to 1400 AD)

From the 10th to 11th centuries Zhizo ceramics found scattered throughout the landscape marks the next phase of occupation in the SLCA (Van der Walt 2012). The Zhizo capital was Schroda. Schroda is located 7km east of the SLCA. Two occupational phases were identified at Schroda. The first, linked with the Zhizo ceramics, was during the 10th century and the second from the

11th century, associated with Leokwe ceramics, lasted only 100 years (Vogel & Calabrese 2000; Calabrese 2007, Huffman 2007).

Schroda's population was estimated to be <600 people. Initially was thought that the Zhizo people moved into the area for agricultural purposes but isotopic data illustrates that the climate was not wholly suitable for agriculture (Huffman 1996a; Smith 2005). This meant that large-scale agriculture was not feasible and as such agriculture was not the primary reason for occupation. Rather, the Zhizo are thought to have moved into the area to take advantage of long-distance trade and the exploitation of the numerous elephant herds for ivory (Huffman 2000, 2008; Smith 2005; Chirikure 2014; Forssman *et al.* 2014). The presence of herds meant that most Zhizo settlements were located far from the Limpopo floodplains, most likely as the elephants would have posed a danger to any crops (Hanisch 1980, 1981; Voight 1983). The distribution of Zhizo-period beads suggests that trade was engaged with other farmer groups, possibly in exchange for grain (Wood 2000, 2005; Van der Walt 2012). This does not by any means indicate the Zhizo people did not practice agriculture. Exploitation of wet areas among rocky outcrops and river tributaries may have resulted in some agricultural success (Smith 2005). This coupled with Schroda's relatively low population meant that a substantial agricultural surplus was not needed to sustain the population. By 1000 AD ivory hunting resulted in a displacement of elephants from the SLCA, allowing farmers to gain access to the floodplains for agriculture (Schoeman 2006).

Excavations at Schroda found a site that was rich in material culture (Hanisch 1980). Some material found include clay figurines, ceramics, tuyére fragments, metals tools (including a hoe and an adze); ornaments and weapons, bone, archaeobotanical material, grain bin stands, glass beads, ostrich eggshell beads and grinding stones. Three grinding stone fragments with small depressions were found. Additionally, two complete grinding stones were also found. Both had elongated grinding hollows roughly 20x6x3cm. The first found on a hut floor feature had two parallel grinding hollows on its upper surface and the second had a single elongated grinding hollow which measured 20x10x3cm. Moreover, twenty-eight dolley holes and 101 grinding hollows were also found at the site. The dolley holes (Figures 3.1. to 3.3.) were generally 10 – 15cm in width, tapering towards the bottom. The depth of these holes varied from 3cm to 20cm. These deepest ones were distinctly funnel in form. Hanisch (1980) believes that these dolley holes were used as mortars to most likely pound grain. Numerous grinding hollows were found both as single hollows but primarily in groups. The hollows were 20/30x6cm with worn centres. Many of the hollows displayed fine parallel longitudinal striations. Owing to the close proximity of many of the hollows to one another, it was estimated that this would have allowed only two to three persons to use the hollows at a time. Many grinding stones from early farming communities had narrow grooves suitable for the grinding of sorghum and small millets (Mitchell 2002).

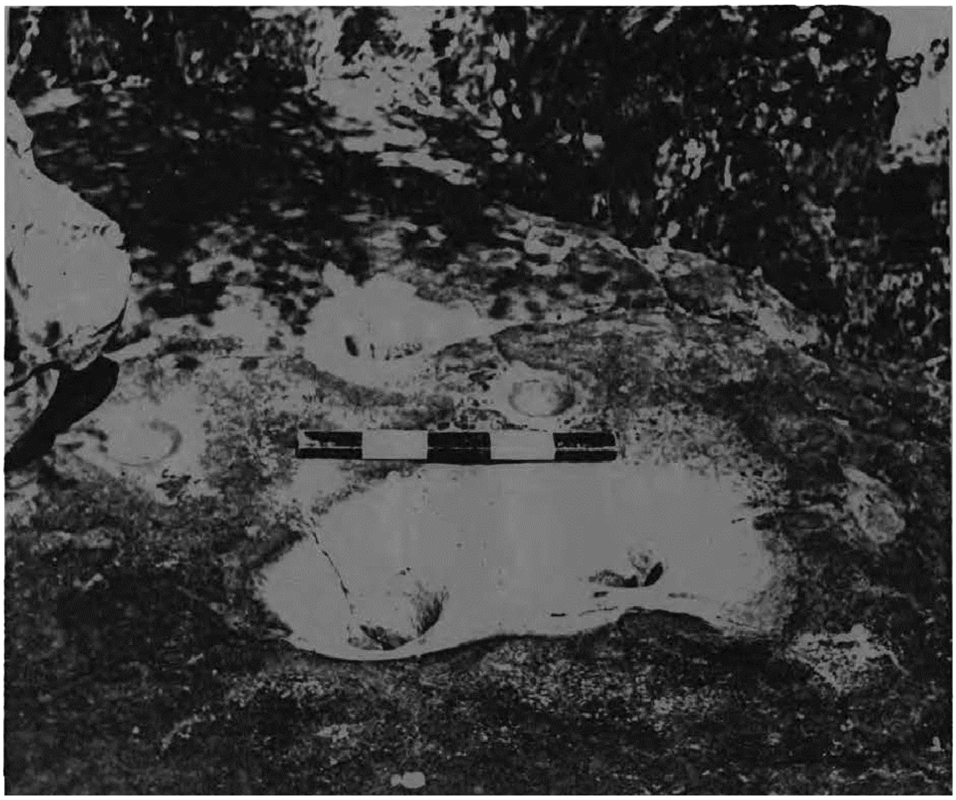


Figure 3.1. Grinding dolleys at Schroda (Hanish 1980: 214)

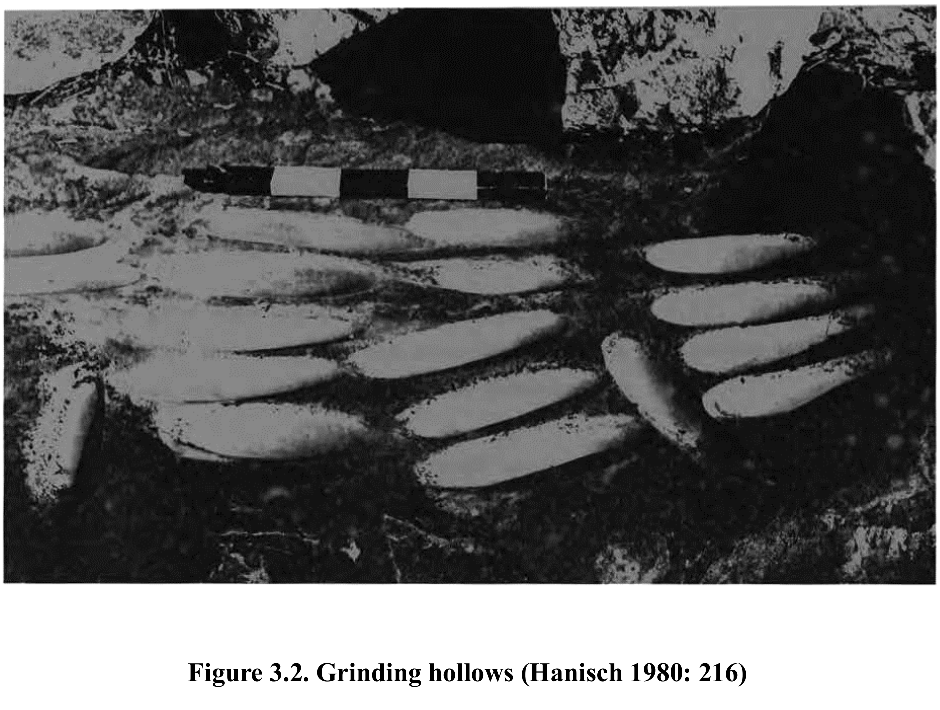


Figure 3.2. Grinding hollows (Hanisch 1980: 216)

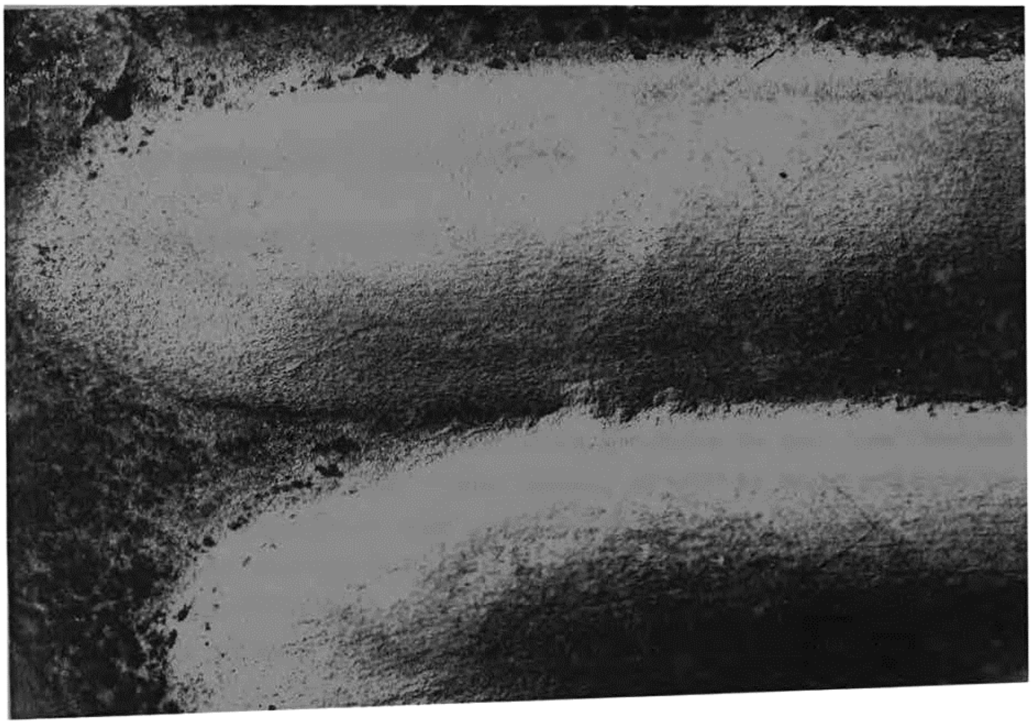


Figure 3.3. An enlargement of a grinding hollow (Hanisch 1980: 216)

Leokwe Hill was initially interpreted by Huffman (1986) as a Mapungubwe provincial capital. This was later found not to be the case. Instead, it was found that the site was occupied by two separate groups, each associated with distinct ceramic styles (Calabrese 2007). The Leopards Kopje occupation (Area A) is linked to large stone walling and yielded 148 beads while the Zhizo, Area B, only yielded five beads (Calabrese 2000a, 2007). Calabrese's (2000a, 2005) work at Leokwe Hill demonstrated a unequal relationship between Zhizo and Leopards Kopje communities.

By 1000 AD the number of Zhizo producing sites lessened while those producing Leopard's Kopje increased (Du Piesanie 2008). This was interpreted as the result of the Zhizo political core moving away from the area into eastern Botswana (Calabrese 2005).

By the 12th century K2, located 6km southwest of Schroda, became the largest Leopard's Kopje site north of the Soutpansberg Mountain (Huffman 1982, 2000, Du Piesanie 2008). It was occupied between 1030 and 1220 AD during a period when the climate was much more favourable towards agriculture than previously (Vogel 2000; Du Piesanie 2008). This prompted a move towards floodplain agriculture, allowing population increases (Du Piesanie 2008). Du Piesanie (2008: 16) credits the use of a more intensive agricultural strategy and surplus trade wealth in the transformation of the social rank-based Leopard's Kopje society into a class based one seen at Mapungubwe.

Estimates of K2's population have ranged from between 1500 and 5000 people (Meyer 2000; Huffman 2009). At first, the site was organised around a central cattle kraal (Huffman 2007). Cattle played an integral role in agro-pastoralists social systems (Huffman 2001; Badenhorst 2009). Cattle were a sign of wealth and status, used in the payment of bridewealth and ancestral sacrifices (Kuper 1980; Huffman 2001; Badenhorst 2009). The cattle kraal also symbolised the judicial seat of power where men held court and deliberated on important issues (Kuper 1982; Huffman 2009). Settlements which are structured around a kraal are interpreted using the Central Cattle Pattern or CCP. The CCP model is based on Kuper's (1980, 1982) ethnographic work on Nguni and Sotho-Tswana settlement patterns which Huffman (1986, 2001, 2007) then applied to the interpretation of the internal structure and layout of Iron Age archaeological sites.

The CCP is characterised by a central kraal which is viewed as the domain of males. Within this central area men and other high-status individuals were buried in the kraal, smithing activities took place, court was held and sunken grain pits and long-term storage grain-bins were kept (Huffman 2007). The size of the court equated the power and status of the chief and as such the larger the court, the more powerful the chief was (Huffman & Hanisch 1987).

The outer area is arranged according to seniority, in a left-to-right manner, is the domain of married women and encompasses their private sleeping huts, kitchens, grain bins, storage pits and graves (Huffman 2001, 2007). Badenhorst (2009: 152) noted that the position of storage pits correlated to their function and utilisation. Pits located in the cattle kraals were preferable for the storage of plant foods as the heat from the cattle dung assisted in the curing of grain and the trampling of the surface by cattle ensured that the pits remained sealed, preventing damp (Robinson 1963). Food was stored in pits to prevent animals such as monkeys, rodents and insects from obtaining access. In Pedi ethnography, stored grain was treated with aloe ash to prevent weevils (Quin 1959). Excavations at K2 provided some idea of the plants that were grown and consumed (Gardner 1963: 82). Three domesticates were noted (*S. bicolor*, *P. glaucum* and *Vigna* unguiculata) and six wild species (*Sclerocarya birrea*, *Xanthocereis zambesiaca*, *Vangueria infausta*, *Citrullus lanatus*, *Syzygim cordatum* and *Adansonia digitata*).

Another distinction is that the front area of the settlement was public and secular while the back was private and sacred (Kuper 1980; Huffman 2001, 2007). Certain activities such as metal smelting and childbirth took place outside the settlement as these were tied to reproduction and were thus considered sacred (Kuper 1980; Huffman 2007). The notion that the front was public and secular while the back was sacred and private was replicated at a household level (Kuper 1980; Huffman 2007).

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By 1150 AD the kraal at K2 had shifted away from the centre of the settlement. Denbow *et al.* (2008) took this as an impetus towards greater herd mobility with herds disseminated across smaller settlement rather than being kept in a central place. In contrast to this, Huffman (2007, 2009, 2014) saw this shift as a restriction in cattle ownership and an increased emphasis on metal items and long-distance trade goods as a form of wealth and power.

During K2's occupation some of the population also resided at the bae of the nearby Mapungubwe Hill. When K2 was abandoned at around 1220 AD, the entire community resettled at Mapungubwe Hill (Vogel 2000; Huffman 2009). At Mapungubwe, a new elite pattern settlement pattern emerged, one which "represented the materialisation of sacred leadership" (Huffman 2007: 373).

Occupation at Mapungubwe was short lived. The site was inhabited for approximately 80 years but within that short period, the organisation of the settlement underwent significant changes and the population increased exponentially (Vogel 2000; Huffman 2009). The elite residence on the hilltop defined the leader's status through spatial separation from the rest of the society for example the summit sports free-standing stone walling, daga cement walls, possible defensive walls, stone terracing, stone steps and an enclosure on the hill providing the king with ritual isolation (Schoeman 2006; Huffman 2009; Meyer & Cloete 2010). Over the course of K2's occupation, the hill served as a site of rainmaking (Schoeman 2006). While the leader settled on the hilltop the commoners settled around the base where agriculture was practised due to the fertile soil and floodplain agriculture (Meyer 1998).

The elite residence marked a visible spatial separation of a leader from his people. This separation was also distinct in that there was a visible distinction in the material on the hill as opposed to the base. The separation of the elite from commoners conforms to a settlement pattern known as the Zimbabwe Culture Pattern (Huffman 2009). This pattern had five components: a court, the palace, a compound for the leader's wives, an area for soldiers and a space for the leader's followers (Murimbika 2006). The separation of the palace in relation to the rest of the settlement emphasised its sacredness. The rear of the palace played an essential role in rainmaking where the king would pray to the gods through his ancestors (Murimbika 2006; Schoeman 2006, 2009). The change from a kinship-based system to that of sacred leadership is mirrored in the king undertaking rainmaking (Schoeman 2006, 2009). However, this new manner of rainmaking did not replace older rainmaking rituals (Huffman 2009).

Archaeological evidence indicates that the cattle-based wealth system was replaced by the control of exotic trade goods as this form of wealth was easier to accumulate, manipulate and store (Huffman 1982, 1986, 2007, 2009). Imported exotic trade goods include glass beads, cloth, celadon and *Vigna radiata* (Mung bean) seeds (Meyer 1998; Pikirayi 2001; Steyn 2018).

It is uncertain as to why Mapungubwe was in decline by 1280 AD and abandoned by 1300 AD. Power had shifted to Great Zimbabwe, whose rulers usurped control over long-distance trade networks and established local centres producing gold (Pikirayi 2001; Huffman 2009). A popular theory as to Mapungubwe's abandonment was poor climatic conditions unsuitable to agriculture (Huffman 1996a). Huffman (2008) suggests that Mapungubwe's decline could be as a result of the Little Ice Age which rendered the area colder and dried than it previously was which in turn could have disrupted agricultural productivity. However, Smith (2005; Smith *et al.* 2007) suggests the area continued to receive adequate rainfall even after Mapungubwe's abandonment.

3.3. Beyond the SLCA

The majority of research to date has focussed on sites such as Schroda, K2 and Mapungubwe. Few studies have examined smaller sites and those that have are mostly sites located in close proximity to the SLCA (Calabrese 2007). However, there is an increasing number of studies on sites located outside the SLCA.

3.3.1. Kromdraai

Kromdraai is a large site located 85 km southeast of Mapungubwe and was excavated in the 1980s by H.P Prinsloo. Radiocarbon dates put occupation between 1270 and 1410 AD. The data from the excavation was never published and very little is known about the excavation. The excavated material was stored at the University of Pretoria and recently analysed by Mouton (2017) for an unpublished honours project. Mouton (2017) found 202 disk beads, 692 glass beads, soapstone beads, a soapstone amulet, 203 non-utilitarian metal objects and spindle whorls.

3.3.2. Stayt

Stayt is a small site also excavated by H.P Prinsloo and is 25 km south-west of Kromdraai. The site has been dated to between 1227 to 1283 AD and is considered to be a single occupation site. Excavated material from the site includes copper ingots, a soapstone amulet and over a dozen gold beads (Prinsloo & Coetzee 2001). The material was stored at the University of Pretoria and some of it was analysed by Hopf (2017) for an unpublished honours project. Hopf (2017) found 208 shell beads, six soapstone beads, 66 glass beads spindle whorls and non-utilitarian metal objects.

3.3.3. Princess Hill

Princess Hill is 5 km north of Mutamba (MUT) in the Soutpansberg. Unfortunately, a large portion of the site was lost during the construction of a house located on the site. Material culture excavated at the site include an iron blade, spindle whorls, shell beads, copper helixes with fibre cores and Mapungubwe ceramics (Loubser 1991).

3.3.4. Vhunyela

Vhunyela is located 10 km north of Mutamba (MUT). The site was excavated by Loubser (1991) who placed two trenches. Excavated material includes Mapungubwe ceramics, an arrowhead, iron wire, shell beads, a glass bead and spindle whorls.

3.3.5. Verulam

Verulam is located 5 km north of the Soutpansberg, close to the Sand River. This site was also excavated by Loubser (1991) who placed an L-shaped unit over an ashy deposit. Only the bottom layer could be linked to the Mapungubwe period occupation. Loubser (1991) found only a single wound copper object.

3.3.6. Tavhatshena

Tavhatshena is located just south of the Soutpansberg. Loubser's excavations uncovered a series of occupations dating between the 12th and 17th centuries (Loubser 1991). The only Mapungubwe-era material that was found is ceramics, a single piece of coiled copper and iron bangle fragments.

3.4. Conclusion

The SLCA has undergone centuries of occupation with much of the research concentrated on social and political complexity at Mapungubwe and other sites located in the SLCA. Increasingly, research has begun to study sites located outside of the SLCA. This includes the sites analysed as part of this dissertation.

Chapter 4

Archaeobotany

Archaeobotany is the study of ancient plant material found preserved within the archaeological record (Darvill 2008: 331). This plant material ranges from macroscopic (carpology, whole plants, wood, tubers etc.) to microscopic (phytoliths, starch, pollen) and are usually only preserved under specific severe conditions such as desiccation, conflagration or anaerobiotic environments (de Vareilles *et al*. 2021). Unfortunately, in southern Africa, archaeobotany's role within archaeological practice is neither well developed nor as widely utilised as it is in other parts of the world (Antonites & Antonites 2014).

Southern African archaeologists have long had a general idea of the range of taxa cultivated by Iron Age agro-pastoralists by way of ethnographical, historical and archaeological data, and it was only until recently that the paucity in archaeobotanical research continued (Antonites & Antonites 2014). A contributing factor to this lack of research may be the long-held belief by some archaeologists that botanical material does not preserve well and that plants were not vital to Iron Age communities (Antonites & Antonites 2014). This is a more holistic idea as to matters pertaining to past plant use, agriculture etc is needed. As a result, this chapter will present a brief history of macro-botanical research in South African farmer archaeology and conclude with a discussion of phytolith research as a potential method to retrieve additional plant data.

4.1. Macrobotanicals – a brief history in South African farmer archaeology research

Amongst the earliest mentions of Iron Age archaeobotanical material are by Gardner (1963), Eloff (1978) and Fouché (1937). Fouché (1937) makes the earliest mention of botanical material in his report on Mapungubwe. In this report he briefly lists botanical material. Likewise, an equally brief mention is made by Gardner (1968) in his report on excavations at K2 and Mapungubwe. Eloff's (1978) later study on K2 and Mapungubwe provided more detailed information on the botanical material recovered from the sites, listing both identified taxa and their corresponding contexts.

Antonites and Antonites (2014) reviewed the content of three archaeological journals (*South African Humanities*, *South African Archaeological Bulletin* and *Southern African Field Archaeology*) published between 1980 and 2012 which they felt best reflected the local trends in archaeological research. They found that very little of the content was directly applicable to Iron Age farming communities and that the botanical data present in the journals could be categorised into four broad themes, these being either environmental reconstruction and ecological perspectives, economy and diet and to a lesser extent social identity and political complexity. Topics under the environmental theme encompassed environmental reconstructions and how human settlement impacted their environments. Prins (1993) used charcoal, botanical and phytolith material to determine that the southern limits of first millennium C.E farmer settlements along the Kwa-Zulu Natal and Eastern Cape coast were influenced by the range of summer rain and climatic oscillations. Using charcoal analysis Hall (1984) was able to demonstrate that iron smelting practices contributed to the formation of certain *Euclea divinorum* woodlands in Kwa-Zulu Natal, thus providing evidence that farming communities impacted the vegetation of areas where they settled. The more positive effects of human settlements on their environments can be seen in the work of Cunningham (1988) who emphasised the beneficial selective influence farming communities had via the maintenance of shade and fruit trees, spreading and propagation of certain species at homesteads, altering the sex ratios of some species, more varieties of spinach on disturbed soils and the fruiting stimulation required of certain species through deliberate veld burning.

Under the theme of economic systems and dietary reconstructions Antonites & Antonites (2014) noted that reconstructions of this particular theme are largely based on macro-botanical materials and that much research remained concerned with only surface-level crop species identification, rarely moving beyond this to include the role of crop taxa within the local economies and the importance of agricultural and wild taxa in the local diet. It was also noted that archaeobotany could prove useful for discussions on land use and agricultural systems, such as for example in studies of the terracing present in the high-altitude Mpumalanga grasslands (Maggs 1984; Maggs & Ward 1984). The assumption was that terracing was broadly employed in agriculture but this assumption proved to have little in the way of ethnographic substantiation and knowledge of crop types cultivated by the second millennium farmers remaining unknown. Maggs (1984) and Maggs and Ward (194) distinguish differences between the terracing system employed by second millennium farmers and their predecessors' preference for the alluvial soils of valley floors, suggesting that agriculture influenced settlement location. Based on the archaeobotanical and archaeological data that Greenfield *et al*. (2005) collected from early farming communities in the Thukela River Basin, it was determined that empty spaces in settlements may have been the locations of horticultural gardens.

Archaeobotany does not form the focus of research on the third theme, socio-political complexity, but Antonites and Antonites (2014) drew attention to the importance of matters such as how agricultural output was organised and amassed to bolster and sustain large-scale social and political developments. For example, at Mapungubwe Huffman (2000, 2007) inferred an interaction between the expansion of floodplain agriculture and the changes in ideology, trade and class structure.

