EARLY IRON AGE SOCIAL AND ECONOMIC ORGANIZATION IN SOWA PAN, BOTSWANA

By

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ABSTRACT

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The Early Iron Age (ca 200 – 1000 AD) in Southern Africa was a time of expansion, reorganization, and innovation that laid the foundation for the complex system of inter-group interaction that early European explorers first encountered in the 15th century and that continues to influence community dynamics today. Across the subcontinent, indigenous hunting-and-gathering communities encountered groups of immigrant farmers and herders from Central and East Africa who brought with them new technologies and new forms of subsistence. Over the centuries, both indigenous and migrant communities experienced demographic shifts, changes in settlement patterns, transitions in economic practices, and cultural and social transformations. Much research for this time period focuses on the changes experienced by hunter-gatherer communities as they were affected by the presence of encroaching agro-pastoral populations. Another related body of research seeks to understand internal dynamics of agro-pastoral groups over time, particularly in the economic and cultural heartland of Shashe-Limpopo. However, a number of studies have documented hunter-gatherer influence on agro-pastoral community cultural practices. Furthermore, agro-pastoral socioeconomic strategies have been shown to vary regionally to an extent. Here, I ask what external influences acted on agro-pastoral communities, and what an understanding of those influences means for archaeologists' interpretations of the Early Iron Age culture(s) as a whole. This project reframes community-level socioeconomic processes: rather than seeing agropastoralist sites as parts of a predominant and hegemonic sphere of influence, sites are nodes within a cross-continental, multi-scalar network in which multiple avenues of influence – social, geographical, and environmental – operate on all communities. In other words, if agro-pastoral communities are recontextualized as one influence among many in a network, how might regional variation in their

material culture be explained? Researchers acknowledge the presence of a multi-scalar network of interaction and exchange incorporating several types of communities (including hunter-gatherers and coastal traders), but most assemblages tend to be analyzed from the point of a local and Iron Age-predominant perspective. Strong preference is given to the ‘keystone’ material types – ceramics in particular – while spatial organization of settlements are seen as ‘texts’ by which to interpret the structure of Iron Age society. On a methodological level, this research asks what inquiry that incorporates multiple lines of evidence, including non-traditional artifact types, can elucidate about the socioeconomic organization of a geographically and culturally peripheral site. In particular, through the use of a high-resolution site-level spatial dataset, this project seeks to lay the foundation for a more robust interpretation of use of space within sites in Early Iron Age Southern Africa. Excavation of Thabadimasego, survey of parts of its surrounding landscape, and interpretation of the resulting assemblage formed the basis of the dataset for this project. Thabadimasego is one of several Early Iron Age sites in the Mosu Escarpment area of northeastern Botswana which form a settlement complex that is only beginning to be understood. Overall, the research project addresses the role of smaller sites like Thabadimasego within the social and economic exchange network which is so often cited as crucial to the development of socioeconomic complexity in the Southern African Iron Age. Areas such as South Sowa, situated on the fringes of known Early Iron Age settlement distribution, are frequently framed as peripheral, if only implicitly, and in comparison with contemporary ‘cores’ of cultural and economic production. The data collected for this project comprise one of the few high-resolution spatial datasets for Early Iron Age sites in Southern Africa that give attention to the site's comprehensive set of material culture components. As such this dataset stands to contribute to the ongoing scholarly discussion on the relationship between site organization, socioeconomic organization, and group identity, as well as the interplay between regional economies and supra-regional cultural processes.

This work is dedicated to my parents, Greg and Sara, for their immeasurable support and love.