Archaeobotany has the potential to provide valuable insight into the fourth theme, social identity, particularly with regards to ritual. Rain control rituals were an important part of Iron Age agriculture (Antonites & Antonites 2014). Excavations at a number of rain-control sites in the Shashe-Limpopo indicated the presence of wild and domestic archaeobotanical material (Shoeman 2006). Through a combination of ethnography and archaeobotanical material Schoeman (2006) sought to understand how rain-control was connected to and expressed in the ideology of farming communities between 1000 and 1250 AD. Schoeman (2006) identified a number of wild and domestic taxa whose function they were able to link with specific functions such as lightning prevention or rain summoning.

Ultimately, this literature survey by Antonites and Antonites (2014) was able to illuminate an inadequacy regarding the sampling of botanical materials and recovery methodologies along with theoretical gaps in human-plant interaction in farmer communities. They attributed this inadequacy to generally held misconceptions: that archaeobotany is of limited importance as historical ethnography already documented plant use, that plants were not important, and that botanical do not preserve well in the archaeological record. Despite these misconceptions, there has been an increase in Iron Age research utilising botanical materials (Benkwitz 2013; Steyn 2018; Steyn & Antonites 2019; Schofield *et al* 2022).

Benkwitz (2013) conducted a brief honours project on the analysis of macro-botanical material excavated at the MIA site of Mutamba. During analysis, he was able to identify three crop taxa and two wild taxa. The material was then re-analysed by Steyn (2018) for an MA dissertation. Please refer back to Chapter 2, section 2.2. for more details concerning Steyn's research. This research was later published as a journal article (Steyn & Antonites 2019). Surveys and excavations at the MIA site of Mtanye in Zimbabwe by Schofield *et al.* (2022) recovered a wealth of material including plant remains. A total of 259 seeds were identified with most of the taxa being wild rather than crop taxa.

4.2. Phytoliths

Archaeobotanical research has largely focused on charred macrobotanical material. Many sites lack macrobotanical material resulting in a possible assumption of absence of evidence (Piperno 2006). This type of material can only survive temperatures of up to approximately 500 ºC, in the process losing more fragile materials such as chaff, while phytoliths can survive temperatures up to 800 ºC (Van der Veen 2007). Experiments have verified that macrobotanical material can be damaged or lost during dry sieving and floatation (Piperno 2006; Pearsall 2015). Phytoliths do not require being waterlogged or carbonized to preserve and can offer evidence of a wider range of activities than can be indicated in macrobotanical material (Shillito 2003). They are also able to provide the possibility of detection and identification of plants used for subsistence and non-dietary uses (Out & Madella 2020).

4.2.1. A brief history of phytolith research

The term phytolith is a Greek word meaning "plant stone" and has in the past been used to indicate all forms of mineralized concretions forming in higher plants (Piperno 2006). Calcium phytoliths are made up of calcium oxalate crystals produced in virtually every part of the plant. This form of phytolith can be found within a wide variety of species but is only sporadically found in soil and are thus hard to extract and as a result, the primary focus of phytolith research has been on silica composed phytoliths which are more readily recovered from soil (Piperno 2006; Pearsall 2015; Mulholland & Rapp 1992).

The first phase of research in phytoliths began in 1675 with Loeuwenhoek's discovery of calcium phytoliths in the early years of microscopy (Mulholland & Rapp 1992). No advances were made until 1835, when German botanist Struve noted the presence of phytoliths in living plants but it was his fellow German scientist Ehrenberg who had a profound effect of the early years of phytolith research (Piperno 2006). Ehrenberg, a plant and animal microbiologist, began the first systematic classification of phytoliths based on plant and soil samples sent to him from across the world. Initially, he believed phytoliths to be the skeletons of micro-organisms living in the plants but later came to realise that these were mineralized plant tissue (Mulholland & Rapp 1992). Of the many samples sent to him, those sent by Darwin are of particular interest. The sample contained dust which Darwin had collected from the sails of the HMS Beagle as it was anchored off the Cape Verde Islands. Ehrenberg immediately recognized phytoliths within the sample and as such Darwin became the first person to sample phytoliths in aerosols (Pearsall 2006).

The second phase, referred to as the botanical phase, was centered in Germany between 1895 and 1935 where scientists produced numerous reports regarding the production, taxonomy, intraspecific variation and dispersion techniques of phytoliths, particularly of those in the Poaceae family (Mulholland & Rapp 1992). It should be noted that main body of botanical research during this period is largely in German as phytoliths were mostly unnoticed in the English-speaking world (Piperno 2006). The start of World War II put a stop to phytolith research which would only resume again in the mid-1900s.

The next phase, which Piperno (2006: 3) refers to as the ''Period of Ecological Research'', took place between the mid-1950s and 1975. During this time scientists utilized phytoliths found in soils to create indices of past environmental histories. The focus of research moved out of Germany into the United States and United Kingdom. Many new discoveries were made. Phytoliths were found to last millions of years as opposed to only 1000 and that they could be found in a variety of contexts such as deep-sea cores or atmospheric dust. Additionally, many studies expanded into the examination of the physical and chemical properties of phytoliths as well as observing siliceous bodies present in non-monocotyledon as well as woody dicotyledon species (Piperno 2006). Of the most important studies conducted in this period was that by Twiss *et al.* (1969) in which a classification system was developed for Festucoid, Chloridoid and Panicoid which are Poaceae subfamilies. This system is still in use today.

Modern phytolith research commencing from the 1970s and onwards shifted towards a more archaeological and palaeoecological direction. The focus of contemporary phytolith research in archaeology has been centred around the creation and application of phytolith typologies (Hart 2007). Research since the 1970s has seen a global expansion in archaeological research with an increasing number of projects attempting to reconstruct past environments and "uncovering the origins and intensification of agriculture" (Hart 2016: 24). Hart (2016) believes that as of 2001 phytolith research has begun to move into a new phase which he refers to as the "Period of Expanding Applications". Several important developments have taken place since 2001. The numerous new studies have brought about advances in knowledge in in topics such as plant utilisation by early Homo Sapiens, ritual practices, hunter-gatherer foodways etc. Technology is now increasingly playing a role in morphometric analysis using computer imaging technology and statistical software to refine criteria differentiating between phytoliths that have similar morphotypes. However, the creation a of standardised terminology and recommended methods, protocols and measurements are likely the most important development in contemporary phytolith research (Madella *et al*. 2005).

4.2.2. Phytolith production

Phytoliths are inorganic inclusions occurring in the leaves, inflorescence, roots and stems of plants. They exist as a result of metabolic and physical processes whereby soluble monosilicic acid ($SiO_{2.n}H_2O$) is absorbed from groundwater through the roots, transported via the xylem and deposited in intracellular and extracellular spaces where it settles, solidifies and takes the form of that space in which it was deposited (Jones *et al.* 1963; Piperno 2006; Shillito 2013). Two principal mechanisms, determined by environment and genetics, control the production of phytoliths (Madella *et al.* 2009). Certain cells in the plant are genetically primed to deposit opaline silica taken up through the roots to fill tissues while others are filled with opaline silica due to what is referred to as evapotranspiration (Madella & Lancelotti 2011). The aqueous silicic [$Si(OH)_4$] is transported through the plant via transpiration. The silica serves several essential functions in a plant, providing structural support; protection against herbivores and mitigation against the effects of toxic heavy minerals such as aluminium (Piperno 2007). The degree of development of phytoliths in a plant are influenced by the taxonomic affinity of the specific plant, the plant's age, the nature of the soil, the volume of water in the soil and the climatic environment in growth (Piperno 2006).

Phytoliths are produced through two rudimentary mechanisms. The first is formation within idioblasts or specialized silica-accumulating cells, while the second is formation in the previously mentioned intercellular and cellular spaces (Pearsall 2015). Piperno (1991) referred to the various forms which phytoliths take as incidental and non-situational. Incidental formations are produced when "a cell is completely, or almost completely, silicified, resulting in a mineralized replica of the living structure. The shape and surface decoration of the phytolith are then contingent on the structure of the parent cell" (Piperno 1991: 162). Examples include trichomes and epidermal cells. Non-situational formations though are produced by incomplete silicification of the cell's interior which results in forms which do not imitate the original shape of the cell (Piperno 1991).

Whether silica absorption is active or passive is in dispute (Blackman 1968; Jones & Handreck 1965, 1969; Van der Vorm 1980; Jarvis 1987; Piperno 1991, 2006; Liang *et al*. 2005; Mitani & Ma 2005). Passive absorption refers to "passive, non-selective, process in which the monosilicic acid moves concomitantly with water both across the root and in the transpiration stream" (Jones & Handreck 1969: 79). Active absorption is when the plant actively regulates the absorption of monosilicic acid. The amount of monosilicic acid that is absorbed is reliant on environmental elements such as the silica content of the soil while the areas where it settles is reliant on by biological elements such transpiration and plant maturity (Jones & Handreck 1965, 1969; Piperno 2006).

Jones and Handreck (1965, 1969) undertook two studies examining passive silica uptake. In their 1965 study, they undertook an experiment to study the silica uptake of *Trifolium incarnatum* (Crimson clover) in which the plants were grown in solution cultures were compared to plants grown in soils. It was found that monosilicic acid became more concentrated in areas high in transpiration. Therefore, passive uptake can lead to phytolith formation. This finding is corroborated by Blackman (1968) and Piperno (2006). However, studies by Van der Vorm (1980), Jarvis (1987), Piperno (2006) and Okuda and Takahashi (1964) demonstrate that silica is an active process in which plants can control silica absorption via metabolic processes. Van der Vorm (1980) was able to demonstrate in different species that silica levels were higher than would be possible in passive absorption. Additionally, there are other systems of silica uptake such as a combination of passive and active uptake or rejective silica uptake in which a plant has the ability to cease or limit uptake (Liang *et al.* 2005; Mitani & Ma 2005).

4.2.3. Phytolith research in South Africa

Relatively few research projects in South Africa have employed phytolith analysis in the determination of plant usage at archaeological sites. This stands in stark contrast to other regions, most notably New Zealand, China, the Amazon, and Japan where extensive use has been made of phytoliths in determining terrestrial paleo-environments or past climatic/ environmental conditions through the analysis of peat bogs, hearths, lake sediments and so forth (Tsutsuki *et al.* 1993; Iriarte *et al.* 2004; Piperno 2006; Cabanes *et al.* 2010). Those studies in South Africa that have studied phytoliths have done so for paleo-botanical research. The earliest study was by Oberholser (1968) to understand the presence of phytoliths sediments from the Springbok flats in Limpopo. McLean and Scott (1999), Scott and Rossouw (2005), Finné *et al*. (2010), Hahn *et al.* (2015) and Rossouw (2009) used phytoliths in creating and observing paleo-environmental proxies. However, a limited number of studies have employed phytoliths in the context of Iron Age agro-pastoralists. This can be partly attributed to the lack of studies undertaken on phytoliths produced by plants domesticated in Africa (Hattingh 2018). Additionally, there is a dearth in phytolith studies on the crops grown by agro-pastoralists in southern Africa.

Hattingh (2013, 2018) attempted to address this shortage. In her MSc (2013), her aim was to determine the types of crops grown by the Bokoni people to establish whether the introduction of terracing in agricultural practices was a result of the introduction of new crops, such as *Zea mays*. Her secondary aim was to identify indigenous plants grown in the area of the Bokoni settlements, situated in the Mpumalanga Province, in order to explore the regional climate at the time of settlements' occupation. In this work, she stressed the importance of having access to a comparative reference collection. Due to a lack of research on the diagnostic phytoliths produced in African cultivars, Hattingh created a reference collection detailing the morphology of *S. bicolor*, *P. glaucum*, *E. coracana*, *V. radiata* and *V. unguiculata*. She concluded that *P. glaucum* and *E. coracana* may have been cultivated on the terraces but it is more likely that the terraces were more likely to have served the purpose of limiting erosion, managing moisture or to create ideal growth conditions for crops (Hattingh 2013: 87).

Later Hattingh (2018) further expanded upon the phytolith comparative collection which she had created. This expansion contains two important additions. The first being the incorporation of an additional three species. These species being *Z. mays*, *Vigna subterranea* and *Arachis hypogaea*. Moreover, an assessment was made on whether phytolith morphology in juvenile and mature plants alter with age and a comparison was made between the morphology, length and width of selected species in order to determine any diagnostic phytolith production. Her subsequent findings were as follows: *A. hypogaea*, *V. subterranea* and *V. unguiculata* do not produce any useable diagnostic phytoliths. *E. coracana*, *S. bicolor* and *P. glaucum* only produce a limited number of diagnostic phytoliths and *Z. mays* produces unique diagnostic phytoliths. Lastly, no substantial differences were found in the phytoliths produced in juvenile and mature Fabaceae but that some striking differences were found between the phytoliths produced in juvenile and mature Poaceae.

4.2.4. Phytolith deposition, preservation and dissolution

Phytoliths are not released via a dispersal mechanism such as pollen or seeds are. The most common manner of release is through the decay of the plant leading to deposition directly into the A horizon or uppermost section of soil (Piperno 2006; Pearsall 2015). This is known as highly localized in situ deposition or the decay-in-place model (Dimbleby 1978; Mulholland 1989; Piperno 1988, 2006). In studies of Panamanian soil profiles Piperno (1985) demonstrated that phytoliths decreased with depth in soil profiles. However, past research has shown that if the soil moves, the phytoliths move (Pearsall 2015). Phytoliths have been found in wind-blown dust, such as that found by Darwin (1909) in the sails of a ship or washed into bodies of water (Twiss *et al*. 1969; Fredlund & Tieszen 1994; Piperno 2006). This facet of phytolith assemblage formation was referred to by Fredlund & Tieszen (1994) as the inheritance and dispersal model.

Inheritance in this context denotes the long-term incorporation of phytoliths into the soil assemblage (Fredlund & Tieszen 1994). The length of time represented for any such assemblage will inevitably vary. Firstly, the inheritance is affected by proportion of soil accretion and secondly, the configuration of the assemblage is affected by mean residence time for phytolith persistence. Mean residence time alludes to the average life expectancy for phytoliths within a specific type of soil until dissolution occurs. Mean-residence time and inheritance are still poorly understood and may affect the interpretation of phytolith soil assemblages, and any interpretation thereof must take this into consideration along with a consideration of phytolith dispersal (Fredlund & Tieszen 1994). In this approach phytolith dispersal is modelled as five processes: ‘‘decay-in-place, fire, eolian transport, herbivory fluvial/colluvial transport’’ (Fredlund & Tieszen 1994: 321). The source areas for these phytoliths may be local, extra-local or regional. Fluvial/colluvial, fire-eolian, eolian, decay-in-place/gravity and herbivory are responsible for phytolith dispersal. It is based on the assumption that over an extensive period these mechanisms hypothetically remove and deposit an equal amount of soil. The model commences by estimating the total likely phytolith weight resulting from annual grassland productivity. In their research, Fredlund & Tieszen (1994: 331) projected a hypothetical yearly phytolith influx ‘‘budget’’ for a soil plot in the Great Plains of the United States. Their model confirmed their hypothesis: that the mechanism for the mixing of extra-local and regional source areas was vital in understanding the assemblage formation for grassland soils. Furthermore, they put forward that in an open plains environment local vegetation could not be held solely responsible for the deposition of phytoliths. They concluded that regardless of local, extra-local and regional phytolith sources, that it is possible to foresee and reconstruct the composition of grasslands from their phytolith assemblages.

During her research on archaeological site formation processes affecting botanical remains in open desert environments Lawlor (1995) replicated seed processing sites and compared them to matched control plots. In these experiments, Lawlor (1995) conducted food preparation activities such as grinding, threshing, parching and burning on the control plots and as well as the effects of granivore activity. It was concluded that ''variation among … modern soil, in an open, very windy environment and a very homogeneous vegetation distribution, indicates that in-place decay may account after all for at least some of the phytolith distribution on the plots'' (Lawlor 1995: 372). Dispersal, such as bioturbation and water percolation contribute to phytolith assemblage formation and stability in soil (Hart & Humphreys 1997; Hart 2003; Humphreys *et al*. 2003; Fishkis *et al.* 2010). In a study of a soil profile that displayed high levels of bioturbation in the A soil horizon, it was shown that phytoliths declined with depth and that phytoliths moved down into the B horizon due to bioturbation. This finding was supported by Fishkis *et al.* (2010), Hart and Humphreys (1997) and Humphreys *et al*. (2003).

The inorganic nature of phytoliths make it possible to survive environment conditions hindering the preservation of starch and macrobotanical material. Anaerobic conditions are necessary to halt the disintegration of organic material through micro-organisms and the types of soil (Piperno 2006). Phytoliths are able to preserve in various soil types. However, soil alkalinity with pH levels of nine and over, leads to dissolution, especially in hot, humid conditions (Piperno 2006). Certain contexts, such as ashy middens, often do not preserve phytoliths. Despite this, phytoliths have been found in such contexts (Piperno 1985, 2006; Pearsall & Trimble 1984). In addition, Rovner (1983) asserted that the size and shape of phytoliths also influenced preservation. Poaceae phytoliths tend to have good preservation due to their polyhedral shapes, whereas arboreal phytoliths tend to have poor preservation as they have a large flat surface area (Rovner 1983; Piperno 2006; Cabanes & Shahack-Gross 2015).

4.2.5. Phytolith morphology

Phytoliths are copiously produced by plants and a single taxon often produces many different phytoliths of which some are reproduced in countless other taxa (Rovner 1983; Piperno 2006; Barboni & Bremond 2009; Pearsall 2015). Rovner (1983) refers to this as multiplicity and redundancy. Poaceae is an excellent example of multiplicity and redundancy. Poaceae is a large family comprised of eight subfamilies in roughly 10 000 species in about 700 genera, including *S. bicolor*, *Z. mays*, *P. glaucum* and *E. coracana*. Eight sub-families are found in southern Africa. These are Pooideae, Panicoideae, Ehrhartoideae, Danthonioideae, Chloridoideae, Bambusoideae, Arundinoideae and Aristidoideae (Hattingh 2013).

Phytoliths are bisected into long-cells and short-cells. Long-cells (Figure 4.1.) tend to vary in shape but generally have rectangular outlines with interlocking, sinuous borders (Pearsall 2015). The usefulness of long-cells in identifying between different Poaceae tends to vary as some forms are commonly produced in the family. It is the lesser occurring long-cells which are most useful in providing identification as certain taxa produce long-cells with epidermal appendages such as prickles, hairs and spines (Pearsall 2015). This produces a characteristic appearance advantageous to identification.

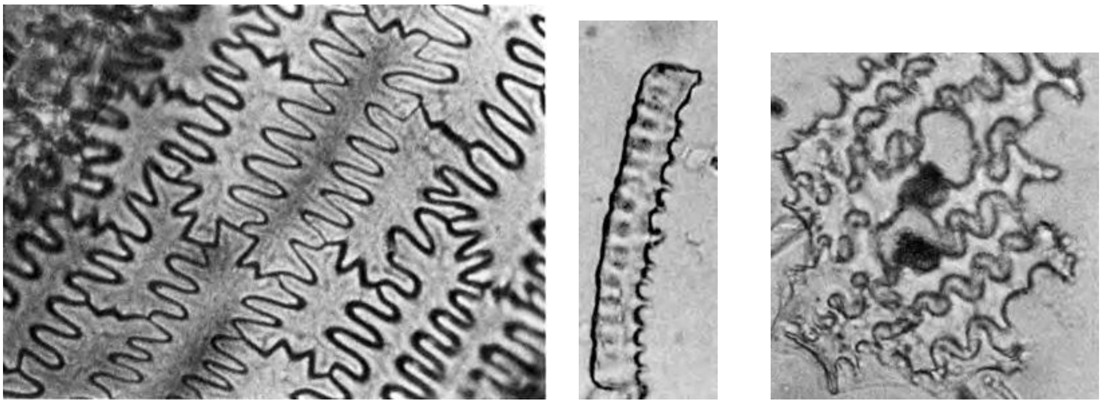

Figure 4.1. Examples of long cells (Pearsall 2015: 257).

Short-cell phytoliths are copiously produced in Poaceae and are found lying across the veins of a leaf, between the veins and in leaf-derived tissue such as glumes (Pearsall 2015). Certain short-cells phytoliths have been shown to be diagnostic to sub-family level and in rare instances, species level (Twiss *et al.* 1969; Rovner 1983; Rossouw 2009). Short-cells fall into the Festucoid (Pooid), Panicoid or Chloridoid classes (Twiss *et al.* 1969; Pearsall 2015). Festucoid (pooid) tends to produce orbicular (circular), elliptical, rectangular, acicular, crescent, polylobate (crenate), or oblong forms. Chloridoid is characterized by saddle-shaped forms and Panicoid by cross-, bilobate- and polylobate forms. Twiss *et al.* (1969) Also noted a fourth class, termed Elongate possessing no sub-family characteristics but uniform in distribution across taxa. Some phytoliths match to particular sub-families, for example Bambusoideae and Chloridoideae create bilobates (Twiss *et al.* 1969; Rossouw 2009). Although bilobates are most commonly found in Panicoid Poaceae, Polylobate and cross phytoliths are also found in Panicoideae and are thus seen as diagnostic of Panicoid (Fredlund & Tieszen 1994). Pooideae tend towards oblong, rectangular, square, orbicular and trapezoid (Twiss *et al.* 1969; Rossouw 2009). Variant one or depressed saddles, elongated and squat saddles are most commonly found in Chloridoideae with Variant two saddles frequently occurring in taxa belonging to the Aristoideae sub-family (Twiss *et al.* 1969; Rossouw 2009). In addition, trapezoid phytoliths have been observed in Pooid but are more diagnostic of the sub-families Ehrhartiodeae and Danthonioideae. Deviations do occur in phytolith morphology. Pearsall (2015) identified eight variants of the cross shaped phytoliths (4.3.), permitting for diagnostic identification of *Z. mays*. Three bilobates (Figure 4.4.) and two saddle (4.5.) variants were also identified by Rossouw (2009).

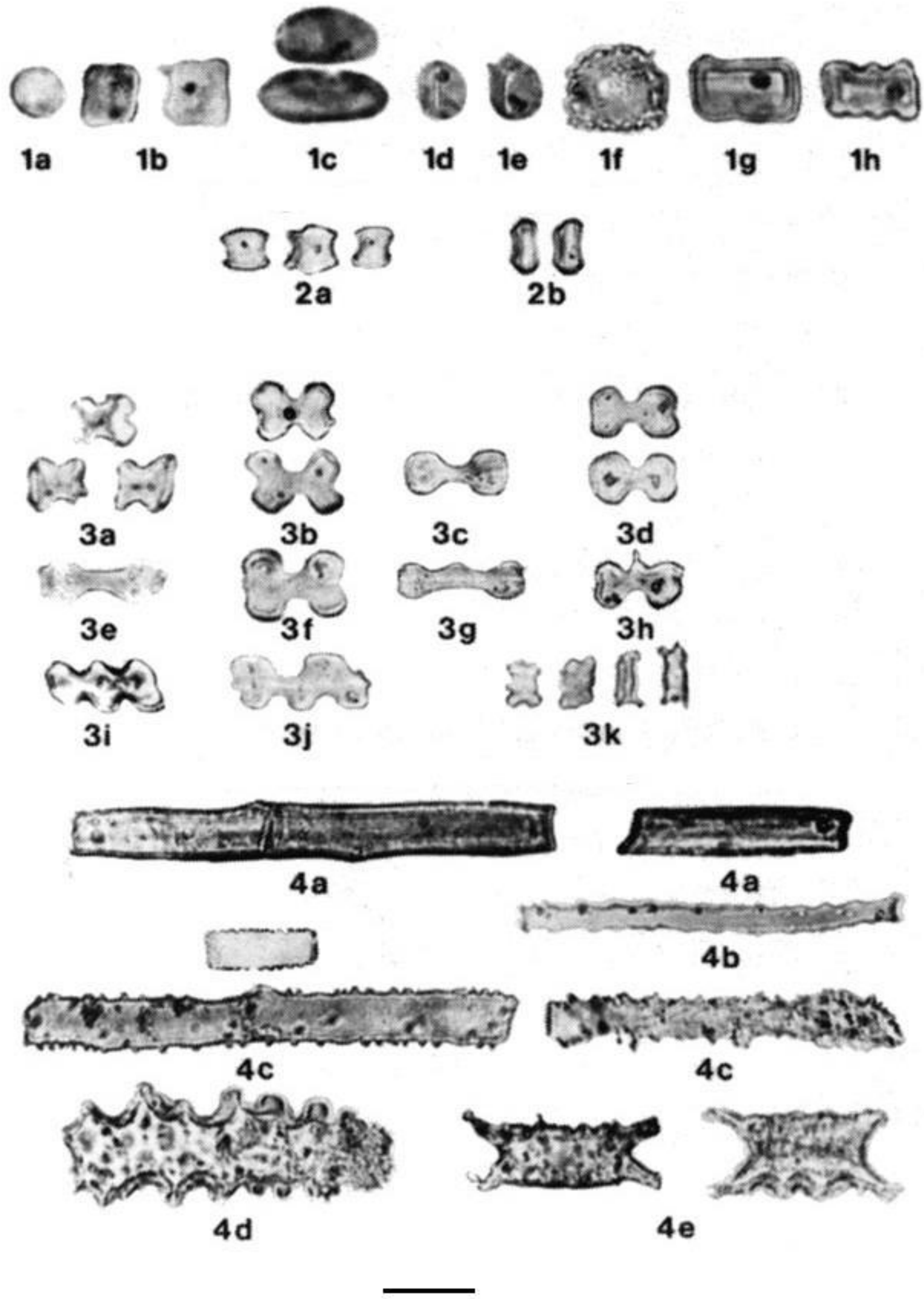

Figure 4.2. Classification of Poaceae phytoliths. (1a-h) Orbicular, oblong, rectangular and square phytoliths produced by Pooid grasses. (2a-b) Saddle phytoliths from Chloridoideae and Aristidoideae. (3a-k) Bilobate, cross and polylobate phytoliths produced by Panicoideae. (4a-e) Undiagnostic phytoliths uniformly created by all Poaceae taxa (Twiss et al. 1969: 111).