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Chapter 1 Introduction: site description, research questions, and environmental background

The last 2000 years witnessed a series of substantial shifts in both the demographic and the economic characteristics of societies in Southern Africa. Prior to then, small and usually mobile communities of hunter-gatherers were the only occupants of the subcontinent. The earliest centuries AD, however, saw multiple waves of colonization by food-producing migrants incoming from East and Central Africa, thus marking the start of what archaeologists generally characterize as the Iron Age in Southern Africa. As these herding and farming communities established themselves first on the coasts and, over time, within the interior of Southern Africa, both the indigenous hunter-gatherers and the 'new arrivals' underwent transformations in terms of where they settled, how they organized their communities, what they ate, and how they represented themselves as individuals and groups. Furthermore, a series of shifts in the social and economic organization beginning in the late first millennium AD, particularly in the Shashe-Limpopo Basin of South Africa, indicate the beginnings of social stratification and political centralization which would come to encompass much of the subcontinent in the second millennium.

A considerable portion of Southern African archaeological study has been dedicated to understanding these transformations and how they led to the diverse societies encountered by early European explorers in the 15th and 16th centuries AD. We as archaeologists are only beginning to appreciate the complexity of the social, economic and political systems that formed in the first 1500 years AD in Southern Africa. This project takes a look at some of those systems from the perspective of a specific area in northeastern Botswana known as the Makgadikgadi Pans. In particular, an extensive yet little-studied cluster of sites on the southern edge of Sowa Pan, the largest of the Makgadikgadi Pans, is the geographic focus of this study. In particular, the material evidence from one small site within South Sowa, called Thabadimasego, is scrutinized.

The research discussed in this dissertation addresses the nature of the area's participation in, and localized adaptation of, region-wide cultural and political systems. For the time period in question - the last half of the first millennium AD, also called the Early Iron Age - archaeologists consider the eastern third of Southern Africa (that is, what are now Zimbabwe, southern Mozambique, eastern Botswana, eastern South Africa, Lesotho, and Swaziland) to be a coherent geographical unit in terms of its subsistence traditions, ethnic affiliations, and language family. At the same time, it is also widely recognized that multiple streams of migrations, moving into Southern Africa from relatively disparate parts of Central and East Africa, contributed to the series of cultural developments which occurred during the Early Iron Age (for a map of these migration streams, see Huffman 2007:122). Likewise, the eastern third of Southern Africa is home to a wide range of physical environments, from desert-like semi-arid savannahs to montane forests and coastal plateaus. As is discussed in detail in the proceeding chapters, the range of diversity in natural resources and demography alike is sometimes addressed in Southern Africa's archaeological literature, and sometimes not. Much attention has been given to settlements located in what is often viewed as the cultural center of the Iron Age, like Schroda in the Shashe-Limpopo river confluence (Hanisch, 1980; Huffman, 2000; Calabrese 2000; Van Doornum, 2005; Antonites 2014)**,** and these settlements no doubt made highly influential contributions to socioeconomic processes of the time. However, numerous smaller and potentially more peripheral sites populate the landscapes surrounding the larger sites (as studies such as van Doornum 2005 and Klehm 2013 can attest), as well as in less-central areas of Southern Africa.

Here an argument is presented for a need to move from broad to more specific localized characterizations of subsistence and social organization, while still paying heed to the way that local studies speak to what 'the Early Iron Age,' as a cultural designation, means for Southern Africa as a whole. The predominant explanatory framework for Early Iron Age lifeways across the whole subcontinent has been developed based on data from one particular region – the Shashe-Limpopo Basin of South Africa – and partly because of this, variation and change tend to be explained in simplistic terms of the migration and diffusion of culture-historic 'packages.' As a result, certain types of material culture, particularly ceramics, have been privileged as objects that signal group identity, behavior, and population movement. While shared cultural traditions clearly played a strong role tying together communities throughout the subcontinent - shared or related pottery styles range over hundreds of kilometers, for example, and goods produced in one area can be observed as trade items in other localities - it must also be recognized that some specific attributes of geography, climate, and community dynamics would likewise be major structuring forces in the way that the set of subsistence practices and sociocultural traditions called the 'Early Iron Age' manifested in any given area of Southern Africa. Much more work needs to be done to interpret regional developments in social and economic behaviors to acknowledge the way these factors came into play.