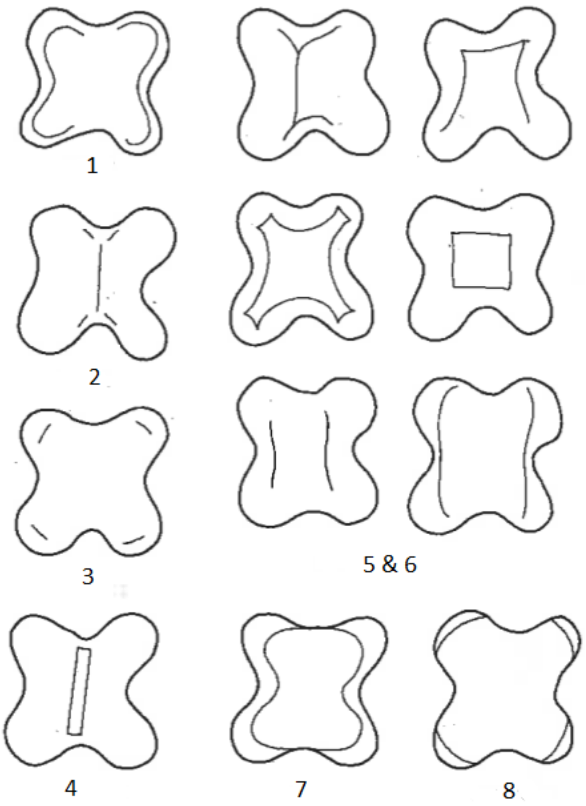

Figure 4.3. Cross variants (Pearsall 2015: 313)

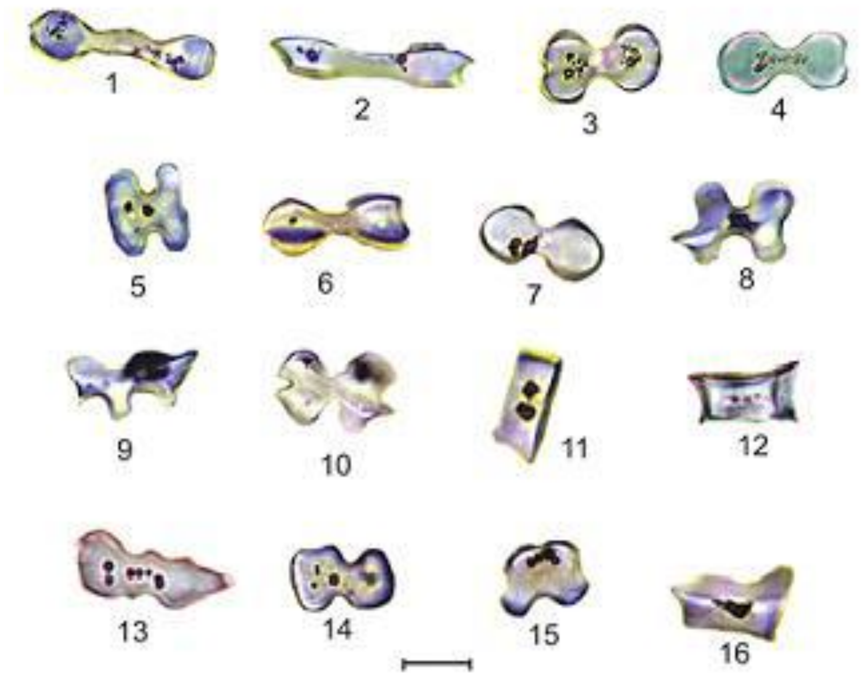

Figure 4.4. Bilobate variant 1: (1) Planar view; (2) Side view. Bilobate variant 2: (3-7) Planar view; (8-10) Oblique view; (11-12) side view. Bilobate variant 3: (13-15) Planar view; (16) Oblique view (Rossouw 2009: 52).

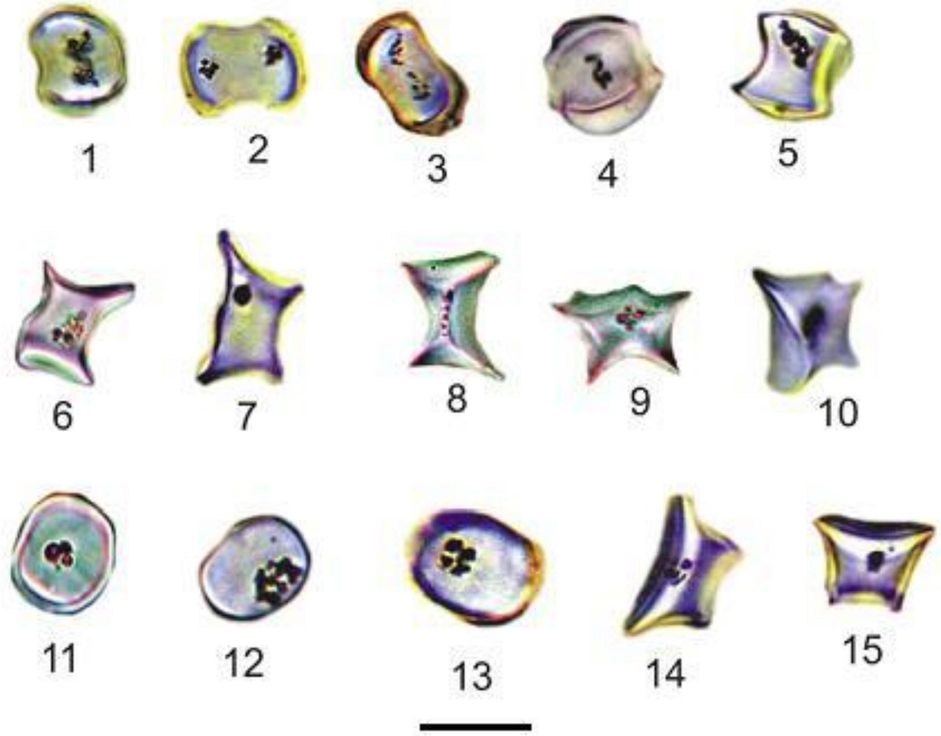

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Figure 4.5. Saddle variant 1 (squat saddles): (1-5) planar view; (6-8) side view; (9) end view; (10) oblique view. Variant 2 saddles (elongated saddles): (11-13) planar view; (14-15) side view (Rossouw 2009: 53).

4.2.6. Phytolith morphotypes

Bilobate (Lobate class) and polylobate

Rossouw (2009) put forward his hypothesis that bilobates, of which he recognizes three variations, are the most diagnostic grass silica short-cells (GSSC). The lobate class morphotypes are characterised by ‘‘trough-shaped outer surfaces, distinctive central portions and modular structures’’ (Rossouw 2009: 46). These morphotypes are bilobates, polylobates and crosses (Figures 4.3. – 4.5.). Lobates (Figure 4. 6.) are comprised of two lobes which are parted by a central segment of differing length and thickness, also known as a shaft. The planar surfaces and lateral walls are generally concave and in planar view, the terminal margins of the lobes tend to be rounded with some displaying depressions. Rossouw (2009: 46 – 47) based his three variants according to the proportions of the shaft between the lobes and the outline symmetry of the planar surface.

Variant one (Figure 4.8.) has a relatively elongated shaft in which the length exceeds one-third of the total length. The lobes are orbicular and presents as symmetrical in planar view. The lateral plane is symmetrical with the length of the shaft equal to or greater than one-third of the total length. Included in this class is the bilobate detailed by Fredlund and Tieszen (1994), Mulholland (1989) and types 3c and 3e (Figure 4.2.) in Twiss *et al.* (1969).

Variant two (Figure .4. 3 – 10) has a relatively short shaft where the length is less than or equal to one-third of the length. The lobes are orbicular to ovate and symmetrical in planar view. The side view displays a symmetrical lateral plane. This variant correlates to Panicoid and Chloridoid bilobates in Mulholland (1989) and types 3b, 3d and 3f (Figure 4.2.) in Twiss *et al.* (1969).

Variant three (Figure .4. 13 – 16) is symmetrical in planar view with the length of the shank less than one-third of the total length. The side is trapezoidal or tabular and is compared by Rossouw (2009) to the irregular dumbbell in Twiss *et al.* (1969) and the 'other' lobate in Fredlund and Tieszen (1994). An additional variant was cited by Twiss *et al.* (1969) and has symmetrical lobes and a shank of more than a third of the length.

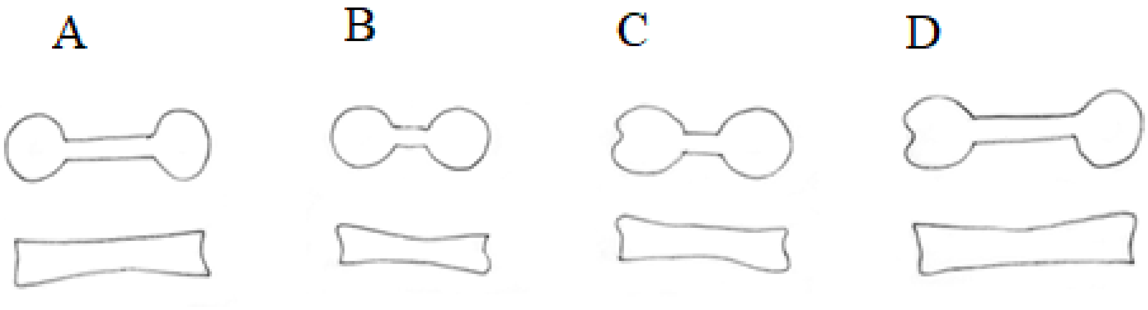


Figure 4.6. Variant one (A), Variant two (B), Variant three (C), Variant four (D) (Hattingh 2018: 37)

Polylobate

Polylobates have more than two lobes with characteristic central portions between the lobes. The lateral planes are symmetrical with tabular outlies in the side view (Mulholland 1989; Rossouw 2009). This morphotype is compared by Twiss *et al.* (1969) to their type 3i (Figure 4.2.). The distinctive form of polylobates distinguishes it from the sinuate trapeziform morphotypes.

Cross

Mulholland (1989: 495) defined crosses as having approximately four equal lobes (Figure 4.7.). Crosses are shorter than bilobates. The lobes can be irregular or symmetrical in shape. Lobes are either rounded or spiky with a moderate central portion (Rossouw 2009). This morphotype corresponds to 3a (Figure 4.2.) in Twiss *et al.* (1969). Piperno (1984) and Pearsall (2015) identified eight variants of cross-shaped phytoliths. The differentiation between the variants is based on the morphological features when observed in planar view. This morphotype is viewed from four angles. These are dorsal, ventral, and both sides. In planar view when the ventral is observed the dorsal is presented as a shape within the cross itself (Pearsall 2015). In side view, regardless of variant, cross-shaped phytoliths appear as trapezoidal or rectangular.

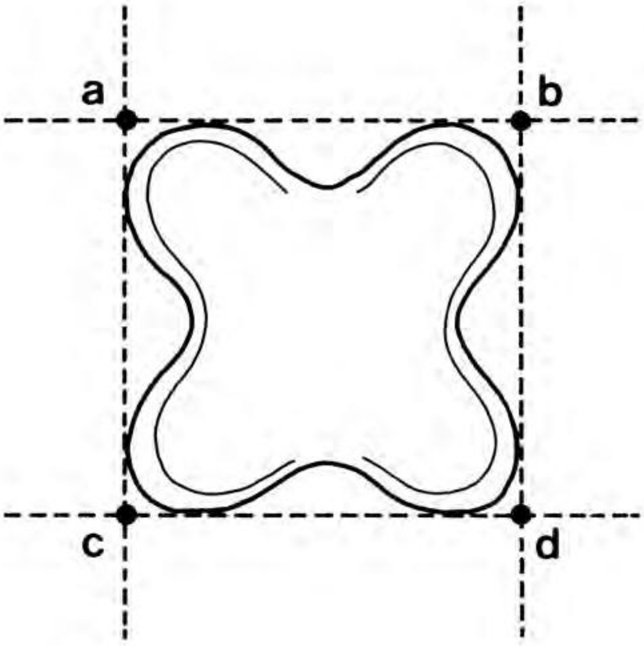


Figure 4.7. Example of the definition and measurement of cross-shaped, all sides are equal (ab, cd, ac and bd) (Pearsall 2015: 312).

Variant one (Figure 4.3.) the ventral and dorsal surfaces hold the same shape and when the ventral side is viewed the dorsal side is visible and gives the appearance of a cross within a larger cross (Piperno 1984). Variant two (Figure 4.3.) has a vertical line across its axis, giving the dorsal side a tent-like appearance. Variant three (Figure. 4.3.) has four projections on the dorsal side which in planar view present as small lines within each lobe. Variant four (Figure 4.3.) has a slim rectangular dorsal side which is seen as a vertical rectangle within the centre of the cross. Variants five and six (Figure 4.3.) are very similar in appearance as they both have two pieces of silica protruding along the length of the form that when seen in planar view appear as parallel lines restricted to the sides of the cross. Variant seven (Figure 4.3.) when viewed from the dorsal side is bilobate shaped and in planar view presents as bilobate in a cross. Variant eight (Figure 4.3.) whose dorsal view is rondel shaped and its planar view shows sections of the circumference visible from the lobe tips.

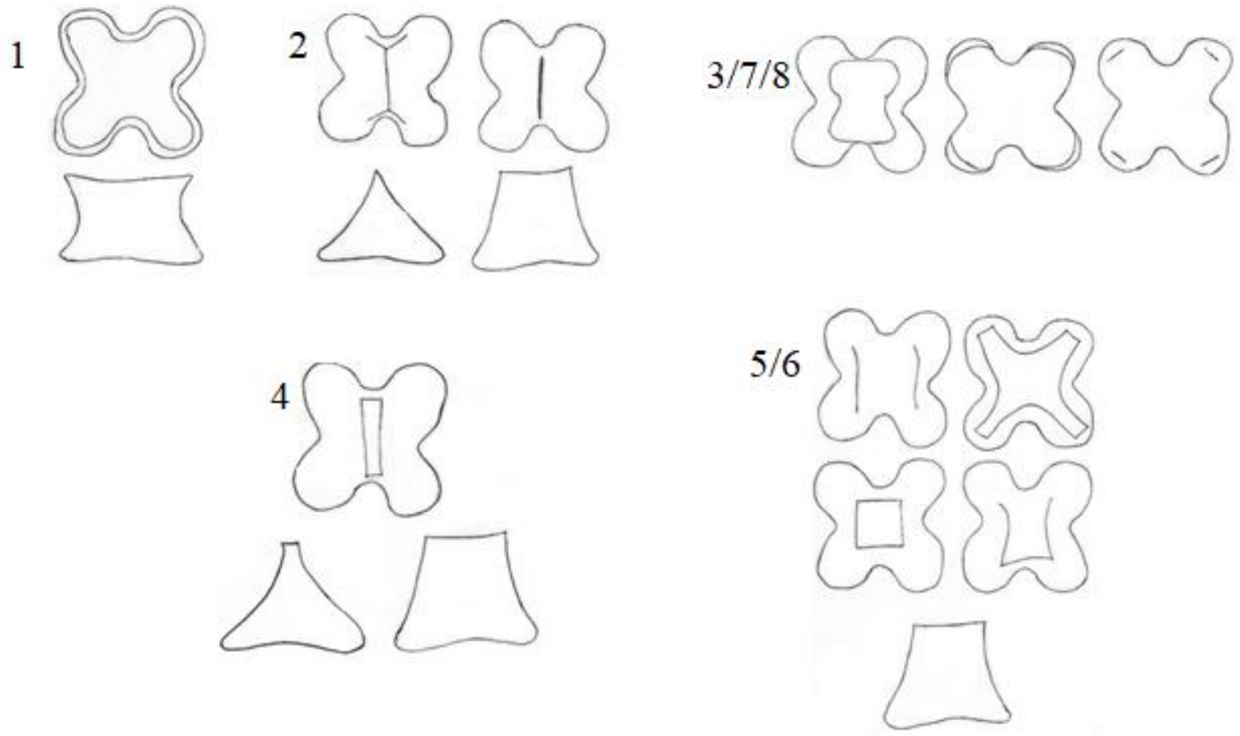


Figure 4.8. Cross variant 1: Planar and side view, Variant 2: Planar and side view, Variant 3/7/8: Planar and side views, Variant 4: Planar and side views, 5/6: Planar and side view (Hattingh 2018: 38 – 40, adapted from Pearsall 2000).

Saddle

‘‘The saddle class is represented by equidimensional bodies, also with concave outer surfaces, that are distinguished mainly by their planar outlines’’ (Rossouw 2009: 48). They are distinguished from the trapezoids in the Trapeziform class by their moderately shorter proximo-distal length (Rossouw 2009). Rossouw (2009) listed two variants (Figures 4.9. and 4.10.) and Thorn (2004) recognised three types. Thorn’s (2004) types were, wide-based 1-spiked, narrow-based winged and tabular. These were distinguished from each other by their proximo-distal proportions. Variant one is trapezoidal in the side view and displays a plateau varying from square to rectangular in planar view. Its base is hardly ever vertical and the widens or tapers distally. The plateau possesses rounded corners with one or two medially constricted margins (crescent-shaped) and two moderately convex sides. Variant two is similar to the variant with the exception of the plateau which has rounded corners with no constricted margins (Rossouw 2009).

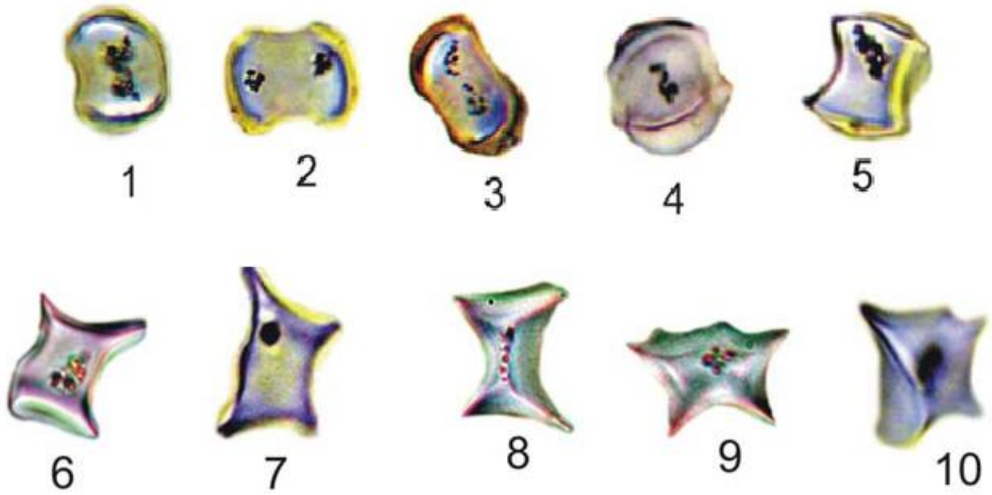
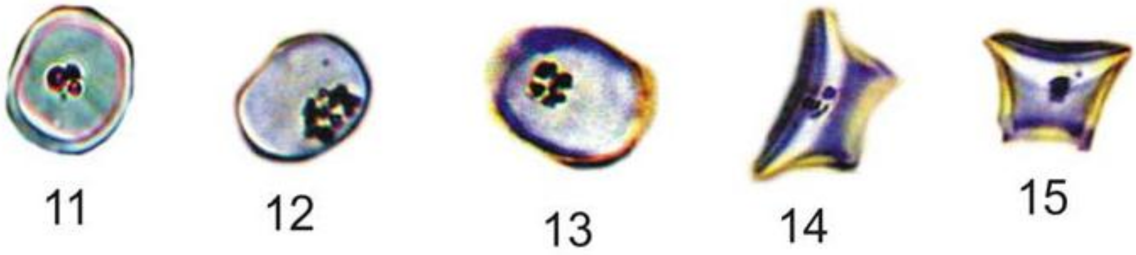


Figure 4.9. Saddle variant one (1-5): Planar view, (6-8): Side view, (9): End view, (10): Oblique view (Rossouw 2009: 53).



4.10. Saddle variant two (11-13): Planar view, (14-15): Side view (Rossouw 2009: 53).

Trapeziform

This class is named after its three-dimensional characteristics (Mulholland 1989). Included in this class are heterogenous geometrically uncomplicated morphotypes (Twiss *et al.* 1969; Mulholland 1989). Omitting the rondel, all the other morphotypes in this class when seen in planar view display quadrilateral dimensions (Rossouw 2009).

Rondel

Rondels (Figure 4.11.) are circular, elliptical, acicular or elongate in planar view and a truncate cone in side view (Rossouw 2009). Their ends are tapered or occasionally medically constricted (Fredlund & Tieszen 1994; Rossouw 2009).

Figure 4.11. Rondels (1-2): Planar view, (3-5): Oblique view, (6): Side view (Rossouw 2009: 55)

Trapezoid

Trapezoids (Figure 4.12.) are square and rectangular, six-sided morphotypes with parallel sides (Rossouw 2009). Its planar margins are angular and not medically constricted. Its proximal-distal length tends to be longer than saddles. This class is equivalent to the rondels described in Mulholland (1989), conical and pyramidal types in Fredlund & Tieszen (1994) and types 1b, 1d and 1f (Figure 4.2.) in Twiss *et al.* (1969).

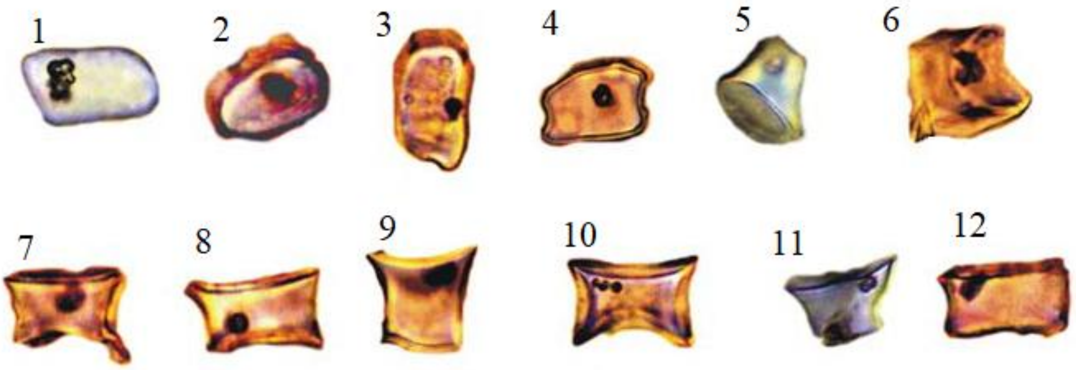


Figure 4.12. Trapezoids (1-4): Planar view, (5-6): Oblique view, (7-12): Side view (Rossouw 2009: 55).

Reniform

The reniform (Figure 4.13.) is crescent-shaped with medially constricted edges and angular planar margins (Rossouw 2009). It is comparable to the rondel type in Mulholland (1989) and type 1e (Figure 4.2.) in Twiss *et al.* (1969).

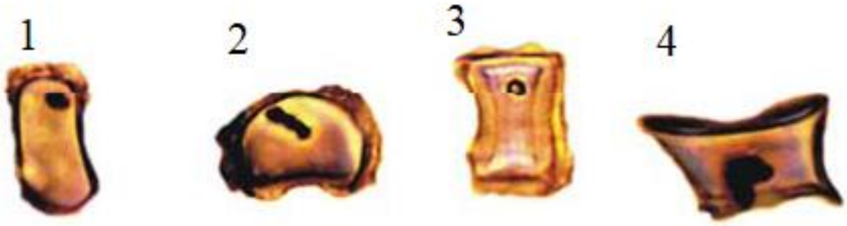


Figure 4.13. Reniform (1-3): Planar view, (4): Side view (Rossouw 2009: 55)

Oblong

“The oblong category includes six-sided silica bodies that are at least twice as long broad with parallel or nearly parallel sides” (Rossouw 2009: 49). Oblongs (Figure 4.14.) have crenate, smooth, sinuous edges and trapezoidal in cross-section. It corresponds to the longer forms with polygonal shapes in cross-section in Mulholland (1989), crenate types in Fredlund & Tieszen (1994) and types 1c, 1g and 1h (Figure 4.2.) in Twiss *et al.* (1969).

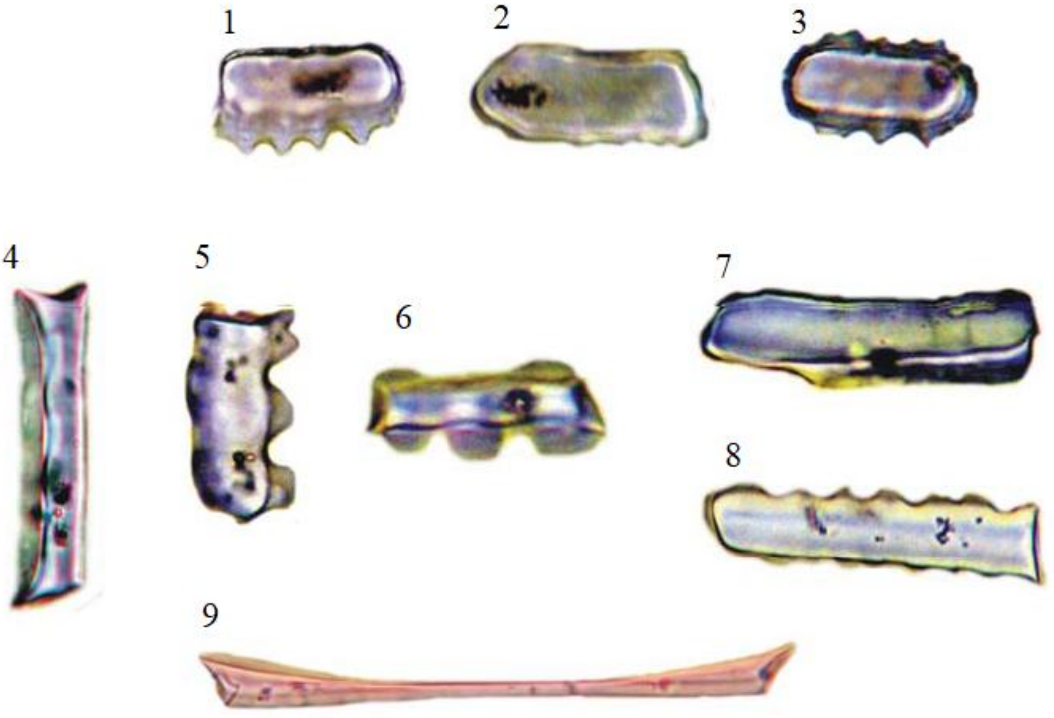


Figure 4.14. Oblongs (1-3, 8): Trapeziform sinuate Planar view, (4, 7, 9): Trapeziform smooth oblique view, (5-6): Trapeziform polylobate oblique view (Rossouw 2009: 55).

4.3. Conclusion

A great deal of research has been done on non-African crop and other non-dietary plants such as *Z. mays*. More recently, researchers have begun researching phytoliths produced by African plants which agro-pastoralists of the MIA utilized. Hattingh (2013; 2018) created a reference collection on many species cultivated and naturalized by the Bokoni. Due to their inorganic nature and ability to survive various environmental conditions phytoliths preserve where macrobotanicals do not. It is recommended that future archaeobotanical research attempt to add to and build more extensive reference collections for both macro-botanical material and phytoliths.

CHAPTER 5

METHODOLOGY

Over the past few decades numerous sampling, extraction and analysis techniques have been employed concerning archaeobotanical material (See Madella *et al.* 1998; Scott 2005; Piperno 2006; Jennkins 2009; Sievers 2013; Pearsall 2015; Diehl 2017). The efficacy of these methods depends on factors such as the nature of the research questions, chemicals and equipment used in the process of extraction, analysis methods and the type of site studied as well as any samples taken from that site (Piperno 2006). No single method is appropriate or even useful for all the varieties of archaeobotanical material, i.e., the methods used in the extraction and analysis of macrobotanicals may vary wildly from those used for phytoliths (Miller 1988; Popper 1988). In the end, the most suitable methods of extraction and analysis must be selected according to the type of material and which are best able to answer the research questions. As such this chapter will outline the methods employed for this study in the analysis of macrobotanical and phytolith materials.

5.1. Macrobotanical Methods

5.1.1. Sample selection, material retrieval and identification

Macrobotanical samples were recovered from flotation material taken during the excavation of each of the sites between 2010 and 2018. The collection of flotation material is a routine aspect of excavations conducted by the University of Pretoria's Department of Anthropology and Archaeology. The flotation samples are then placed in the department's laboratory storage until such time as they can be analysed. For the macrobotanical samples, it was decided that as many samples as possible would be incorporated based on time available.

For the recovery of the macrobotanical material a modified SMAP-style (Shell Mound Archaeological Project) flotation machine was used. The SMAP machine utilises two parts, an outer barrel body and a rigid screen insert (Watson 1976; Pearsall 2015). The body of the barrel functions akin to a water reservoir for the flotation during which a continuous flow of pressurised water washes the soil, releasing material trapped in soil. Non-buoyant material such as ceramics sink to the mesh bottom of the insert while lighter buoyant material such as botany floats to the top and is carried out via a sluiceway attached to the insert into a waiting mesh container. The flotation machine used to recover the material for the study sites was an adjusted 200 L barrel with a 2 mm mesh for the insert. Flotation on material was conducted by the addition of soil from each loci to the flotation machine whereupon the material was agitated by hand. Buoyant material passed out the sluiceway into a chiffon bag hanging beneath it. The bags were then placed in a shady area in the laboratory to dry. The contents of the insert were scooped into a dense cotton bag and also left to dry. Once the material was completely dry analysis took place.

The dried light material was then placed in a set of nested geological sieves with the mesh varying between 1.25mm to 9.5mm. The content of each pan was examined under light microscopy with magnification between 0.65 – 4 X. This was done by filling up each petri dish to only a third-full to better facilitate visibility of material whilst sorting. Fine point tweezers and brushes were used to sort through the material. Any identified archaeobotanical material was placed into separate waiting petri dishes with a dish set aside for each individual taxa as well as for any unknown and indeterminate material.

Once all macrobotanical material was retrieved, identification of the material took place. All material was identified, where possible, to family, genus or species. Once identification (See Appendix A for seed morphological criteria) was completed the material was placed in gelatine capsules or plastic sample containers (depending on size and fragility), labelled, and placed into storage. Identification was undertaken with the aid of a small lab reference collection and botanical literature.

5.1.2. Quantification

Quantification of archaeobotanical material can utilise a wide variety of methods. However, not all methods can be applied, or are suitable for every analysis (Popper 1988). The type of analysis is dependent on the specific types of material recovered (Miller 1988). The method I chose for this study was ubiquity analysis, since much of the archaeobotanical material retrieved was highly fragmentary in nature.

Ubiquity or presence analysis measures archaeobotanical material at an assemblage level as it takes note of whether a taxon is present or absent within each sample (Pearsall 2015). Absolute counts are disregarded as it is assumed that the value of each taxon is heavily influenced by the preservation of the material (Popper 1988). Ubiquity scores are determined by recording the presence or absence of a taxon, regardless of whether the sample contains only one sample of the taxon or 100, in so doing giving the same weight to one or 100 (Popper 1988). Each taxon's ubiquity score is determined by the total number of samples a specific species is present in. This is then expressed as a percentage of the total number of samples in an assemblage, e.g., if *Vigna radiata* is present in forty out of 100 samples then the score will be 40%. Each taxon's score holds no influence over that of another, permitting an independent appraisal of each taxon within the assemblage. Ubiquity analysis is inherently comparative in nature and not absolute and any figures generated by this form of analysis are influenced to a certain degree by the quality of the raw data and as such significance must be attributed to overall trends as opposed to singular points (Hubbard 1980). Furthermore, incorrect grouping of samples can alter any results as having too few samples may lead to inflation of the score and the relationship between the score and the type of information sought must be made overt (Popper 1988). To counter this Diehl (2017) proposed sampling from all available features. This allows for confident sampling especially when sites are either very small or have very little available material.

5.2. Phytolith Sampling Methods

5.2.1. Sample selection

Samples for phytoliths were selected after the excavation records were examined to determine which samples would be most suitable for analysis. This was done to avoid any material which may have been contaminated as a result of animal burrowing. Due to time constraints and the low quantity of samples available for analysis, ten samples were selected for each of the sites. The samples were collected from features such as hut floors, middens, and kraals. Using the protocol established by Pearsall (2015: 275) 10g of soil was subsampled from the larger soil samples taken in-field. All samples were collected with a small sterile metal scoop which was cleaned in between each sample to remove any adhering soil. The sampled material was then transferred to sterile plastic bags and labelled.

5.2.2. Phytolith extraction

The 40 samples selected were processed at the University of Pretoria's archaeology laboratory. The presence of phytoliths is not immediately obvious when examined under the microscope as aside from the phytoliths themselves sediments are composed of several components such as soil particles, organic material, carbonates, clay particles etc. These unwanted components all bind themselves to phytoliths (Piperno 2006). Thus, to identify and quantify phytoliths these extraneous components must be removed through heavy liquid flotation (Lentfer & Boyd 1998; Piperno 2006). To do this several steps must be followed.

The first step in the processing of the samples was the removal of clay by placing 10g of sediment in centrifuge tubes filled with distilled water and Calgon ($Na_6O_{18}P_6$), shaken and left to stand overnight. Clay particles are usually up to 2 µm in size and remain suspended in the water (while the remainder of the material settles at the bottom of the tube (Zhao *et al.* 1998). The following day the tubes were centrifuged and the liquid containing the clay was decanted. The tubes were then filled with distilled water, centrifuged for three minutes at 1500 rpm and decanted. This process was repeated until the water in the tubes were cleared. The tubes were then left to dry.

The next step was to eliminate any carbonates from the samples. This was done by adding 15 ml of a 5% Hydrochloric Acid (HCl) solution to the tubes. These were then placed in a hot water bath until the bubbling reaction ceased. Once the reaction stopped the tubes were topped up with distilled water, centrifuged for three minutes at 1500rpm and decanted. This process was repeated a further three times and the tubes were then left to dry after the final decanting.

Thereafter, steps were taken to remove organic material from the samples. To do this 15ml of 30% solution Hydrogen Peroxide (H_2O_2) was placed in the tubes. The tubes were then again placed in a hot water bath until the reaction stopped. After the reaction stopped the tubes were filled with distilled water and centrifuged for three minutes at 1500 rpm and then decanted. This was done a further three more times before the tubes were left to dry. The dried tubes containing the Acid Insoluble Fraction or AIF were then weighed.

Next was the phytolith recovery. 10ml of a solution of Sodium Polytungstate [$Na_6(H_2W_{12}O_{40})H_2O$] with a density of 2.3g/cm^3 was added to the AIF. The tubes were then centrifuged for three minutes at 3000rpm. The floating fraction was recovered with a pipette and transferred to a newly labelled centrifuge tube; filled with distilled water and centrifuged again. This cycle was repeated several more times. After the final centrifuge, the resulting silicates were transferred to weighed and labelled glass storage vials using Pasteur pipettes. These vials were left to dry until the relevant slides were ready for preparation.

5.2.3. Phytolith mounting and counting

Slides were prepared by placing approximately 10µg of the extracted material onto a microscope slide. Four drops of Entellan New (Merck) were placed onto the material and mixed before a cover slide was put over the suspension. The slides were left to dry prior to phytolith analysis.

The slides were examined with a Nikon Eclipse 50iPOL microscope at 500x and 1000x magnification both under polarised and non-polarised light. When considered necessary photographs were taken of the phytoliths over the course of the analysis using an attached microscope camera and NIS Elements BR version 4.20 software. During analysis of the slides, a power failure caused the camera software to malfunction and as such there are no photos available of the material from MNR 074.

For analysis diagnostic scanning was chosen. Diagnostic scanning involves the identification and counting to a predetermined number of all identifiable phytoliths per a given slide. The predetermined number was 200. This number was decided upon as patterns of short cell occurrence tend to remain consistent even beyond a count of 200 (Piperno 2006; Pearsall 2015). Diagnostic scanning is both reliable and time-effective (Piperno 2006; Hattingh 2013; Pearsall 2015). The slides were examined in a linear fashion from top to bottom until 200 was reached. Every short cell encountered was tallied with a hand counter. Any redundant cells, or those which could be allocated to any sub-family, were not counted but were noted. If 200 was not reached upon completion of a slide then additional slides were made and counting continued until 200 was reached. Once analysis was completed all slides were placed in microscope slide storage containers and stored in the archaeology laboratory storage at the University of Pretoria.

5.2.4. Phytolith identification

For the identification of phytoliths use was made from published comparative reference material. This comparative reference material included photographs, drawings, descriptions of morphological shapes or morpho-types and identification keys. Once it was established which taxa may be encountered during analysis focus was placed on reference material about those taxa. The works of Rossouw (2009) and Hattingh (2013; 2018) proved to be the most useful reference materials. However, as Sjöström (2013) has noted, the use of previous studies as reference material for phytolith morphological classification can often present difficulties as different standards have been applied by different authors to describe phytolith morphotypes. In response to this, a standardised protocol to describe morphotypes was developed by the International Code for Phytolith Nomenclature (ICPN 1.0) (Madella *et al.* 2005). This protocol was applied to phytoliths found during analysis.

5.3. Conclusion

There is a myriad of ways in which archaeobotanical material can be collected, retrieved/extracted, analysed and quantified. Those chosen for this research were done so to facilitate a better understanding as to which plants were potentially This chapter presents the results of the analysed macrobotanical material recovered from Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074) The macrobotanical material referred to specifically in this chapter is that of primarily charred carpological remains.

Chapter 6

Macrobotanical results

This chapter presents the results of the analysed macrobotanical material recovered from Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074). The macrobotanical material referred to specifically in this chapter is charred carpological remains (See Appendix B for sample details).

Each site was analysed individually starting with the site with the most material (MUT) and ending with the site with the least amount of material (MNR 074). While Mutamba had a great deal of material available for analysis, the constrained nature of the material from Vryheid (MNR 04) and Frampton 1 (MNR 074) did not permit the utilisation of complicated statistical analysis. Thus, the decision was made to use ubiquity analysis, a quantitative approach (Popper 1988:60), to study the material.

6.1. The Mutamba (MUT) assemblage

6.1.1. General assemblage

Mutamba was found to have a rich macrobotanical assemblage (See Appendix C for seed identification characteristics) preserved in both carbonised and desiccated form. The material originates largely from two domestic features situated in the saddle area of the hill. A hundred samples were analysed from the site, representing approximately 1000 liters worth of floated material.

A total of 13 taxa were identified (See Table 6.1.). Eleven taxa could be identified to species level. Only two taxa were identified to genus level. Of the taxa identified at Mutamba, the most predominantly present was Poaceae. There are three cultivated taxa (*P. glaucum*, *S. bicolor*, *E. coracana*) and two wild taxa (*B. deflexa* and *B. nigropedata*). This family, in particular the cultivated taxa, accounts for the majority of the Minimum Number of Individuals (MNI).

Table 6.1. Mutamba assemblage

Family	Genus	Species
Poaceae	*Sorghum*	*bicolor*
Poaceae	*Pennisetum*	*Glaucum*
Poaceae	*Eleusine*	*coracana*
Poaceae	*Brachiaria*	*deflexa*
Poaceae	*Brachiaria*	*nigropedata*
Fabaceae	*Vigna*	*unguiculata*
Fabaceae	*Acacia*	
Fabaceae	*Vigna*	*radiata*
Malvaceae	*Gossypium*	*herbaceum*
Malvaceae	*Adansonia*	*digitata*
Rhamnaceae	*Ziziphus*	*zeyheriana*
Tiliaceae	*Grewia*	
Anarcardiaceae	*Sclerocarya*	*birrea*

Aside from the numerous Poaceae, the second most found taxa are Fabaceae. Two of the three Fabaceae found at the site were cultivated as crops. One, *V. unguiculata,* was indigenous while the other, *V. radiata*, was an exotic species originating from India (Fuller & Harvey 2006; Fuller 2007). The wild taxon being *Acacia* sp.

Other taxa found include those from the Malvaceae, Rhamnaceae, Tiliaceae and Anarcardiaceae families. All of these taxa were wild species. Moreover, no crop processing by-products or weed taxa were identified during the analysis.

Feature 1 assemblage

Feature 1 is made up of five layers containing ten identifiable contexts. These were described as follows: excavated surface collection (ESC), general (G), midden (M), surface outside structure (SOS), floor contact or material directly on floor surface (FC), unvitrified dung and ash (UDA), in-situ hearth (H), dung smeared floor outside the structure (DSF), gravel floor (GF) and an ashy pit fill (PF) (See Table 6.2.).

Table 6.2. Feature 1 assemblage content

Context	Domestic Taxa	Wild Taxa
ESC	*S. bicolor*, *P. glaucum*	*S. birrea*
G	S. bicolor, P. glaucum	
M	*S. bicolor, P. glaucum*, *V. radiata*, *V. unguiculata*	*Z. zeyheriana, Grewia* sp., *B. nigropedata*, *G. herbaceum, S. birrea*
SOS	*S. bicolor*	*S. birrea, G. herbaceum, Z. zeyheriana, A. digitata*

FC	*S. bicolor*, *P. glaucum*	*Z. zeyheriana*, *Grewia* sp., *S. birrea*
UDA	*S. bicolor*, *P. glaucum*	*Z. zeyheriana, Acacia* sp., *S. birrea*
H	*S. bicolor*, *P. glaucum*	*Z. zeyheriana*, *Grewia* sp., *Acacia* sp., *G. herbaceum, S. birrea*
DSF	*S. bicolor*, *P. glaucum*	*S. birrea, Grewia* sp.
GF	*S. bicolor, P. glaucum, V. radiata, V. unguiculata*	*S. birrea, Grewia* sp.
PF	*S. bicolor, P. glaucum, V. radiata, V. unguiculata*	*Z. zeyheriana, S. birrea, Grewia* sp., *Acacia* sp.

M and PF had the most material present. These two contexts had a wide variety of crop and wild taxa. M and PF are located in layers two to four of Feature 1 (Antonites 2012: 93-94). The deposit for these layers tended towards soft and ashy. Within these specific layers are the fragments of three consecutive floors. The first floor (floor 1.1) rests on layer three whose general consistency suggests the presence of a midden. This layer ends on a prepared gravel floor (floor 1.2). Layer four containing the third floor (floor 1.3) had in its northern profile a small pit-like feature filled with white ash and charcoal. However, aside from G which only contained only crop taxa, the other contexts contained a wider variety of wild taxa than crop taxa.

Feature 2 assemblage

Feature 2 comprises four layers containing five identifiable contexts containing archaeobotanical material. These were as follows: burnt hut remains (BHR), floor contact (FC), general (G), midden (M) and Rocky fill (RF) (See Table 6.3.).

Table 6.3. Feature 2 context contents

Context	Domestic Taxa	Wild Taxa
BHR	*S. bicolor, P. glaucum, V. radiata*	*B. deflexa, Acacia* sp., *S. birrea, G. herbaceum*
FC	*S. bicolor, P. glaucum*, *V. radiata*, *V. unguiculata*, *E. coracana*	*Z. zeyheriana*, *Acacia* sp., *G. herbaceum, S. birrea, A. digitata, B. deflexa, B. nigropedata*
G	*S. bicolor, P. glaucum*, *V. radiata*, *V. unguiculata*, *E. coracana*	*A. digitata, S. birrea*
M	*S. bicolor, P. glaucum*, *V. radiata*, *V. unguiculata*, *E. coracana*	*S. birrea, Acacia* sp.
RF	*S. bicolor*	

FC held the most material. It is present in level four of Feature 2. This level was interpreted as the rubble remains of a hut associated with the floor which rests on sterile soil (Antonites 2012). Two small features interpreted as possible hearths were also uncovered in the eastern part of the floor.

6.1.2. Mutamba ubiquity

Thirteen taxa, identifiable to species and genus level, were found at the site. However, some material was present but could not be identified as any specific family, genus or species. Overall, three taxa were overwhelmingly ubiquitous in the assemblage (See Figure 6.3.). One taxon was a wild species (*S. birrea*) and two were crop species (*P. glaucum*, *S. bicolor*). *S. birrea* and *P. glaucum* were the only two taxa with ubiquity scores exceeding 50%, while *S. bicolor* had a score just lower. The majority of the assemblage were below 50%. Five taxa, of which two were crop and three were wild were within the 10 – 20% range. These were *Acacia* sp., *V. radiata*, *V. unguiculata*, *A. digitata* and *Z. zeyheriana*. The remaining five taxa had scores below that of 10%. Only one of these taxa was a crop (*E. coracana*) species and the other four (*B. nigropedata*, *B. deflexa*, *Grewia* sp., *G. herbaceum*) were wild.

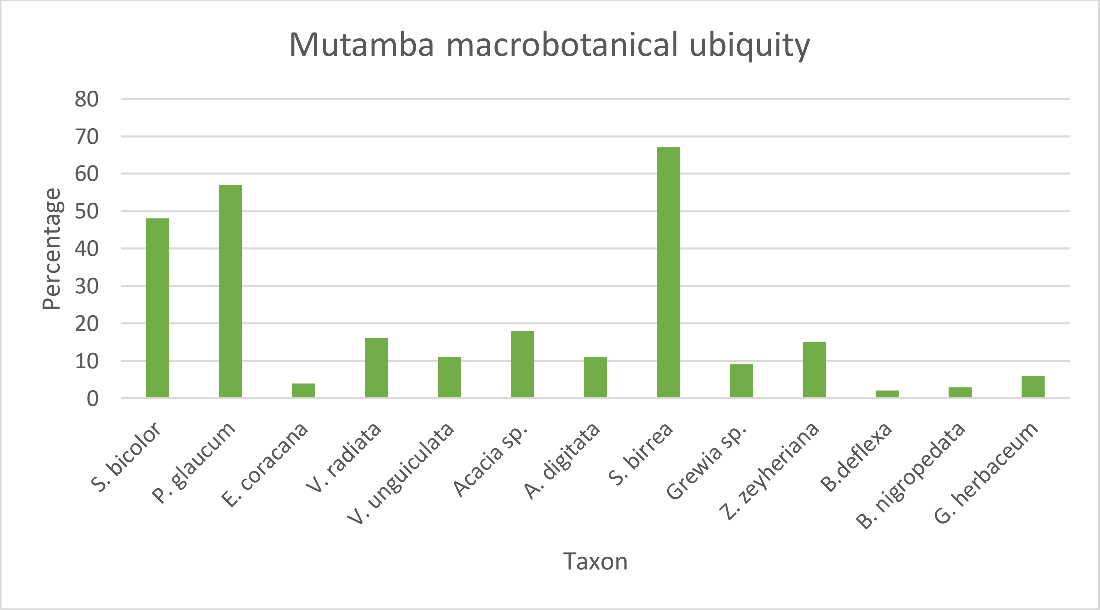


Figure 6.1. Mutamba macrobotanical ubiquity

6.1.3. Crop taxa, chaff, weeds and wild taxa

Crop taxa, chaff and weeds

Among the numerous taxa present within the samples *S. bicolor* was visibly the most dominant cultivated species, composing roughly 33% of the sum total of seeds found at the site (Figure 6.4.). It was present in almost half of the samples (u=48 samples, MNI=173). Some of the *S. bicolor* grains showed indications of malting for possible beer brewing. This is the only taxon where both sprouted and unsprouted forms were identified. Sprouting here refers to a seed showing an indication of germination having taken place before carbonisation.

Of the other cultivated grain species at Mutamba, *P. glaucum* was also among the most commonly occurring grain. It occurs in slightly smaller quantities (MNI=150) than the previously mentioned grain, accounting for almost 29% of the total material and is present in over half of the samples (64 samples). The third grain, *E. coracana*, is the least occurring grain (4 samples, MNI=4). This grain, found only in Feature 2, constitutes 0.8%. Its low occurrence may be concerned with the difficulty in the handling of the crop due to its minuscule size (National Academy of Sciences 1996).

Of the two legumes cultivated, both are present in relatively low numbers. *V. unguiculata* makes up approximately 6% of the material, and *V. radiata is* almost 4%. The former occurs in slightly fewer samples than the latter, with *V. unguiculata* found in 18 samples (MNI=32) *and V. radiata* in 16 samples (MNI=19).

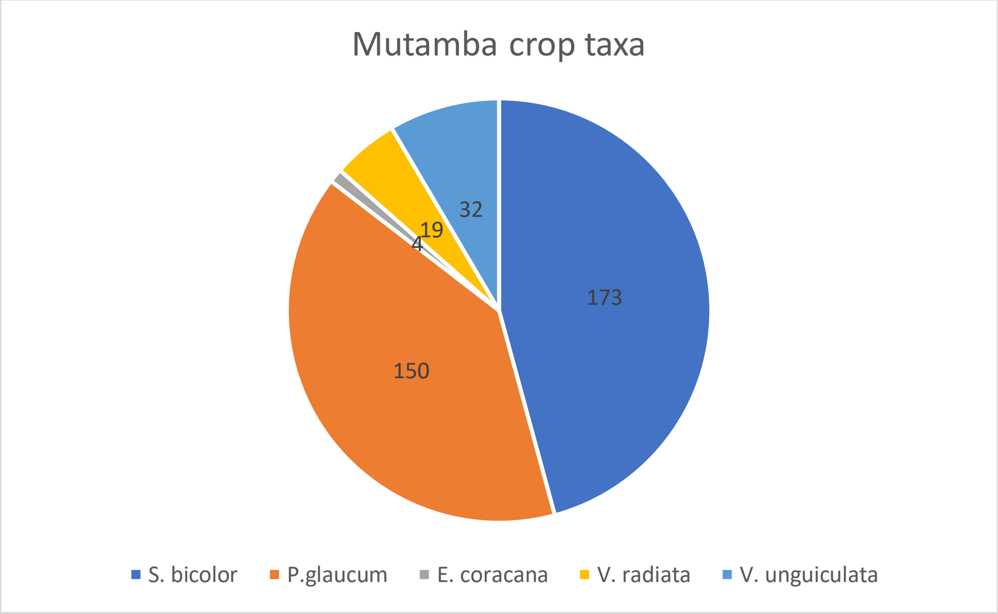


Figure 6.2. MNI of crop taxa identified at Mutamba

Wild taxa

Wild taxa were present in virtually all the samples. The taxa include species used for food, craft or medicine. Two of the taxa are grasses and the remainder are either trees or shrubs. The most dominant wild species is *S. birrea*, accounting for approximately 13% of the total material from Mutamba (68 samples, MNI=71). The species is largely found in the form of either endocarp fragments or opercula in the samples. Its large presence within the samples (Figure 6.2.) is overwhelming due to the species' remarkably high fruit yields.

The second highest wild taxon at Mutamba was *Grewia* sp., constituting almost 4% of the material (9 samples, MNI=19). This is followed closely by *Z. zeyheriana* with approximately 3% (14 samples, MNI=17). In general, the remainder of the wild taxa at Mutamba have low relative abundance scores below 2%. This included the two wild grass taxa, *B. deflexa (*2 samples, MNI=7) and *B. nigropedata* (3 samples, MNI=3). Their presence and low abundance scores may be a result of preservation but do serve to inform as to the wild taxa found in Mutamba's surrounding environment.

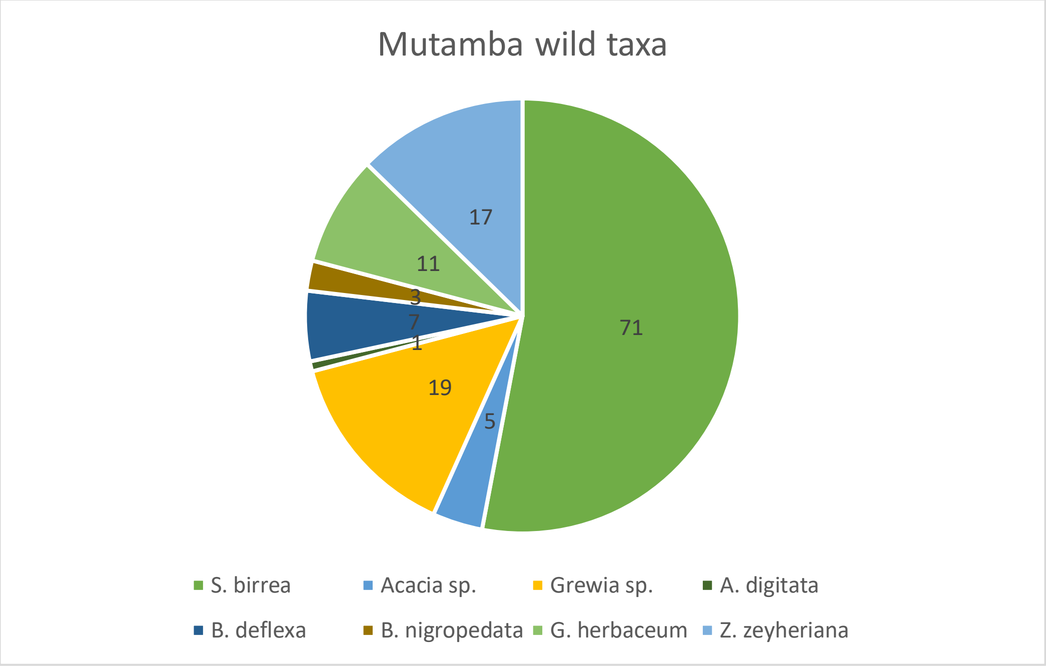


Figure 6.3. MNI of the wild taxa identified at Mutamba

6.2. Vryheid (MNR 04)

6.2.1. General assemblage

Vryheid (MNR 04) had a limited macrobotanical assemblage. All of the macrobotanical material was preserved in carbonised form and originates from domestic and kraal features. A total of 72^2m of material was excavated from which eight samples, representing 80 litres of floated material, were identified out of the 54 processed floatation samples.

From the samples, five taxa (Table 6.2.) were identified. One taxon was identified to species four to genus and one to family. Wild taxa are the most dominant at MNR 04. Only a single crop species (*P. glaucum*) was identified at the site. Malvaceae was the most predominant, with two of the taxa (*Gossypium* sp. and *Grewia* sp.) belonging to this family. Amaranthaceae (*Chenopodium* sp.) and Fabaceae (*Acacia* sp.) were also present at the site. Of particular note is the presence of crop processing by-products at the site.

Table 6.4. Vryheid (MNR 04) assemblage

Family	Genus	Species
Malvaceae	*Gossypium*	
Malvaceae	*Grewia*	
Fabaceae	*Acacia*	
Amaranthaceae	*Chenopodium*	
Poaceae	*Pennisetum*	*glaucum*

The MNR 04 macrobotanical material originates from six contexts. These contexts are midden (M), kraal, (K), domestic, (D), general (G), alluvial deposit (AD) and grain bin (GB). M held one wild taxon (*Gossypium* sp.) and one crop taxon (*P. glaucum*). K held two identifiable wild taxa (*Gossypium* sp. and *Chenopodium* sp.). D contained only fragments of *Acacia* sp. G had one crop taxon (*P. glaucum*) and one wild taxon (Grewia sp.). AD contained a single taxon (*P. glaucum*) and GB held one wild taxon (*Chenopodium* sp.) and one crop taxon (*P. glaucum*).

6.2.2. Vryheid (MNR 04) ubiquity

MNR 04 held a low number of samples with only five identified taxa occurring within the assemblage. The sole crop taxon identified, *P. glaucum*, was the only taxon with a ubiquity score exceeding 50% with a score of 63%. Its presence within the samples includes both caryopsis and crop by-products. The wild taxa all scored well below 50%. *Acacia* sp. and *Gossypium* sp. both had scores of 25% while *Grewia* sp. and *Chenopodium* sp. respectively had scores of 13%.

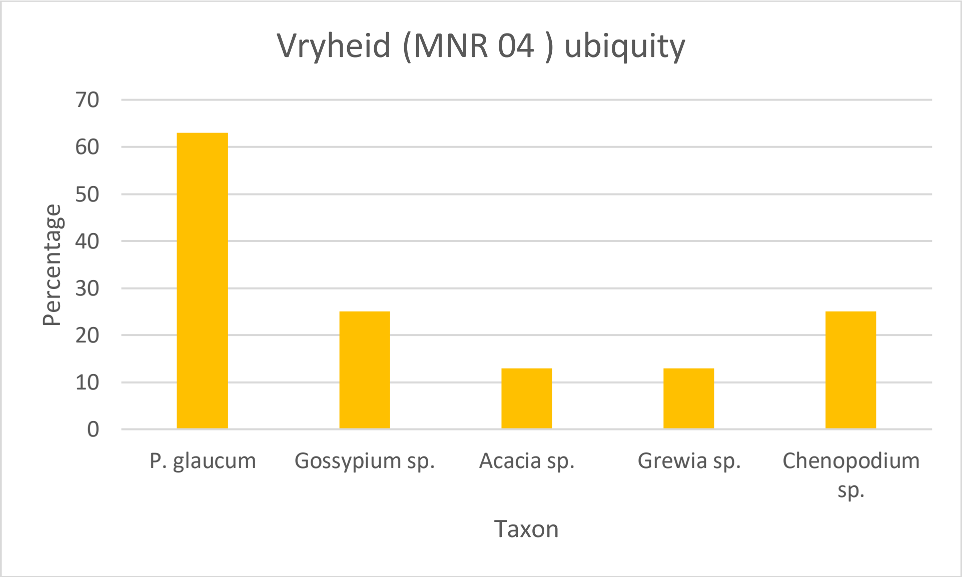


Figure 6.4. Vryheid (MNR 04) ubiquity

6.2.3. Crop taxa, chaff, weeds and wild taxa

Within the samples, *P. glaucum* is the only crop taxon identified. It accounts for roughly 67% of the identified material at the site (8 samples, MNI=8). Its presence within the samples includes both caryopsis and crop-byproducts. *Chenopodium* sp. is a small weed species that is widely distributed in the arable fields of South Africa and eaten as a popular leafy vegetable (Oas 2010; van Wyk & Gericke 2017). This taxon makes up 17% of the material at the site (2 samples, MNI=2). The remaining three taxa, *Gossypium* sp., *Acacia* sp. and *Grewia* sp., are wild species found at the site. *Gossypium* sp. (2 samples, MNI=1) and *Grewia* sp. (1 sample, MNI=1) both respectively made up 8% of the site's material. *Acacia* sp. was identified based on the presence of distinct testa fragments and due to it being present only in testa fragments, it could not be quantified (1 sample).

6.3. Frampton 1 (MNR 074)

6.3.1. General assemblage

MNR 074 had a small assemblage, preserved in carbonised form. All samples are from domestic features. From these features, only a few samples contained identifiable macrobotanical material. The low quantity of material is to be expected as the archaeological deposit was very shallow, with depths of 5 – 10cm. The samples held five taxa (Table 6. 3.), all of which can be considered wild species. Two taxa were identified to species and three to genus. Two of the taxa (*Citrullus* sp. and *cf. Solanum retroflexum*) are unique to this site. A total of 23m^2 worth of material was excavated from which five samples were identified, representing 50 litres of floated material., out of the 34 floated samples analysed.

Table 6.5. MNR 074 assemblage

Family	Genus	Species
Amaranthaceae	*Chenopodium*	
Solanaceae	*cf. Solanum*	*retroflexum*
Anarcardiaceae	*Sclerocarya*	*birrea*
Malvaceae	*Gossypium*	
Cucurbitaceae	*Citrullus*	

The material derives from two contexts. The first is a suspected midden (SM) and the second is referred to as undifferentiated occupational material (UOM) (Lippert 2019). Most of the material identified was from UOM which contained examples of all the taxa found at the site. SM contained only *Chenopodium*. No agriculturally related macrobotanical material was identified at MNR 074.

6.3.2. Frampton 1 (MNR 074) ubiquity

MNR 074 contained five identifiable taxa. These identified taxa are all wild species, and no crop plants were present in the site's samples. *Chenopodium* sp. and *cf. S. retroflexed* are the two most commonly occurring taxa (See Figure 6.7). They are represented in equal measure, with scores of 67%. The other three taxa had scores of 33%, 33%, and 33%, respectively.

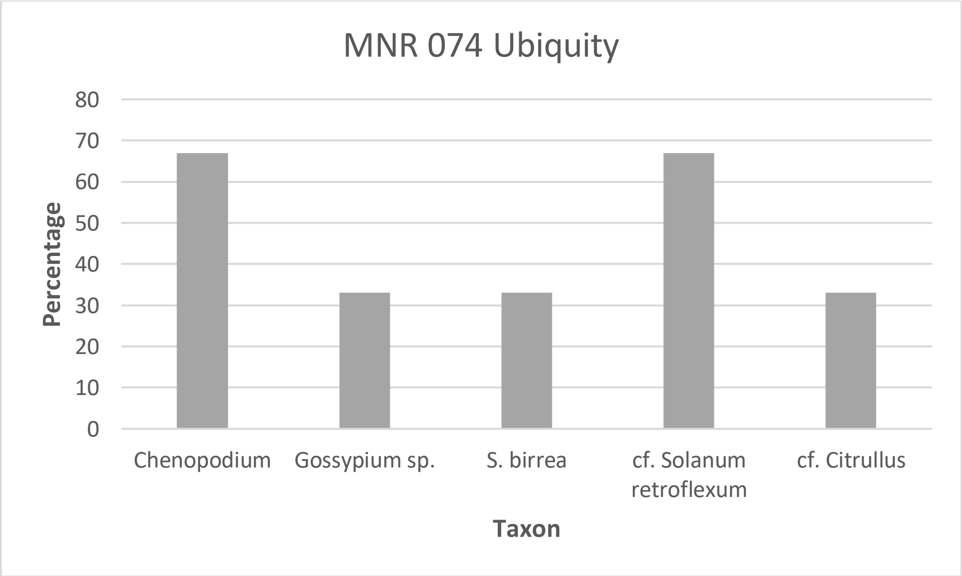


Figure 6.5. MNR 074 Ubiquity

6.3.3. Crop taxa, chaff, weeds and wild taxa

Wild taxa were the only macrobotanical material present at MNR 074. The most dominant taxon at the site was *Gossypium* sp. which accounts for 36% of the total material (1 sample, MNI=4). This is followed closely by *cf. S. retroflexum* which makes up 27% of the material (2 samples, MNI=3). The third most found taxon is *Chenopodium* sp. with 18% (2 samples, MNI=2). *S. birrea* (1 sample, MNI=1) and *Citrullus* sp. (1 sample, MNI=1) only constitute 9% each.

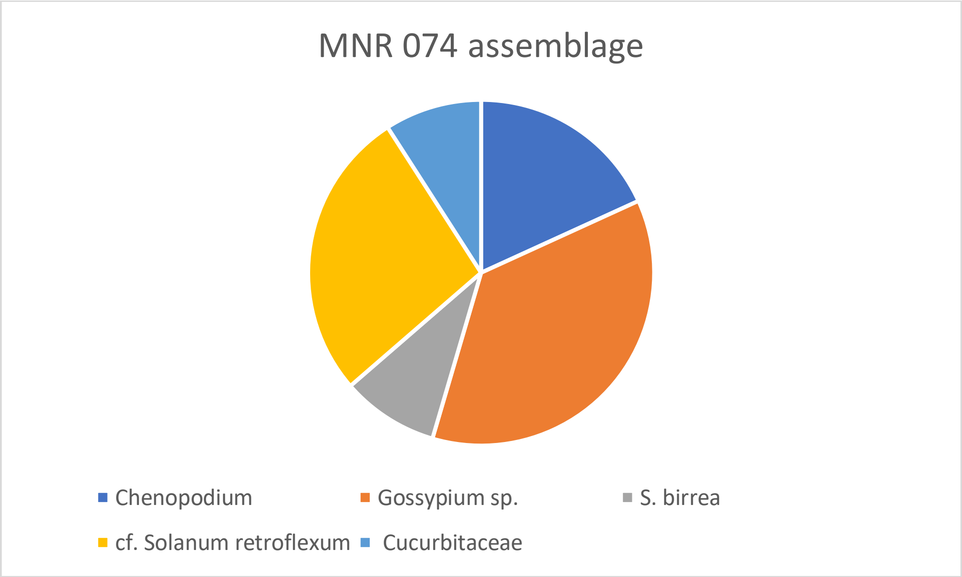


Figure 6.6. MNR 074 Wild taxa

6.4. Conclusion

Of the three sites analysed Mutamba (MUT) had the richest archaeobotanical assemblage. It had a high number of identified material with thirteen taxa. Five of the taxa were crop species and eight were wild. The crop taxa at MUT were largely *S. bicolor* and *P. glaucum* with a few grains of *E. coracana* found only in Feature 2. Two of the crop taxa were legumes. These are

V. radiata, a legume originating from India, and *V. unguiculata*. No crop processing by-products or weed taxa were identified at the site.

While Mutamba had a wide variety of domestic and wild taxa present in large numbers, the same cannot be said for Vryheid (MNR 04) and Frampton 1 (MNR 074). The archaeobotanical assemblages for these sites were very limited with regard to the variety of taxa identified and the low volume of material found. This is most likely a result of the shallow archaeological deposits.

Vryheid (MNR 04) had five identifiable taxa. Four of the taxa were wild. The only crop taxon identified at the site was *P. glaucum*. Crop by-product and a small arable weed (*Chenopodium* sp.) were also present at the site. Frampton 1 (MNR 074) also had five taxa present. However, none of the identified taxa were crop taxa. Although no crop taxa were identified the site did have *Chenopodium* sp. which while usually associated as an arable weed also traditionally is consumed as a leafy vegetable. Another species identified at the site that is consumed similarly is *S. retroflexum*.

Chapter 7

Phytolith results

This chapter presents the results of the phytolith analysis undertaken on the material from Mutamba (MUT), Vryheid (MNR 04) and Frampton (MNR 074). The chapter will first note the results of the diagnostic scanning for each site after which the correlating sub-families will be discussed at the end. The results will be presented for each soil sample by site in the order that they were analysed. It should be noted that the attempt to categorise the morphotypes did prove difficult as many wild and domestic taxa produce very similar phytolith variants (Hattingh 2018) and identification was hampered by my inexperience with phytolith analysis.

7.1. Mutamba (MUT)

Sample 1 (Unit 100/171, Locus 2185)

Sample 1 (Table 7.1.) is from a midden-like deposit in level four of Feature 1 (See Figure 2.9 in Chapter 2). In this sample, the most common morphotypes are bilobates and saddles. Bilobates account for 97 (48.5%) of the total morphotypes and saddles account for 65 (32.5%) of the total morphotypes. Of the 97 bilobates, 50 were broken at the shaft. This was most likely a result of taphonomic damage as the shafts are easily broken and may have occurred during post-depositional events such as people or animals having walked over the area (Lancelotti 2022, *pers. comm*). Trapezoids and rondels are the next highest occurring morphotypes. With 17 (8.5%), trapezoids are the third highest occurring morphotype and rondels make up 12 morphotypes (6%) of the slide. Oblongs account for only 3 morphotypes (1.5%). The rarest forms were cross, polylobate and reniform. A single cross (0.5%) was identified and 2 (1%) each respectively for polylobate and reniform. The final morphotype was designated as Indeterminate as no clear identification could be obtained from it. In addition to this, some hairs (3), 2 bulliform (5) and echinate cells (1) were noted.

Table 7.1. MUT Sample 1 morphotypes

Phytolith morphotype	**No.**	**% of sample**
Bilobate	97	48,5
Polylobate	2	1
Saddle	65	32,5
Trapezoid	17	8,5
Rondel	12	6
Reniform	2	1
Oblong	3	1,5
Cross	1	0,5
Indeterminate	1	0,5
	200	100

Sample 2 (Unit 100/173, Locus 2037)

Sample 2 (Table 7.2) is from the same midden in Feature 1. Bilobates are the most frequently occurring morphotypes, numbering 116 (58%) of the total of which 69 were broken at the shaft. Polylobates only account for 2 (1%) of the total, whereas saddles make up 45 (22.5%) of the total morphotypes. The third most occurring form was trapezoid with 20 (10%), followed by rondels with 10 (5%). Next is cross making up 4 (2%), oblong with 1 (0.5%) and Indeterminate with 2 (1%). No reinforms appear to have been present in the sample. Also present, were several hairs (5), a bulliform and a long cell, usually associated with *S. bicolor* (Logan 2012; Hattingh 2013).

Table 7.2. MUT Sample 2 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	116	58
Polylobate	2	1
Saddle	45	22,5
Trapezoid	20	10
Rondel	10	5
Reniform	0	0
Oblong	1	0,5
Cross	4	2
Indeterminate	2	1
	200	100

Sample 3 (Unit 101/ 1721, Locus 2182)

Sample 3 (Table 7.3.) is also from the same midden as samples 1 and 2 from Feature 1. Bilobates are the most dominant morphotype accounting for 118 (or 59%) of the total forms in the sample of which the majority (72) were broken. The second most dominant is saddle with 52 (26%). Next are trapezoids with 16 (8%) rondels with 7 (3.5%). There are 3 polylobates (1.5%) and a single morphotype (0.5%) for cross, Indeterminate, oblong and reniform respectively. As with the previous sample hairs, bulliforms and a probable *S. bicolor* associated long cell were noted.

Table 7.3. MUT Sample 3 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	118	59
Polylobate	3	1,5
Saddle	52	26
Trapezoid	16	8
Rondel	7	3,5
Reniform	1	0,5
Oblong	1	0,5
Cross	1	0,5
Indeterminate	1	0,5
	200	100

Sample 4 (Unit 99/171, Locus 2098)

Sample 4 (Table 7.4.) was taken from material covering a clay floor in level four of Feature 1. Bilobates represent a little over half of the morphotypes in the sample with 102 (51%) with 50 of those broken at the shaft. The second most identified morphotype was saddle with 59 forms (29.5%). The third most Sample represented morphotype is trapezoid with 22 forms (11%). Next was oblong with 6 (3%) and cross with 1 (0.5%). No reniform or polylobates were identified in the sample. However, the sample contained hairs, a bulliform and an echinate.

Table 7.4. MUT Sample 4 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	102	51
Polylobate	0	0
Saddle	59	29,5
Trapezoid	22	11
Rondel	10	5
Reniform	0	0
Oblong	6	3
Cross	1	0,5
Indeterminate	0	0
	200	100

Sample 5 (Unit 103/ 173, Locus 2175)

Sample 5 (Table 7.5.) is from a different part of the floor on level four of Feature 1. The sample contains 95 bilobates (47.5%) of which 50 were broken. The second most commonly identified morphotype was saddle with 52 (26%). Next was trapezoid with 41 (20.5%). There are 5 (2.5%) rondels and 4 (2%) oblongs. The least represented morphotypes were polylobate and cross with 1 each (0.5%) and cross with 2 (1%). Also noted were hair phytoliths and a bulliform.

Table 7.5. MUT Sample 5 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	95	47,5
Polylobate	1	0,5
Saddle	52	26
Trapezoid	41	20,5
Rondel	5	2,5
Reniform	0	0
Oblong	4	2
Cross	2	1
Indeterminate	0	0
	200	100

Sample 6 (Unit 100/173, Locus 2194)

Sample 6 (Table 7.6.) was taken from an in-situ hearth in level five of Feature 1. The most abundant morphotypes were bilobates with a total of 110 (55%) of which 58 were broken. Saddles are the second most abundant with 48 (24%) morphotypes. The third most abundant were trapezoids with 27 (13.5%). The next most commonly found morphotype in the sample were rondels with 9 (4.5%). The remaining morphotypes identified were as follows: polylobate with 1 morphotype (0.5%), reniform with 1 (0.5%), oblong with 2 (1%) and cross also with 2 (1). Several hairs (10) were also present.

Table 7.6. MUT Sample 6 morphotypes

Phytolith morphotype	**No.**	**% of sample**
Bilobate	110	55
Polylobate	1	0,5
Saddle	48	24
Trapezoid	27	13,5
Rondel	9	4,5
Reniform	1	0,5
Oblong	2	1
Cross	2	1
Indeterminate	0	0
	200	100

Sample 7 (Unit 110/183, Locus 2147/1)

Sample 7 (Table 7.7.) is from the floor in level four of Feature 2. Bilobates were the most common morphotype with 93 (46.5%). Saddles were the second most common with 46 (23%) and trapezoids were the third most commonly occurring morphotype with 41 (20.5%). Reniforms and rondels account for 8 (4%) and 7 (3.5%) respectively. The remaining identified morphotypes are oblong with 1 (0.5%) morphotype and cross with 4 (2%). Several hairs (14), a bulliform and 3 long cells were also identified.

Table 7.7. MUT Sample 7 morphotypes

Phytolith morphotype	**No.**	**% of sample**
Bilobate	93	46,5
Polylobate	0	0
Saddle	46	23
Trapezoid	41	20,5
Rondel	7	3,5
Reniform	8	4
Oblong	1	0,5
Cross	4	2
Indeterminate	0	0
	200	100

Sample 8 (Unit 108/102, Locus 2083)

Sample 8 (Table 7.8.) was taken from the burnt remains of a hut in level four of Feature 2 (Figure 2.9, Chapter 2). The most abundant morphotype was bilobate with 89 (44.5%) forms of which 52 were broken. The second most abundant morphotype in the sample was saddle with 58 (29%) and the third was trapezoid with 38 (19%). Rondels, reniform, oblong and cross make up the remainder of the sample. There are 6 (3%) rondels, 4 (2%) reniforms, 3 (1.5%) oblongs and 2 (1%) crosses. The sample also contained 7 hairs and two bulliforms.

Table 7.8. MUT Sample 8 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	89	44,5
Polylobate	0	0
Saddle	58	29
Trapezoid	38	19
Rondel	6	3
Reniform	4	2
Oblong	3	1,5
Cross	2	1
Indeterminate	0	0
	200	100

Sample 9 (Unit 110/185, Locus 2012)

Sample 9 (Table 7.9.) is from a hearth in level four in Feature 2 (See Figure 2.9. in Chapter 2). Bilobates make up 78 (39%) of the total morphotypes, of which 45 were broken at the shaft. Saddles and trapezoids are the next most occurring morphotypes in the sample. There are 58 (29%) saddles and 42 (21%) trapezoids. Rondels are the next most abundant with 13 (6.5%). Sample 9 has the highest number of rondels from the site. Reniform and oblong morphotypes are the next most abundant after rondels. There are 4 (2%) reinforms and 4 oblongs (2%). Crosses are the least abundant with there only being a single (0.5%) cross present. Also noted were the highest number of hairs (15) of all the samples at the site.

Table 7.9. MUT Sample 9 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	78	39
Polylobate	0	0
Saddle	58	29
Trapezoid	42	21
Rondel	13	6,5
Reniform	4	2
Oblong	4	2
Cross	1	0,5
Indeterminate	0	0
	200	100

Sample 10 (Unit 112/ 182, Locus 1175)

Sample 10 (Table 7.10.) is from burnt hut remains in level four of Feature 2. The sample had less variety present in the morphotypes identified than the previous samples. As with the other samples, bilobates are the most common morphotypes, making up 115 (57.5%) of the samples. Saddles account for 55 (27.5%) of the sample total. Trapezoids make up 21 (10.5%) of the morphotypes and 8 (4%). The least occurring morphotype in this sample is polylobate with a single form (0.5%). The sample also contained hairs (9), bulliform (2) and long cells (2).

Table 7.10. MUT Sample 10 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	115	57,5
Polylobate	1	0,5
Saddle	55	27,5
Trapezoid	21	10,5
Rondel	8	4
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

7.2. Vryheid (MNR 04)

Sample 1 (Unit 104/238, Locus 195)

Sample 1 (Table 7.11.) originates from midden-like deposit in Area C (See Figure 2.3 in Chapter 2). Bilobates constitute about half of the total morphotypes in the sample with 101 (50.5%) of which 53 were broken. Trapezoids and saddles are the most common with 23 (11.5%) and 47 (23.5%) each. Next were rondels with 14 (7%), reinforms with 9 (4.5%) and crosses with 4 (2%). Additionally present were 2 (1%) Indeterminate forms that could have been crosses but which would not be identified with enough certainty to classify them as such. Also present, were hairs, an echinate and a bulliform.

Table 7.11. MNR 04 Sample 1 morphotypes

Phytolith morphotype	**No.**	**% of sample**
Bilobate	101	50,5
Polylobate	0	0
Saddle	47	23,5
Trapezoid	23	11,5
Rondel	14	7
Reniform	9	4,5
Oblong	0	0
Cross	4	2
Indeterminate	2	1
	200	100

Sample 2 (Unit 104/ 238, Locus 199)

Sample 2 (Table 7.12.) is from a midden deposit in Area C (See Figure 2.3 in Chapter 2). Bilobates make up 122 (61%) of the forms in the sample. Of these 88 were broken. Saddles account for 42 (21%) of the forms and trapezoids for 19 (9.5%). The next most abundant morphotypes were rondels with 8 (4%) and crosses with 6 (3%). Reniforms were rare with only 2 (1%) identified. Almost as rare was a single example of a polylobate (0.5%) from the site. Hair phytoliths and a bulliform were also noted.

Table 7.12. MNR 04 Sample 2 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	122	61
Polylobate	1	0,5
Saddle	42	21
Trapezoid	19	9,5
Rondel	8	4
Reniform	2	1
Oblong	0	0
Cross	6	3
Indeterminate	0	0
	200	100

Sample 3 (Unit 104/ 238, Locus 2021)

Sample 3 (Table 7.13.) was sampled from a gravel floor. Bilobates make up the majority of the morphotypes at the site with a total of 119 (59.5%). Of these 92 were broken at the shaft. Saddles account for 40 (20%), trapezoids for 21 (10.5%) and rondels for 10 (5%). Reniform, oblong and cross morphotypes were fairly rare. There were 3 reniform (1.5%), 4 oblong (2%) and 3 (1.5%) cross morphotypes. Several hairs (19) were also present.

Table 7.13. MNR 04 Sample 3 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	119	59,5
Polylobate	0	0
Saddle	40	20
Trapezoid	21	10,5
Rondel	10	5
Reniform	3	1,5
Oblong	4	2
Cross	3	1,5
Indeterminate	0	0
	200	100

Sample 4 (Unit 96/222, Locus 337)

Sample 4 (Table7.14.) was taken from the kraal in Area B. Bilobates are the most common morphotype, accounting for 102 forms (52.5%). Next were saddles with 73 forms (36.5), trapezoid with 14 (7%) and rondel with 6 (3%). Reniform and crosses were rare with only 1 form each (0.5% respectively).

Table 7.14. MNR 04 Sample 4 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	105	52,5
Polylobate	0	0
Saddle	73	36,5
Trapezoid	14	7
Rondel	6	3
Reniform	1	0,5
Oblong	0	0
Cross	1	0,5
Indeterminate	0	0
	200	100

Sample 5 (Unit 106/238, Locus 200)

Sample 5 (Table 7.15.) originates from a midden in Area C of the site. Bilobates, saddles and trapezoid morphotypes were the most dominant forms. There were 124 (62%) bilobates of which 95 were broken, 51 saddles (25.5%) and 18 trapezoids (9%). Rondels and crosses were rare. Rondels make up 4 forms (2%) and crosses 3 forms (1.5%). Several hairs (9) were noted.

Table 7.15. MNR 04 Sample 5 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	124	62
Polylobate	0	0
Saddle	51	25,5
Trapezoid	18	9
Rondel	4	2
Reniform	0	0
Oblong	0	0
Cross	3	1,5
Indeterminate	0	0
	200	100

Sample 6 (Unit 96/222, Locus 338)

Sample 6 (Table 7.16.) was taken from the kraal deposit in Area B. The most common morphotypes are bilobates and saddles. There are 111 (55.5%) bilobates of which 79 are broken and 56 (28%) saddles. The next most occurring morphotypes are trapezoids with 24 forms (12%). Rondels, oblongs and crosses are also present but to a lesser extent. There are 5 (2.5%) rondels, 2 (1%) oblongs and 2 (1%) cross morphotypes. Also present were hairs (18) and a bulliform.

Table 7.16. MNR 04 Sample 6 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	111	55,5
Polylobate	0	0
Saddle	56	28
Trapezoid	24	12
Rondel	5	2,5
Reniform	0	0
Oblong	2	1
Cross	2	1
Indeterminate	0	0
	200	100

Sample 7 (Unit 104/240, Locus 196)

Sample 7 (Table 7.17.) was taken from the midden deposit in Area C. Of all the MNR 04 samples it was this sample that had the least variety in morphotypes present. There are four morphotypes present. Bilobates make up the majority with 122 forms (62%), flowed by saddles with 44 forms (22%) and trapezoids with 19 forms (12%). Rondels were the least present with 8 forms (4%). Several hairs (13) were also noted.

Table 7.17. MNR 04 Sample 7 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	124	62
Polylobate	0	0
Saddle	44	22
Trapezoid	24	12
Rondel	8	4
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 8 (Unit 104/240, Locus 2011)

Sample 8 (Table 7.18.) is also from a midden in Area C. Bilobates account for the majority of the morphotypes in the sample. There is a total of 133 bilobates (66%) of which 104 were broken at the shaft. The second most common morphotype is saddle with 26 forms (18%). The third and fourth most common morphotypes were trapezoids and rondels with 17 forms (8.5%) and 9 forms (4.5%) respectively. Cross, oblong and reniform morphotypes occurred to a lesser extent. There was 1 oblong (0.5%), 1 (0.5%) reniform and 3 cross (1.5%) morphotypes. Several hairs (9) and a bulliform were present in the sample.

Table 7.18. MNR 04 Sample 8 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	133	66,5
Polylobate	0	0
Saddle	36	18
Trapezoid	17	8,5
Rondel	9	4,5
Reniform	1	0,5
Oblong	1	0,5
Cross	3	1,5
Indeterminate	0	0
	200	100

Sample 9 (Unit 104/240, Locus)

Sample 9 (Table 7.19.) was taken from a locus containing a grain bin stand in Area C of the site. Most of the morphotypes in this sample are bilobates, saddles and trapezoids. There are 127 bilobates (63.5%), 40 saddles (20%) and 20 trapezoids (10%). The remaining morphotypes are rondel and cross. There are 12 rondels (6%) and a single cross (0.5%). No hairs were noted in this sample.

Table 7.19. MNR 04 Sample 9 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	127	63,5
Polylobate	0	0
Saddle	40	20
Trapezoid	20	10
Rondel	12	6
Reniform	0	0
Oblong	0	0
Cross	1	0,5
Indeterminate	0	0
	200	100

Sample 10 (Unit 136/230, Locus 150)

This sample was taken from a domestic space with numerous grain bin stands in Area B. Bilobates are the most frequently occurring morphotype. There are 136 bilobates (68%), of which 85 were broken at the shaft. The next most frequently identified morphotypes were trapezoids and saddles. There were 34 saddles (17%) and 23 trapezoids (11%). Rondels and crosses were also present. There were 7 rondels (3%) and 2 crosses (1%). A high number of hairs (20) were noted.

Table 7.20. MNR 04 Sample 10 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	136	68
Polylobate	0	0
Saddle	34	17
Trapezoid	22	11
Rondel	6	3
Reniform	0	0
Oblong	0	0
Cross	2	1
Indeterminate	0	0
	200	100

7.3. Frampton 1 (MNR 074)

Sample 1 (Unit 115/93.5, Locus 142)

Sample 1 (Table 7.21.) was taken from some washed down midden-like deposit (Figure 2.2., Chapter 2). The most dominant morphotypes are bilobates and saddles. There are 96 bilobates, of which 49 were broken, and 63 saddles. The third most dominant morphotype is trapezoid with 35 forms. Rondels were the least occurring morphotype with 6. Also noted in the sample were hairs (&) and bulliforms (2).

Table 7.21. MNR 074 Sample 1 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	96	48
Polylobate	0	0
Saddle	63	31,5
Trapezoid	35	17,5
Rondel	6	3
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 2 (Unit 115/93.5, Locus 143)

Sample 2 (Table 7.22.) was also taken from wash-down midden deposit. Bilobates are the most commonly identified morphotypes accounting for 103 of the total morphotypes. Of these 73 were broken. Saddles are the second most identified morphotype with a total of 61 forms. Next were trapezoids with 31 forms and lastly rondels with 5 forms. Several hairs (11) were present in the sample.

Table 7.22. MNR 074 Sample 2 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	103	51,5
Polylobate	0	0
Saddle	61	30,5
Trapezoid	31	15,5
Rondel	5	2,5
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 3 (Unit 100/98, Locus 232)

Sample 3 (Table 7.23.) was taken from a kraal deposit. Bilobates account for the majority of the morphotypes. There were 150 bilobates, of which 99 were broken at the shaft. The second most identified morphotype was saddle with 29 forms. Third was trapezoid with 16 forms. Lastly, there were 3 polylobates and 2 rondels. A high number of hairs were also noted.

Table 7.23. MNR 074 Sample 3 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	150	75
Polylobate	3	1,5
Saddle	29	14,5
Trapezoid	16	8
Rondel	2	1
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 4 (Unit 100/98, Locus 233)

Sample 4 (Table 7.24.) was taken from kraal deposit. The majority of the morphotypes present in the sample are bilobates which 67 were broken. Saddles were the next most occurring morphotypes with 65, followed by trapezoids with 20. The least represented were rondels with 4, polylobate with 2, reniform with 1 and oblong with 1. As with sample 3, there were a large number of hairs (>20).

Table 7.24. MNR 074 Sample 4 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	107	53,5
Polylobate	2	1
Saddle	65	32,5
Trapezoid	20	10
Rondel	4	2
Reniform	1	0,5
Oblong	1	0,5
Cross	0	0
Indeterminate	0	0
	200	100

Sample 5 (Unit 100/98, Locus 234)

Sample 5 (Table 7.25.) was another sample taken from a kraal deposit. Of the samples taken from the kraal Sample 5 had the least variety of morphotypes present. Similar to the other two kraal samples bilobates were the most commonly identified morphotype. There were 92 bilobates, of which 65 were broken. The second most identified morphotype was saddle with

78. The third most common was trapezoid with 22. Rondels were the least common with only 8 forms. Also present were a large number of hairs (>20) and a bulliform.

Table 7.25. MNR 074 Sample 5 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	92	46
Polylobate	0	0
Saddle	78	39
Trapezoid	22	11
Rondel	8	4
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 6 (Unit 115/97, Locus 196)

Sample 6 (Table 7.26.) was taken from a unit containing probable midden deposit. Bilobates, saddles and trapezoids are the three most identified in the sample. There were 104 bilobates of which 70 were broken at the shaft. There were 68 saddles and 23 trapezoids. Rondel, polylobate and reniform morphotypes were the least identified within the sample. There was 1 rondel, 3 polylobates and 1 reniform. Several hairs and a bulliform were also noted.

‘

Table 7.26. MNR 074 Sample 6 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	104	52
Polylobate	3	1,5
Saddle	68	34
Trapezoid	23	11,5
Rondel	1	0,5
Reniform	1	0,5
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 7 (Unit 115/97, Locus 198)

Sample 7 (Table 7.27.) originates from a midden deposit. Bilobates are the most commonly identified morphotype. There were 96 bilobates, of which 75 were broken at the shaft. The second most commonly identified morphotype saddle accounted for 64 forms and the third, trapezoid accounted for 33 forms. The least identified morphotypes were polylobate with 1 form, rondel with 4 forms and reniform with 2 forms. Also present, were hairs and 2 bulliforms.

Table 7.27. MNR 074 Sample 7 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	96	48
Polylobate	1	0,5
Saddle	64	32
Trapezoid	33	16,5
Rondel	4	2
Reniform	2	1
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 8 (Unit 115/ 97, Locus 197)

Sample 8 (Table 7.28.) was taken from midden-like deposit. The most identified morphotype in the sample was bilobate. There were 89 bilobates, of which 66 were broken. The next most identified morphotype was saddle with 76 and trapezoid with 28 forms. Rondels, reniform and oblong were not as prevalent. There were 3 rondels, and 1 each respectively for reniform and oblong. Also, present were some hairs (11).

Table 7.28. MNR 074 Sample 8 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	89	44,5
Polylobate	2	1
Saddle	76	38
Trapezoid	28	14
Rondel	3	1,5
Reniform	1	0,5
Oblong	1	0,5
Cross	0	0
Indeterminate	0	0
	200	100

Sample 9 (Unit 115/ 93.5, Locus 141)

Sample 9 (Table 7.29.) originates from washed down suspected midden deposits. Bilobates, saddles and trapezoid morphotypes make up most of the forms in this sample. There are 94 bilobates, with 49 of those broken. Next were saddles with 75 forms and trapezoids with 27 forms. Rondels were rare with only 3 forms. Present in the sample are several hairs (8) and 3 bulliforms.

Table 7.29. MNR 074 Sample 9 morphotypes

Phytolith morphotype	No.	% of sample
Bilobate	94	47
Polylobate	1	0,5
Saddle	72	36
Trapezoid	30	15
Rondel	3	1,5
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

Sample 10 (Unit 77/100, Locus 166)

Sample 10 (Table 7.30.) was taken from ashy deposit interpreted as forming part of a kraal. Bilobates were the most common morphotype in the sample. There are 109 bilobates, of which 70 were broken at the shaft. The second most common morphotype was saddle with 57 forms and the third was trapezoid with 32 forms. Rondels were the least identified with only 2 forms. The sample did have a large number of hairs and bulliforms (7).

Table 7.30. MNR 074 Sample 10 morphotypes

Phytolith morphotype	**No.**	**% of sample**
Bilobate	109	54,5
Polylobate	0	0
Saddle	57	28,5
Trapezoid	32	16
Rondel	2	1
Reniform	0	0
Oblong	0	0
Cross	0	0
Indeterminate	0	0
	200	100

7.4. Grass sub-families represented by the phytoliths

The Poaceae family contains twelve sub-families, of which eight are known to occur in South Africa (Rossouw 2009). Five of these sub-families (Bambusoideae, Pooideae, Danthonioideae, Arundinoideae and Ehrhartoideae) make use of the C_3 photosynthetic pathway, one Chloridoid solely uses the C_4 pathway and two (Panicoideae and Aristidoideae) make use of both pathways

(Sjöström 2013). These grass sub-families grow in different ecological niches and their distribution and presence within a site's assemblage provide information on the environment of the site (Sjöström 2013). Certain phytolith morphotypes (See Chapter 4) tend to correspond to certain grass sub-families. The following section aims to correlate phytoliths identified at MUT, MNR 04 and MNR 074 with grass sub-families.

7.4.1. C_3/ C_4 – Panicoideae

The Panicoideae sub-family has a wide geographical distribution and is found in tropical and sub-tropical regions and contains genera which utilise both C_3/ C_4 photosynthetic pathways (Twiss 1992; Sjöström 2013). This sub-family includes well known taxa such as *S. bicolour* and *P. glaucum* (Twiss 1992; Hattingh 2018). Bilobates, polylobates and crosses are the most characteristic phytoliths produced by the sub-family (Twiss *et al.* 1969; Twiss 1992; Rossouw 2009; Pearsall 2015; Hattingh 2018). These phytoliths are also produced in Bambusoideae and Chloridoideae grasses but in significantly lower numbers (Rossouw 2009; Sjöström 2013).

Bilobate phytoliths were identified at all three sites and were prevalent in most of the samples with roughly half of every sample comprised of this phytolith. The lowest number of bilobates was present in Sample 9 of MUT and the highest number in Sample 3 of MNR 074. A large number of these bilobates were broken at the shaft portion of the phytolith. This may have been a result of site formation processes or due to the shallow nature of deposits at some of the sites. The shafts of bilobates are the weakest aspect of the phytolith and could have broken as a result of the pressure from humans and animals walking over the soil (Lancelotti *pers. comm.* 2023). Although emerging studies appear to indicate that temperatures and CO_2 may play a role in the dissolution of phytoliths (Wu *et al.* 2012; Nguyen *et al.* 2021).

Cross and polylobates were rare across all samples analysed for each site. This is to be expected as these phytoliths are not as common in Panicoideae as bilobates. MUT had the most polylobates, followed by MNR 074 while MNR 04 had only a single polylobate. This phytolith is often observed in the Panicoideae family (Hattingh 2013, 2018). Cross phytoliths were found to be present only at MUT and MNR 04. Based on morphological characteristics some of the cross phytoliths at these two sites appear to be consistent with a variant produced by *P. glaucum* (Hattingh 2013, 2018). However, this could not be verified with absolute certainty based solely on the available published information.

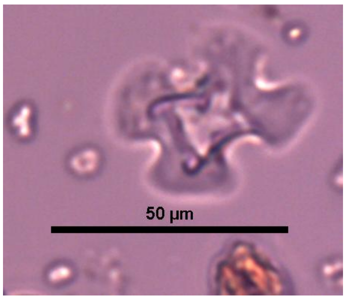


Image 7.1. Cross phytolith (MUT, Sample 2)

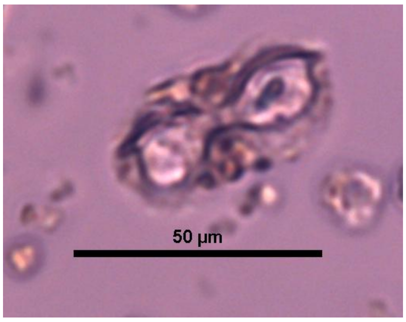


Image 7.2. Bilobate phytolith (MUT, Sample 1)

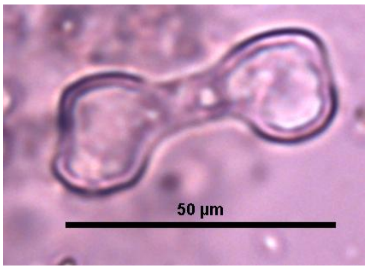


Image 7.3. Bilobate (MNR 04, Sample 1)

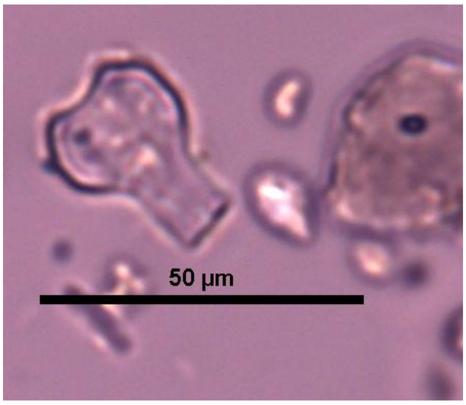


Image 7.4. Broken bilobate (MUT, Sample 4)

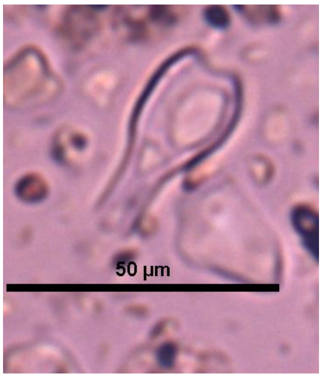


Image 7.5. Broken bilobate (MNR 04, Sample 7)

Image 7.6. Polylobate phytolith (MUT, Sample 1)

Image 7.7. Polylobate (MNR 04, Sample 2)

7.4.2. C_3 – Pooideae

The Pooideae sub-family primarily utilises a C_3 photosynthetic pathway and is primarily located in temperate zones and elevated areas (Twiss 1992; Sjöström 2013). This sub-family is characterised by oblong, circular, rectangular and oval phytoliths (Twiss *et al*. 1969; Twiss 1992). It should be noted that while trapezoids are often associated with Pooideae grasses, they are also produced by the Ehrhartoideae and Danthonioideae sub-families (Rossouw 2009). Many of these phytoliths, were fairly rare in all the samples taken from MUT, MNR 04 and MNR 074. Rondels were somewhat more common than most of the above mentioned phytoliths (oblong etc.) and were present in consistently low numbers at each of the three sites.

However, trapezoid phytoliths were the most commonly identified Pooideae phytolith at the sites. Trapezoid phytoliths were consistently present in each sample at each site, ranging from between approximately 8% to 20% on average per sample.

Image 7.8. Rondel (MUT, Sample 1)

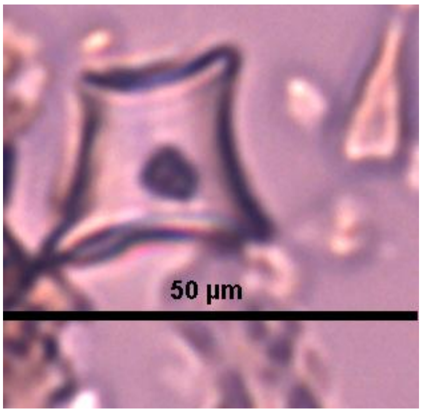


Image 7.9. Rondel phytolith (MNR 04, Sample 4)

Image 7.10. Trapezoid phytolith (MNR 04, Sample 2)

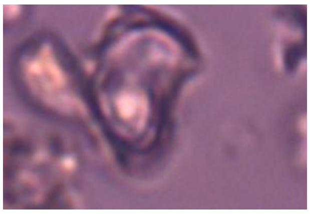


Image 7.11. Trapezoid (MUT, Sample 6)

7.4.3. C_4 – Chloridoideae

The Chloridoideae sub-family is found in arid areas where summer rainfall is less than 500 mm and are most prolific in open grasslands and savannas (Twiss 1992; Rossouw 2009; Sjöström 2013). Chloridoideae grasses are characterised by saddle phytoliths and one of the most notable taxa from the sub-family is *E. coracana* (Twiss 1992; Sjöström 2013; Hattingh 2013, 2018). Saddle phytoliths were present in all samples analysed and accounted for between approximately 20 and 30% of each sample (See Tables 7.1. to 7.10 for Mut, Tables 7.11. to 7. 20. For MNR 04 and Tables 7.21. to 7.30 for MNR 074).

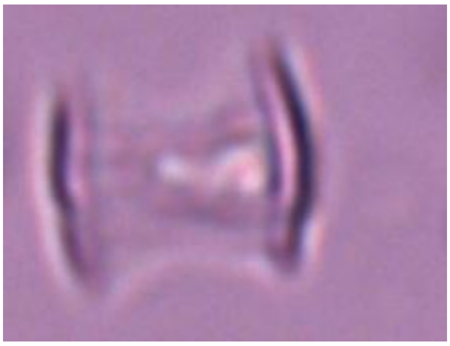


Image 7.12. Saddle phytolith (MNR 04, Sample 1)

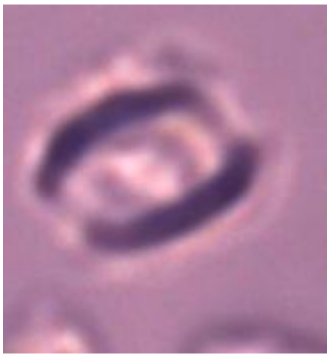


Image 7.13. Saddle phytolith (MUT, Sample 1)

7.4.4. C_3 – Bambusoideae and C_3/ C_4 Arundinoideae

The Bambusoideae sub-family, which uses a C_3 photosynthetic pathway, is found in parts of Asia, the Americas and central to southern Africa (Twiss 1992). The phytoliths produced by this sub-family are indistinguishable from those produced by other sub-families as some taxa produce purely saddles, some only bilobates and crosses whilst others simultaneously produce both bilobates and saddles (Twiss *et al*. 1969; Twiss 1992). Similarly, Arundinoideae does not possess any phytoliths with prominent diagnostic criteria (Twiss 1992).

7.4.5. Other phytoliths

Aside from the above mentioned phytoliths produced by Poaceae, other phytoliths noted in the samples were hairs, long cells, echinates and bulliforms. Hair phytoliths are largely produced in the leaves of plants in numerous Eudicot families, such as Cucurbitaceae etc (Piperno 2006), while bulliform phytoliths are produced by all Poaceae and have largely been considered undiagnostic, however, research increasingly suggests that some bulliform phytoliths could be linked to specific sub-families (Rossouw 2009, Chen *et al*. 2020). Echinate phytoliths are distinguished by their spiny or conical projections spread across the phytolith's surface

(Bozarth 1992; Neumann *et al.* 2019) and are characteristic of woody plants and palms (Huisman *et al.* 2018; Gao *et al.* 2018; Liu *et al*. 2020) and likely represent the extensive use of these types at the sites. Long cells are undiagnostic and are common in all Poaceae sub-families (Hattingh 2013).

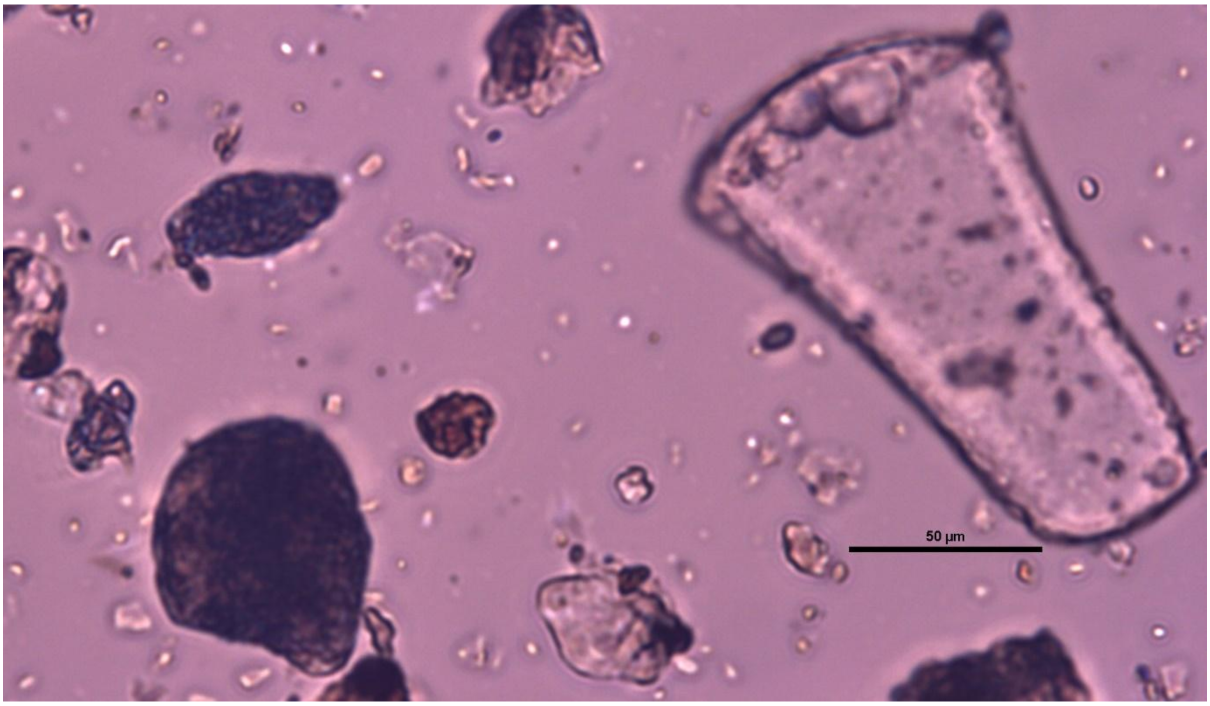


Image 7.14. Bulliform phytolith (MNR 04, Sample 10)

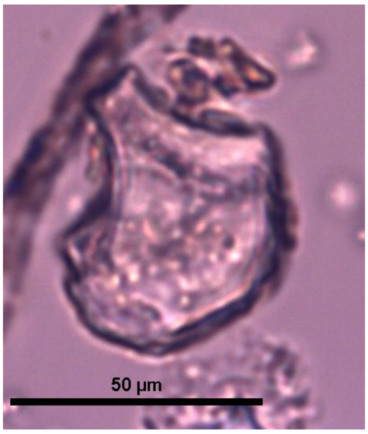


Image 7.15. Bulliform phytolith (MUT, Sample 2)

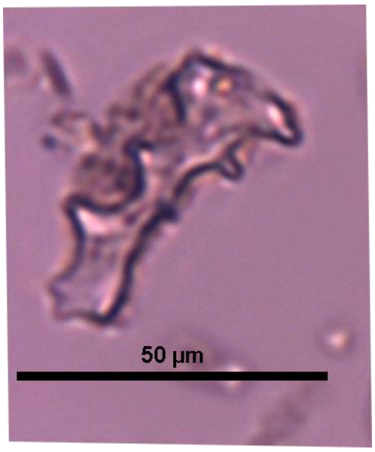


Image 7.16. Echinate phytolith (MUT, Sample 1)

Image 7.17. Hair phytolith (MUT, Sample 1)

Image 7.18. Long cell (MUT, Sample 6)

7.5. Conclusion

This chapter presented the results of a basic phytolith analysis conducted on thirty samples taken from Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074). Not only was the presence of phytoliths at the three MIA sites confirmed but were also linked to several grass sub-families. A variety of morpho-types were found at each site with bilobates and saddles dominating the samples. While many taxa that were identified at the sites through macrobotanical analysis, they cannot be conclusively identified via phytolith analysis.

Chapter 8

Discussion and conclusion

The MIA is usually examined through large sites located in the SLCA. More recent research has begun to look at sites outside this area. Moreover, very little is known about the agriculture practised or the plants utilised during the period. As such, this chapter will discuss, based on the results gathered from analysis, the cultivation strategies employed at each site as well as attempt to discern if there was a marked difference between wild taxa exploited, processed and consumed at each settlement.

8.1. Agriculture at Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074)

Little direct archaeobotanical evidence, in the form of macrobotanicals, has to date been found of the crop types cultivated. From the little material that has been found, it is known that grains such as sorghum and millet were the primary crops (Smith 2005; Steyn 2018). For the successful production of these crops, a certain range of environmental conditions must have been met to ensure adequate growth and maturation of these crops (Huffman 1996; National Research Council 1996; Steyn 2018). The location of a settlement might be seen as reflecting agricultural strategies and the knowledge concerning conditions pertaining to the management of crops and conditions needed to increase agricultural output (Boserup 2014; Cox & Atkins

1979; Richards 1985; Guthrie 1986; McGee 1986; Mortimore 1993; Abalu & Hassan 1999; *cf.* Smith 2005). Where a settlement was located influenced crop production as the taxa that were available to farmers for cultivation held adaptations to different environmental conditions and as the farmers were reliant on fertile soils and good grazing for livestock, settlements were concentrated in valleys, even though many crops are quite adaptable and tolerant of environmental stresses (Schoeman 2006a). This could affect which types of crops could be grown in specific areas (National Research Council 1996). For the cultural component of settlement location, which is outside the scope of this research, please refer to Schoeman (2006a and 2006b). The evidence for agriculture at Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074) will be examined with regard to the crops grown at each site after which an overview will be undertaken.

8.1.1. Mutamba (MUT)

The site, which was occupied during the 13th century, is located 80 km south-east of Mapungubwe on the northern slope of the Soutpansberg Mountain in a saddle on a narrow ridge with access to the Mutamba River and its floodplain a scant 250 m just below the ridge (Antonites 2012). The site's location on the northern slope means that it falls under a rain shadow and that it has a semi-arid environment. Although several micro-climates can be found across the mountain which the inhabitants of Mutamba could have exploited (See Chapter 2).

The archaeobotanical assemblage at Mutamba was very rich with a large amount of well-preserved material identified at the site. Five crop taxa were identified at Mutamba. Three were grains (*S. bicolor*, *P. glaucum*, *E. coracana*) and two (*V. unguiculata* and *V. radiata*) were legumes. Based on the site's location, on a narrow rocky ridge where the soil is shallow, the cultivation of these crops most likely took place away from the settlement. However, some cultivation could have taken place on a smaller scale within the settlement itself (Greenfield *et al*. 2005; Steyn 2018).

Owing to the growth requirements of the crops cultivated at Mutamba cultivation may have taken place between spring and autumn (Sept – May). The grains and legumes, if grown together, required a minimum of 350mm of rain and consistent temperatures of above 15° C (Huffman 2007). All of these crops can grow in a variety of soil types and are frost-sensitive, requiring temperatures between 20° C and 35° C (National Academy of Sciences 1996). *S. bicolor* and *P. glaucum* need as little as 250 to 300 mm of annual rainfall but the other crop taxa need higher annual rainfall of 500 to 1000 mm of annual rainfall (National Academy of Sciences 1996).

The crops grown at the site would have been dependent on summer rainfall and as such dryland agriculture was one of the forms of cultivation practiced at the site. Dryland agriculture refers to non-irrigated cultivation in which artificial watering is considered unnecessary in the securing of regular crop yields, i.e., crops are rain-fed (Biagetti *et al*. 2018). Drylands are generally considered unsuitable for mainstream cultivation and areas receiving less than 450mm of rainfall with no irrigation are considered non-productive (Biagetti et al. 2021). However, as the site sits on shallow rocky soil the argument can be made that it was more feasible that the inhabitants of Mutamba practised agriculture on the nearby floodplain along the Mutamba river.

S. bicolor accounted for the majority of the crop taxa at the site (See Chapter 7). It was found in almost half of the samples and accounted for 33% of the total MNI of macrobotanical material. This taxon was found in both sprouted and unsprouted forms. This was closely followed by *P. glaucum*, which was the second most common grain at the site, accounting for 29% of the total material. The third grain crop was *E. coracana*, which was only found in a single household (Feature 2). The last two crops cultivated were the legumes *V. unguiculata* and *V. radiata*. Two of the grain crops, *S. bicolor* and *P. glaucum*, are drought-resistant taxa and are well suited to dryland agriculture (Mönnig 1978). *S. bicolor* grows well in shallow soils with high clay content but does poorly in sandy soils (Department of Agriculture, Forestry and Fisheries 2010). Its roots are able to penetrate deep into the soil and it has the ability to reduce transpiration when it is moisture-stressed (Department of Agriculture, Forestry and Fisheries 2010). These traits would have been advantageous at Mutamba if the crop was cultivated using dryland agriculture. *P. glaucum* is also a hardy crop with a short growing season which can grow under high temperatures and very low rainfall and under dryland conditions, it can provide food security better than any other cereal crop (Biagetti *et al.* 2018; van Wyk & Gericke 2018). The third grain crop identified at the site, *E. coracana*, has slightly different growth requirements. The taxon requires 500 to 1000 mm of rain across a single growing season and temperatures up to 35° C (National Academy of Sciences 1996). As the environmental conditions at Mutamba were warmer and wetter than current conditions the cultivation of this crop was feasible at the time (Kabanda 2003). Unlike the other two grains, *E. coracana* is not drought resistant but does have the benefit of being largely pest resistant as the grain is too small for weevils to enter, the grain takes six months to mature and is work intensive with meticulous weeding necessary (National Academy of Sciences 1996).

Of the two legumes cultivated at the site one, *V. unguiculata*, is indigenous to Africa whilst the other, *V. radiata*, is not indigenous (Fuller & Harvey 2006). The former is a hardy rain-fed annual which is frost sensitive needing temperatures of between 20 and 35° C for growth and is well suited to a variety of soils and survives well in semi-arid conditions (Kay 1979). The taxon reaches maturity in as little as 60 days. The latter, also frost sensitive requires temperatures of between 30 to 35° C for growth which takes up to 120 days to achieve (Kay 1979). Its presence at Mutamba can be attributed to the site's involvement in long-distance trade as the taxon originates from India (Fuller & Harvey 2006; *cf.* Antonites 2012).

There is a notable lack of weed taxa and crop by-products within the macrobotanical assemblage of MUT. This may be either as a result of preservation or may be indicative of harvesting and processing practices. Harvesting and threshing of any crops would generally be considered the end of an agricultural year (Mönnig 1978). The various crops grown naturally tended to ripen at different times of the year, with some possibly having been harvested daily or as large harvests (Mönnig 1978). Whilst there is a lack of evidence for this having taken place at MUT within the macrobotanical material, phytoliths appear to indicate the probable presence of crop processing having taken place at the site as several bulliform and hair phytoliths are present within the samples. These forms are located within the epidermis of plants. Additionally, there is no evidence of crop storage at Mutamba, i.e., grain bins/ grain bin stands but the presence of these structures at the site can be inferred from their presence at numerous other Mapungubwe-era settlements where grain bin stands and stone platforms were found (Meyer 1998; Huffman 2007).

8.1.2. Vryheid (MNR 04)

Vryheid (MNR 04) is the largest of the Maremani sites. It covers an area on and around a small hill. The area surrounding the site has been classified as Mopane veld and is seen are having very arid conditions. The Sand River, a perennial water source which is dry during winter, is 200m from the site and the Limpopo River is 3km north. A large number of grain bin bases (n=21) were found scattered across the site and this indicates that extensive agriculturally associated activities were taking place at the site (Lippert 2019).

The analysis identified *P. glaucum* and an agriculturally associated weed taxon *Chenopodium* sp. within the macrobotanical assemblage at the site. It is also possible that based on phytolith data, that *Sorghum* sp. could have been cultivated. The overall low occurrence of macrobotanical material at the site as well as high numbers of broken bilobate within the phytoliths is most likely due to poor preservation as the deposit at the site is very shallow.

It is most likely that dryland agriculture was practised at Vryheid but due to its proximity to the Sand River and the Limpopo River floodplain agriculture is also very likely to also have been practiced. Based on macrobotanical evidence the main crop at the site appears to be *P. glaucum*. There is also evidence for this crop's chaff at the site as fragments of stalk and what appears to be an involucre fragment were found *(c.f.* Fuller *et al*. 2021). Some of the grains and the chaff were found in general household areas and near the grain bin stands. The taxon is superbly well suited to areas subject to aridity and high temperatures with very little rainfall (National Research Council 1996; van Wyk 2005; García-Granero *et al*. 2015; van Wyk & Gericke 2018; Biagetti et al. 2021).

Vryheid had both crop by-products and a weed taxon. This taxon, *Chenopodium* sp., were collected as a food plant but has also often been harvested as an arable weed alongside crops in historical times (Mabogo 1990; Singo 1996; Bogaard 2004). It is a popular wild spinach plant often called marog which thrives in disturbed soil (van Wyk 2005; van Wyk & Gericke 2018).

Traditional forms of non-mechanised crop processing are constructed from a limited set of actions which structure archaeobotanical assemblages in a predictable manner (Fuller *et al.* 2014). Crop processing aims to obtain clean grain by removing all contaminants, weeds and other components such as chaff (Fuller & Stevens 2009). The by-products which remain with the crop tend to vary through the processing sequence (Fuller & Stevens 2009). The processing of crops assists in filtering out plant components based on characteristics such as weight or size and depending on what stage of processing the crop is at before storage certain components will have been removed and therefore not present within the assemblage (Fuller & Stevens 2009; Fuller *et al.* 2014).

Crop processing can be divided into two rudimentary sets of activities, those that break apart the crop plant and those that separate the freed components (Fuller *et al.* 2014). Assemblages in the final stages of processing will be dominated by grain with few weed seeds while assemblages from the early stages will have more chaff and weeds (Fuller & Stevens 2009). Crop processing either precedes storage or was undertaken as and when crops were taken from storage with the first usually occurring once or twice a year in-field in bulk during times of harvest and the other occurring multiple times a year usually within the confines of the settlement (Fuller *et al.* 2014). Assemblages in which crops were stored semi-cleaned for later daily processing tend to have an array of material, i.e., grains, and chaff and are dominated by small weeds such as *Chenopodium* sp. (Fuller *et al.* 2014). Labour is the determining factor in whether crops are processed in-field in bulk or daily. With regards to labour, the storage of semi-clean material placed a large demand on labour after harvest (Fuller *et al.* 2014). As Vryheid is not an excessively large settlement it is very possible that there could not have been a sufficient number of people available to help with large harvests and as such would have promoted the storage of crops in a less processed state with routine processing of smaller batches throughout the year as needed.

8.1.3. Frampton 1 (MNR 074)

Frampton 1 (MNR 074) is a small site located 22km from MNR 04 in similar arid environmental conditions. The site is only 30 m across (Lippert 2019). The very shallow archaeological deposit at the site suggests that occupation was short-lived, and that it likely served as a cattle post. Faunal analysis undertaken at the site indicated a predominance of small stock, sheep and goats, and a large number of wild taxa (Antonites *et al*. 2016).

The macrobotanical assemblage from the site is very poor with no crop taxa visible – likely a result of the shallow deposits. Only wild taxa were found preserved in the macrobotanical assemblage (Chapter 6) while phytolith analysis showed a large number of broken bilobates, hair cells and bulliforms (Chapter 7). These forms are commonly produced in the epidermis of plants and their presence in such large numbers could be interpreted as evidence for fodder for stock animals. The macrobotanical and phytolith analysis taken in conjunction with faunal analysis and the very shallow deposit may serve to bolster the interpretation of the site as a stock post. While the evidence for the practice of pastoralism is stronger than the practice of agriculture at the site, the presence of grain bin stands found scattered across the site may mean that the inhabitants could have cultivated some crops which did not necessarily preserve well but it is also probable that grain and other foodstuff were obtained from other nearby settlements.

8.1.4. Agricultural Overview

The evidence for agriculture was the clearest at Mutamba (MUT) and Vryheid (MNR 04). Despite the number of grain bins found at the site, little evidence for agriculture is present at Frampton 1 (MNR 074) with its focus more akin to pastoralism rather than agriculture. At Mutamba (MUT) five different crop species were cultivated possibly through both dryland and floodplain-based agriculture. At Vryheid (MNR 04) only one crop species was identified alongside an agriculturally associated weed taxon. It is also likely that both dryland and floodplain agriculture also was practised at the site. at Based on ethnographic and historical literature it can be assumed that the size of the fields cultivated Mutamba and Vryheid were, prior to the introduction of the plough, unlikely to have exceeded the range of between half an acre to two acres as this was the most an individual was capable of tilling with a hoe (Mönnig 1978).

The entire agricultural process, from field clearing to harvesting, would have been a time and labour consuming process which consumed much of the daily life (Quinn 1959; Schapera & Goodwin 1962; Stayt 1968; Mönnig 1978; Fuller *et al.* 2010). Recent studies by Biagetti *et al.* (2022) show that many farmers living in arid and semi-arid areas, similar to those in which Mutamba and Vryheid are located, tend to prefer cultivating sorghum in floodplain areas and other crops, such as millet, in dryland fields. *P. glaucum w*as identified at both Vryheid and

Mutamba and this crop is easy to grow, less prone to disease and pests than most other crop taxa, depending of the variety can reach maturity in as little as 80 days and with the aid of their deep roots they are capable of bearing reliable and consistent yields where other major crops, like *S. bicolor* are not able to in areas receiving as little as 150 mm of rain (National Research Council 1996; van Wyk & Gericke 2018; Biagetti et al. 2021). Yield capabilities for this crop have been recorded as ranging from 2500 to 4000 kg per hectare under dryland conditions making it an ideal crop for arid and semi-arid areas (National Research Council 1996; van Wyk & Gericke 2018).

8.2. Wild taxa at Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074)

Wild taxa were found at all three sites. Wild taxa contributed materials, products and so on that could not necessarily be obtained from agricultural plants. These materials were utilised in many different ways and for a variety of purposes including but not limited to crafts, fuel, food, fencing, fodder, medicine and magic (Mabogo 1990; Magwede *et al.* 2019). The utilisation of wild taxa would have been subject to method of use, stored as well and the seasonal availability of those taxa with many fruiting during autumn and winter when agriculture may not have been practised (Steyn 2018). The inhabitants of the three sites would have had extensive knowledge of the plants growing in their surrounding environments (*cf.* Quin 1959; Mönnig 1978, Mabogo 1990).

A total of eleven wild taxa were identified at the three sites. Among the three sites, Mutamba (MUT) had the widest variety of wild taxa. A total of eight wild taxa were identified at the site. Vryheid (MNR 04) had four wild taxa and Frampton 1 (MNR 074) had five. Of the total eleven identified taxa two are grasses, four are shrubs, and three are trees. Taxa which could not be attributed to either are designated as “other”. Each taxon will be noted and its possible utilisation will be discussed.

8.2.1. Shrubs:

G. herbaceum/ *Gossypium* sp.

The taxon was found at MUT and MNR 04. At MUT it was identified to species level, as the only species growing within the Arid Northern Bushveld MVT of the Soutpansberg Mountain, while at MNR 04 it was identified to genus level as both *G. herbaceum* and *Gossypium arboreum* are known to occur in the Limpopo area (Davison & Harries 1980; Mostert 2006). *G. herbaceum* belongs to the Malvaceae family. The genus is found in tropical and sub-tropical areas and tends to occur in savanna, scrub and forest edge habitats (Koekemoer *et al*. 2014). The drought-resistant plant has hairy stems and can reach up to 1.5 m and needs consistent temperatures of over 20°C during the summer period to produce bolls encapsulating numerous seeds encased in a hairy fibre which historically have been known to have been spun and processed into cloth (Theron 2015; van Wyk & Gericke 2018). The fibres are separated from the seeds (ginning) by placing the bolls on a flat surface and rolling a rod over the seeds to separate them from the adhering fibres. The fibres are then untangled by hand or bowing, a process in which the fibres are placed on the string of a bow and repeatedly plucked. Spinning can then commence. The cloth is spun by holding the cotton in one hand while the other hand draws down and twists the fibre. This would have produced a course cloth.

At Mutamba eleven *G. herbaceum* seeds and 187 spindle whorls were found. These were chiefly found in domestic contexts. Antonites (2012) surmised that the large number of spindle whorls in connection with the contexts in which they were recovered demonstrated that cloth production at the settlement was engaged in by multiple members of each household. This meant that more cloth could have been produced than was needed by the inhabitants, which implies MUT's involvement in an economy beyond just a single settlement (Antonites 2019). This level of production contrasts with that of MNR 04 and MNR 74. MNR 04 had one seed and a few fragments of *Gossypium* sp. and seven incomplete spindle whorls concentrated in the kraal area (Lippert 2019). While there is no macrobotanical evidence for cotton cloth production at Frampton 1, it is still possible that cloth was made in some capacity as nine spindle whorls were found at the site (Lippert 2019).

Grewia sp.

Grewia sp. was found at both Mutamba and Vryheid (MNR 04) all within domestic contexts. This taxon also belongs to the Malvaceae family and depending on the specific species is either a shrub or a small tree (Koekemoer *et al.* 2014). Many different species of this taxon grow in and around Mutamba and Vryheid with at least five species (*G. subspathulata*, *G. bicolor*, *G. flavescens*, *G. villosa* and *G. hexamita*) known to occur within Mutamba's immediate vicinity and many more in Vryheid's proximity. Flowering tends to occur in spring, summer and at times in winter and fruiting from summer through winter (Coates Palgrave 2002). The fruit of most *Grewia* sp. is spherical in shape and the seed is composed of two lobes. The fruit for many of the species is edible but in general, based on ethnographical data, the fruit is eaten, the leaves imbibed in a tea, the bark as cordage/ fibres, the branches serve as firewood and the roots have medicinal purposes (Mabogo 1990; Coates Palgrave 2002).

Z. zeyheriana

This species was identified at Mutamba and falls under the Rhamnaceae family. It occurs in many different habitats such as in open woodland, and grasslands and is often found growing on termite mounds (Coates Palgrave 2002). According to botanical data, there is no record of the taxon occurring within MUT's vicinity or on the Soutpansberg Mountain itself (Mostert 2006; Mostert et al. 2009). This suggests that the taxon was brought from elsewhere or that its pattern of distribution may have altered. While the taxon may not be found near MUT, it is commonly found occurring across most of northern South Africa, including Limpopo (*cf.* Coates Palgrave 2002; Mostert 2006; Mostert et al. 2009). This taxon closely resembles its larger relative *Z. mucronata* (Coates Palgrave 2002). The fruit of both species is spherical with a thin layer of dry meal-like pulp covering the seed (Coates Palgrave 2002). The fruit is deemed to be unpleasant tasting but edible (Mabogo 1990). Due to its unpleasant taste, it primarily serves a magico-medical purpose. The bark, leaves and roots are used individually or in combination to treat maladies ranging from skin infections, chest complaints, dysentery, and lumbago to general pain relief (Coates Palgrave 2002; van Wyk *et al*. 2017). It is also believed to cure infertility and aids in purification rituals performed after the birth of twins (Mabogo 1990).

Chenopodium sp.

This taxon, identified at Vryheid and Frampton 1, while generally regarded as an agriculturally associated weed is also viewed as a naturally occurring wild plant (van Wyk & Gericke 2018). It tends to have a competitive advantage over many other plants as it emerges early, grows rapidly, has copious seed production (200 – 75 000 seeds per plant) with long-term viability and can compete excellently with crop plants (Coleman *et al.* 2019). Several varieties occur in

South Africa, such as *C. thunbergii*, *C. paniculatus* and *C. spinosus*, but it is *C. album* which is the most recognised and used in areas in which the sites are located (Quin 1959; Williams 1963; Koekemoer *et al.* 2014). This plant is exploited primarily for food (Quin 1959; Mabogo 1990; van Wyk & Gericke 2018). Young leaves are boiled and eaten as a type of spinach on their own or with other vegetables or leaves are also relished with porridge. In addition to culinary usage some species of *Chenopodium* sp. serve as vermifuges (Mabogo 1990). Mabogo (1990) also notes that the taxon has a magical use among the Vhavenda. The leaves and stem are pounded and mixed with other animal/ plant-based substances and made into a paste which is burned until it becomes a powder which is inhaled by a patient. This is believed to rid the person of a witch's familiars.

8.2.2. Trees

Acacia sp.

A handful of *Acacia* sp. seeds were found at Mutamba and a few testa fragments at Vryheid. This taxon has been reclassified as either *Senegalia* sp. or *Vachellia* sp. but as a more species-specific identification was not possible at Mutamba or Vryheid I will continue to use the more generalised moniker of *Acacia* sp.

This taxon belonging to the Fabaceae family grows across the Soutpansberg Mountain and is characteristic in many parts of the Limpopo (Coates Palgrave 2002). Acacia sp. grows in various climates such as scrub, wooded grasslands, open bush, dunes and woodlands (Ross 1981; Coates Palgrave 2002). The taxon has several uses, depending on the specific taxon. For example, *A. burkei* is primarily used as building material (fencing and hut walls) and fuel (Mabogo 1990) and *A. nilotica* in which the wood is used as fencing and firewood, the bark has medicinal properties and the gum it exudes is edible (Coates Palgrave 2002). Other species are used in craft or medicine, but the general use of this taxon appears to be in construction and as firewood (Mabogo 1990; Coates Palgrave 2002; van Wyk *et al*. 2017).

A. digitata

A single *A. digitata* seed was found outside a house structure excavated at Mutamba. This is a comparatively short but distortedly fat tree of 10 – 15 m in height and a circumference of up to 28 m" (Coates Palgrave 2002). The taxon grows in low altitude areas in dry hot woodlands and produces a hard woody shelled indehiscent fruit roughly 12 cm in length which contains a woody white pulp and kidney-shaped seeds (Coates Palgrave 2002; Kabore *et al*. 2011; Moll 2011). The taxon is very visible in the area surrounding Mutamba (Mostert 2006; van Wyk & Gericke 2018). It can be used in food, craft, medicine and magic. The bark is a source of fibres for cordage, beer sieves, floor mats, bags, snares etc (Mabogo 1990; van Wyk & Gericke 2018). The wood pulp and seeds are eaten. The seeds are nutritious and can be roasted and eaten as nuts. The pulp is exploited to a greater degree. The pulp is used in porridge, added to water to make a beverage or pounded into a powder which can be eaten as is (Mabogo 1990). The tree is believed to protect against lightning, especially that caused by witchcraft, and any plants found growing on the tree are mixed with magical powder to protect homesteads against witchcraft.

S. birrea

A large number of *S. birrea* was found at Mutamba (MUT) and a single fragment of the stone at Frampton 1 (MNR 074). This taxon is a medium-sized tree of 7 – 17 m which grows in medium to low altitude open woodland and bush (Coates Palgrave 2002; van Wyk *et al.* 2017). It is found growing in the region surrounding Mutamba and north-east South Africa (*cf.* Coates

Palgrave 2002; Mostert 2006). It flowers in spring and drops its still green fruit from autumn through winter (Coates Palgrave 2002). The fruit is a fleshy drupe covering a hard woody stone containing two or three nuts (Coates Palgrave 2002). The fruits fall and accumulate in large quantities under the tree where they ripen to a pale-yellow colour (van Wyk & Gericke 2018: 132). According to Coates Palgrave (2002: 540), this taxon counts among the most highly valued indigenous trees. The richly scented fruit is made into a beverage, both alcoholic and non-alcoholic, and is used as a conserve (Mabogo 1990; Coates Palgrave 2002; van Wyk & Gericke 2018). Its bark has medicinal use and is used in the treatment of diarrhoea, dysentery and unspecified stomach problems (van Wyk *et al.* 2017). The nuts are eaten or used to preserve meat (van Wyk & Gericke 2018). The nuts are known to be difficult to extract from the woody stone and could have been extracted using the method described by Quinn (1959) in which the stone is placed on a lower grinding stone and repeatedly smashed until the stone splits and the nuts can be picked out. This may have been the method employed at MUT and MNR 074 as a large number of broken fragments of the stone were identified at the site.

8.2.3. Grasses

Two wild species of grass, *B. deflexa* and *B. nigropedata*, were found exclusively at Mutamba. The former grows in the area surrounding Mutamba, the Arid Northern Bushveld MVT, and also in another part of the part of the mountain in an area where the vegetation is classified as the Moist Mountain MVT (Mostert 2006). This taxon tends to have a partiality for shade and damp or loamy soils, often growing on forest margins or shady open woodland (van Oudtshoorn 2014; Fish *et al*. 2015). The latter does not grow in Mutamba's surrounding environment. However, it can be found growing on the highest crests and plateaus of the Soutpansberg Mountain (Mostert 2006). This grass usually favours undisturbed veld and loamy or sandy soils and can grow in an assortment of environments such as the Karroo or in grasslands (van Oudtshoorn 2014; Fish *et al*. 2015). Based on ethnographic literature, or lack thereof, it is probable that neither of the taxa appears to have been exploited by the inhabitants of Mutamba. Rather, their presence on the site may be interpreted as evidence of background vegetation that occurred around the site or was blown into the site by wind.

8.2.4. Other taxa

Cucurbitaceae

Seeds identified as Cucurbitaceae were found at only Frampton 1. The plants from this family are comprised of a "few shrubby members, but mostly of tendril-climbing herbs with weak, sappy stems" (Allaby 2012: 134). The family includes annual and perennial climbers and creepers which are found mostly in dry tropical and sub-tropical areas within grassland, savanna, woodland, desert and semi-desert areas (Koekemoer *et al*. 2014). There are many vital food plants found in this family, including pumpkin, melon, watermelon, gourds and cucumber. Many Cucurbitaceae or cucurbits are consumed as food. As the species or genus found at MNR 74 is unknown, the three most frequently mentioned Cucurbitaceae found in ethnographic literature will be mentioned below. These are *Citrullus lanatus*, *Lagenaria vulgaris* and *Cucurbita pepo*. Not all of the Cucurbitaceae to be mentioned will necessarily be wild but are included in this section as there is no positive identification for a crop taxon and it is unknown if any were cultivated to the same extent as known agricultural crop plants.

C. lanatus (formerly *C. vulgar)*, the leaves are consumed as a potherb while the pulp is eaten in porridge and the seeds are used as a relish (Quin 1959). The taxon is also considered to be good feed for stock (Quin 1959). Another well-known species in southern Africa is *L. vulgaris*, a gourd, which serves the dual purpose of food and food container (Quin 1959; van Wyk & Gericke 2018). Its leaves and immature fruits are edible and its mature fruits are used for storage (Quin 1959; van Wyk & Gericke 2000). Van Wyk & Gericke (2000 42) note that seeds are considered a delicacy that is extracted from the fruit, roasted and ground into a nutritious nutty-tasting meal. Additionally, the species is considered one of the most important water sources in arid areas (van Wyk & Gericke 2000).

cf. S. retroflexum

This taxon was present only at Frampton 1. The endemic drought-tolerant species is widespread throughout southern Africa and is often found in growing in natural veld areas, often as a weed on disturbed soils (Koekemoer *et al*. 2014; Sivarkumar *et al*. 2020). It is a short-growing perennial herbaceous plant which produces small black berries (Ganapathi & Rao 1986). The species is a popular leafy vegetable eaten as a potherb and is not usually consumed fresh as it is considered too bitter but is boiled before consumption (Maanda & Bhat 2010). Mokganya and Tshisikhawe (2019) do note that the leaves of the species is used medicinally to treat earache.

8.3. Conclusion

Many communities in the MIA were ago-pastoralists and yet there is a paucity of knowledge regarding MIA agriculture and the wider assortment of plants consumed and utilised by settlements located in the Mapungubwe hinterland. As such, the research undertaken at Mutamba, Vryheid and Frampton 1 was an attempt to address this gap to examine whether these settlements implemented a regional cultivation strategy or if they tailored their cultivation practices to their surrounding environment. Secondly, it was to determine if there was any discernable difference in the wild taxa processed, consumed or exploited at these sites. And finally, the research was an attempt to see if phytoliths were present at MIA sites.

Of the three sites examined, Mutamba (MUT) and Vryheid (MNR 04) presented evidence that illustrated agricultural activities having taken place whilst Frampton 1 (MNR 074) seems to have been a short occupation with a focus on stock rather than agriculture. Mutamba (MUT) had a well-preserved and rich crop assemblage comprised of five crop species. Three of the crop species were grains and two were legumes. No crop processing debris or weed taxa were identified at the site, nor was any evidence of grain bins/ stand present. At Vryheid (MNR 04) many grain bin stands were found as well as a single crop taxon, *P. glaucum*, and an agriculturally associated weed *Chenopodium* sp. Frampton 1 (MNR 074) had no crop taxa but did have evidence of grain bin stands. Based on archaeobotanical analysis and the site's proximity to floodplains it is probable that both Mutamba (MUT) and Vryheid (MNR 04) most likely practiced dryland and floodplain agriculture. *P. glaucum* is a common crop taxon found at both sites and it is well suited to dryland agriculture in arid and semi-arid areas. Thus, it appears that the sites utilised similar agricultural practices and may have cultivated some of the same crops.

Unlike crop taxa which were identified at only Mutamba (MUT) and Vryheid (MNR 04) wild taxa are present at all three sites. Mutamba (MUT) had in a similar fashion to its crop assemblage a well-preserved and rich wild taxa assemblage with at least eight taxa identified at the site. Frampton 1 (MNR 074) and Vryheid (MNR 04) however, had material of poor preservation. Five wild taxa were identified at Frampton 1 (MNR 074) and four at Vryheid

(MNR 04). There does not appear to be an overwhelming difference in the wild taxa exploited at these sites as they were all located in similar environments (See Chapter 2).

Mutamba (MUT), Vryheid (MNR 04) and Frampton 1 (MNR 074) were MIA sites occupied by agro-pastoralists who cultivated crops and had access to a variety of wild plants found in and around their surrounding environments. Hopefully, the data generated from the three sites will be able to provide a better understanding of the agriculture practiced in the MIA and the range of wild plants exploited. It is recommended that more sites be incorporated into MIA agricultural and archaeobotanical studies and that macrobotanical and phytolith reference collections be created of plants known and suspected to have been utilised in the MIA. It is also recommended that other avenues of archaeobotanical research such as starch or wood analysis be incorporated into future research for a more holistic image of plant use during the Iron Age.

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Appendix A

Maremani Plant communities:

1. *Croton gratissimus - Danthoniopsis dinteri* rocky outcrops

Subdivided into Entandrophragma caudatum - Portulacaria afra mountain bushveld

2. *Androstachys johnsonii - Terminalia sericea* sandstone hills

3. *Combretum apiculatum - Danthoniopsis dinteri - Tricholaena monachne* rocky outcrops

4. *Colophospermum mopane - Xerophyta viscosa* open to dense bushveld on low hills and rocky outcrops

5. *Colophospermum mopane - Terminalia prunioides - Psiadia punctulata* bushveld

6. *Sclerocarya birrea - Aristida stipitata - Eragrostis lehmanniana* open grass and bushveld

7. *Colophospermum mopane - Kirkia acuminata - Senegalia erubescens*

8. *Colophospermum mopane - Boscia albitrunca - Terminalia prunioides* open to dense bushveld on plains and low rocky hills

9. *Colophospermum mopane - Catophractes alexandri - Vernonia cinarescens* low and dense bushveld

10. *Colophospermum mopane - Sesamothamnus lugardii - Vachellia tortilis* open to dense low bushveld

11. *Colophospermum mopane - Gardenia resiniflua - Tetrapogon tenellus* low thicket

12. *Colophospermum mopane - Aristida adscensionis* bushveld

13. *Colophospermum mopane - Vachellia tortilis - Eragrostis lehmanniana* low dense bushveld

14. *Vachellia tortilis - Eragrostis lehmanniana* old fields

15. *Pechuel-loeschia leubnitziae - Urochloa mosambicensis* open grassland to dense bushveld

16. *Combretum imberbe - Philenoptera violacea* stream community

17. *Xanthocercis zambesiaca - Vachellia robusta* - *Cyperus sexangularis* riparian community

Appendix B

Macro-botanical sample details

Site: Mutamba (MUT)

Sample no.	Locus	Unit	Feature	Level	Description	Litres floated
1	2013	110/185	2	IV	Floor contact (material on floor surface)	10
2	2170	102/173	1	III	Midden, general	10
3	2111/1	99/172	1	IV	Midden, general	10
4	2037/1	100/172	1	IV	Midden, general	10
5	2089/1	101/171	1	III	Midden, general	10
6	2002/1	111/184	2	III	General	10
7	2178	103/173	1	IV	Pit fill - ash	10
8	1177/1	111/182	2	IV	Floor contact (material on floor surface)	10
9	2031	101/172	1	IV	Gravel floor	10
10	1163/1	113/182	2	IV	Floor contact (material on floor surface)	10
11	2040/2	102/174	1	V	Dung smeared floor outside structure	10
12	2021/11	101/174	1	III	Midden, general	10
13	2038/1	99/174	1	IV	Midden, general	10
14	2194/1	100/173	1	V	Hearth (in-situ burnt area with well defined limits)	10
15	1066/1	99/158	12	I	Excavated surface collection	10
16	2173	103/173	1	III	Pit fill - ash	10
17	1175/1	112/182	2	IV	Burnt hut remains	10
18	2118	111/184	2	IV	Floor contact (material on floor surface)	10
19	1178/12	111/183	2	IV	Floor contact (material on floor surface)	10
20	2176/1	103/173	1	IV	Pit fill - ash	10
21	2113/1	99/173	1	V	Unvitrified dung and ash	10
22	1178/1	111/183	2	IV	Floor contact (material on floor surface)	10
23	2077	110/182	2	IV	Burnt hut remains	10

24	2175	103/173	1	IV	Floor contact (material on floor surface)	10
25	2028	102/172	1	III	Surface outside structure	10
26	1008/1	122/134	4	III	Midden, general	10
27	2096/1	101/171	1	III	Gravel floor	10
28	2117/1	100/172	1	V	Unvitrified dung and ash	10
29	1178	111/183	2	IV	Floor contact (material on floor surface)	10
30	2147	110/183	2	IV	Floor contact (material on floor surface)	10
31	2172	103/172	1	III	Gravel floor	10
32	2039/1	102/173	1	V	Unvitrified dung and ash	10
33	2020/1	102/174	1	III	Midden, general	10
34	2174	103/173	1	III	Pit fill - ash	10
35	2159/1	102/171	1	II	Midden, general	10
36	2189/1	102/172	1	V	Unvitrified dung and ash	10
37	2025/1	100/174	1	III	Midden, general	10
38	1173/1	113/182	2	IV	Floor contact (material on floor surface)	10
39	2041/1	101/174	1	V	Floor contact (material on floor surface)	10
40	2015/8	110/184	2	IV	Burnt hut remains	10
41	2027/1	99/173	1	III	General	10
42	2115/1	100/174	1	V	Unvitrified dung and ash	10
43	2090	101/172	1	II	Midden, general	10
44	2108	101/141	3	III	Unvitrified dung and ash	10
45	1172	111/183	2	III	Midden, general	10
46	1174/1	112/183	2	IV	Burnt hut remains	10
47	2191/1	101/172	1	V	Unvitrified dung and ash	10
48	2082/1	108/182	2	IV	Rocky fill (purposeful)	10
49	1026/1	52/142	7	III	Midden, general	10
50	2162/1	102/171	1	II	Midden, general	10
51	1119/1	105/169	13	II	Midden, general	10
52	2163/1	100/172	1	I	Excavated surface collection	10
53	2083	108/182	2	IV	Burnt hut remains	10
54	2100	102/173	1	III	Gravel floor	10

55	2148	109/183	2	IV	Floor contact (material on floor surface)	10
56	2003/1	111/184	2	III	Midden, general	10
57	2007	111/184	2	IV	Floor contact (material on floor surface)	10
58	2010/1	111/185	2	II	General	10
59	2019	199/174	1	I	Excavated surface collection	10
60	2167/4	101/173	1	III	Midden, general	10
61	2036	100/174	1	IV	Midden, general	10
62	2088/1	99/173	1	II	Midden, general	10
63	2087	100/173	1	II	Midden, general	10
64	2024/1	101/174	1	III	Midden, general	10
65	2165/1	99/173	1	III	Midden, general	10
66	2084/1	101/171	1	II	Midden, general	10
67	1046/4	99/141	3	III	Sterile	10
68	2091/1	100/173	1	III	Midden, general	10
69	1230/1	121/181	14	II	General	10
70	1121/1	105/169	13	IV	Midden, general	10
71	1156	113/181	2	IV	Floor contact (material on floor surface)	10
72	2186/1	99/171	1	IV	Midden, general	10
73	2043/1	110/184	2	IV	Burnt hut remains	10
74	1036	103/172	1	I	Excavated surface collection	10
75	2101	102/172	1	III	Gravel floor	10
76	2042	101/173	2	V	Floor contact (material on floor surface)	10
77	2081	108/182	2	III	Midden, general	10
78	2182/1	101/171	1	IV	Midden, general	10
79	2193/1	100/171	1	V	Unvitrified dung and ash	10
80	2011	110/185	2	III	Midden, general	10
81	1056	65/155	10	III	Midden, general	10
82	2188/1	103/172	1	V	Unvitrified dung and ash	10
83	1176/1	112/183	2	IV	Floor contact (material on floor surface)	10
84	2102	103/172	1	IV	Floor contact (material on floor surface)	10

85	2116/1	100/173	1	V	Unvitrified dung and ash	10
86	2094	100/172	1	III	Midden, general	10
87	2016/1	102/174	1	II	Midden, general	10
88	2030	101/172	1	I	Excavated surface collection	10
89	2026/1	99/174	1	III	Midden, general	10
90	2086/1	99/171	1	II	Midden, general	10
91	2166/1	101/172	1	III	Midden, general	10
92	2092/1	100/171	1	II	Midden, general	10
93	2035/1	101/174	1	IV	Midden, general	10
94	2190/1	102/171	1	V	Unvitrified dung and ash	10
95	2014/4	111/185	2	III	Midden, general	10
96	2114/1	99/174	1	V	Unvitrified dung and ash	10
97	2169/1	103/173	1	II	Floor contact (material on floor surface)	10
98	2099	99/173	1	II	Midden, general	10
99	2029	102/173	1	III	Floor contact (material on floor surface)	10
100	2168/1	103/173	1	II	Midden, general	10

Site: Vryheid (MNR 04)

Sample no.	Locus	Unit	Area	Description	Litres floated
1	336/1	96/220	A	Midden	10
2	839/1	90/70	A	Kraal	10
3	343/2	111/89	B	Domestic context	10
4	337/3	96.3/219	A	General	10
5	340/1	96/220	A	General	10
6	202/2	104/238	B	Cattle kraal	10
7	199/1	104/238	B	Grain bin	10
8	150/2	136/230	C	Midden	10
9	191/1	106/238	C	Alluvial deposit	10

Site: Frampton 1 (MNR 074)

Sample no.	Locus	Unit	Description	Litres floated
1	138	118/114	midden deposit	10
2	134	118/114	midden deposit	10
3	105	106/102	undifferentiated material N of kraal	10
4	140	120/114	midden deposit	10
5	108	106/100	undifferentiated material N of kraal	10

Appendix C: Seed morphological characteristics

Taxon	Common name	Seed morphology	Useful reference/s
Sorghum bicolor	Sorghum	Seed (caryopsis) is round to ovate dorso-ventrally compressed with a projecting concave hilum. Scutellum is shallow, long and wide, comrising 1/2 to 2/3 of seed's length	Fuller 2006
Pennisetum glaucum	Pearl millet	Seed is ovate in plan with a deep projecting scutellum (3/4 of scutellum length). Hilum also projects. Seed sizes tend to vary.	Brunken *et al.* 1977; Fuller 2006
Eleusine coracana	Finger millet	The is globose shaped. Its scutellum is only 1/3 of the seed. Surface decoration is pusticulate. Size up to 2 mm.	Hilu *et al.* 1979; Fuller 2006
Vigna unguiculata	Cowpea	There is some variation present with size and shape. Shape tends towards reniform or globular. Length is up to 12 mm.	Kay 1979
Vigna radiata	Mung bean/ Green gram	Seeds are oblong or globular shaped with flattened ends. Length up to 4 or 5 mm	Kay 1979
Chenopodium sp.	Goosefoot/ Depends on species	Seeds are obicular. Sides are convex and with keeled margins. Testa is smooth to striate with raised reticulum.	Williams 1963
Cucurbitaceae	Depends on species	Seeds are oval to spherical. Testa is smooth. Size varies.	Ajuru & Okoli 2013
Adansonia digitata	Baobab/ Kremetart	Seed is reniform in shape with length up to 15 mm	Moll 2011

Sclerocarya birrea	Marula/ Moroela	Possesses different parts: a oval shaped stone (endocarp) with two to four (sometimes only one) locule/s containing nuts and operculum covering the locule	Von Teichman *et al.* 1986, Von Teichman *et al.* 1988
Solanum retroflexum	Wonderberry/ Sunberry/ nightshade	Seeds are <2mm in length and width. Shape is a flattened lacrimal sub-apicalhlim. Testa minutely pitted.	Särkinen *et al.* 2018
Vachellia sp./ *Senegalia* sp.	Depends on species	Seed size and shape tend to vary, based on species. A noted feature on these seeds is the obovate areole.	Al-Gohary & Mohammed 2007; Venier *et al.* 2012; Sivakumar *et al.* 2013
Grewia sp.	Depends on species	The seed's shape, size and reticulation depend on the species.	Anther *et al.* 2009; Cappers *et al. 2009*
Gossypium herbaceum/ *Gossypium sp.*	Cotton	The seed is ovoid with a point	Bouchaud *et al.* 2011
Ziziphus zeyheriana	Dwarf buffalo thorn	The seed is small (up to 5 mm) and elliptal in shape	Cappers *et al.* 2009
Brachiara deflexa	False signal grass	Seed is rather elliptically shaped. The spikelets are between 2.5 to 3.5 mm	Ibrahim *et al.* 2018
Brachiaria nigropedata	Spotted signal grass	No technical data found for seed characteristics but it has an inflorescence of racemes along a central filiform ro ribbon-like rachis. The lower glume tends to be shorter than the spikelet and the upper lemma is obtuse to accute or mucronate	Thompson 1988; Clayton & Renvoize 1986 in Torres Gonzalez & Morton 2005

Appendix D: MNI and ubiquity data

Taxon	**Site**					
	MUT		**MNR 04**		**MNR 074**	
	MNI	**Ubiquity %**	**MNI**	**Ubiquity %**	**MNI**	**Ubiquity %**
S. bicolor	173	48	x	x	x	x
P. glaucum	150	64	8	63	x	x
E. coracana	*4*	4	x	x	x	x
V. radiata	19	16	x	x	x	x
V. unguiculata	32	18	x	x	x	x
Chenopodium sp.	x	x	2	25	2	40
G. herbaceum/ Gossypium sp.	11	6	1	25	4	20
Acacia sp.	5	19	NQF	13	x	x
S. birrea	71	68	x	x	1	20
Grewia sp.	19	9	1	13	x	x
Ziziphus sp./ *Z. zeyheriana*	17	14	x	x	x	x
A. digitata	1	10	x	x	x	x
cf. S. retroflexum	x	x	x	x	3	40
cf. Cucurbitaceae	x	x	x	x	1	20
B. deflexa	7	2	x	x	x	x
B. nigropedata	*3*	3	x	x	x	x

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