Inferences that Southern Africanist scholars make based on extant archaeological datasets can also be problematic. In particular, establishing the socioeconomic identity – such as San hunter, Khoe herder, or Bantu farmer – of the prehistoric occupants of archaeological sites has been a scholarly priority far more than the extant archaeological record has the power to actually answer this question (see, for example, Maggs and Whitelaw 1991; Smith et al. 1991; Denbow 1999, 2002; Sinclair 2004**;** Shepherd 2003; A. B. Smith et al. 2008. Archaeologists have indeed been questioning the prevalence of this line of inquiry for nearly as long as the classic tri-partate scheme of hunter-farmer-herder has been in use within Southern African scholarship (e.g., Lane 1994/5, Walker 1998; Meskell 2002).

In order to address both of these issues the data used to formulate archaeologists' understanding of EIA lifeways ought to be expanded upon beyond ceramic typologies and high-status objects like metal, and regional case studies which incorporate the full range of variation present in site types and settlement patterns must be adopted. The relatively narrow sample data as well as site types which currently inform the existing models provide a weak foundation for theoretical arguments about social organization. Excavating a wider geographic range of sites, using a more robust methodology and with increased attention to the geophyisical and environmental contexts of the remains, is the kind of foundational work that will vastly increase the extant body of data from which Southern Africanist archaeologists develop their models. In other words, archaeologists working in Southern Africa need to spend more time fleshing out our understanding of what can be observed more directly, such as diet, technology, and the taphonomic effects on site formation, before we can coherently answer questions about such intangible phenomena as ethnic identity. In light of this, the research presented here does not suggest an alternative model of social and spatial organization per se, but it does make the case for an alternative system of data collection and a more flexible interpretive framework. In this research project, the evidence for subsistence activities, material culture traditions, and spatial organization at Thabadimasego is reviewed in detail and its relevance to understanding the dynamic between local and regional sociocultural processes of the Early Iron Age is discussed. As will be shown, small, peripheral sites such as this one contain enormous potential for providing context-specific feedback to the broad-stroke behavioral models currently favored in Southern African archaeology.

1.1 Research questions

Early Iron Age settlements are typically characterized as small Bantu-speaking agricultural communities which were more or less self-sustaining in terms of subsistence but who nevertheless maintained extensive economic and cultural relationships with one another (Mitchell and Whitelaw 2005; Huffman 2007). These relationships involved, to a greater or lesser degree over the centuries, the exchange of both bulk and luxury items; some of these goods were local products and some, such as glass beads, were acquired via connections to trading networks further abroad across eastern coastal Africa and glass-producing regions across the Indian Ocean (Gilbert Pwiti 1991; Popelka et al. 2005; Robertshaw et al. 2010). For the Southern African Early Iron Age, access to and control over the foreign goods exchange network has been cited as a potentially important factor in the development of social complexity (Hall 1987; Huffman 2000). My research addresses the role of smaller sites like Thabadimasego within this social and economic network. Areas such as South Sowa, situated on the fringes of known Early Iron Age settlement distribution, are frequently seen as peripheral - if only implicitly, and in comparison with 'cores' of cultural and economic production such as Schroda or Bosutswe which are posited to have widespread influence over their surrounding landscape (Denbow 1984; Reid and Segobye 2000a; Huffman 2000; Calabrese 2007).

The socioeconomic processes that characterize the Early Iron Age have been addressed on a number of scales. Some researchers look at regional patterns of trade or settlement (Denbow 1982; Denbow 1984; van Doornum 2005), while others look on the level of the site (H. J. Greenfield and Miller 2004; H. Greenfield and van Schalkwyk 2006; Badenhorst 2009). On the scale of the individual site, Huffman's (1986, 1990, 2001) 'Central Cattle Pattern' (CCP) model has played a major role in informing archaeologists' understanding of spatial layout as well as social organization. This model emphasizes the role of cattle-keeping, and cattle as bridewealth, as a means of maintaining political authority and increasing communal longevity, thus placing cattle are the heart of Early Iron Age social, spatial, cultural and economic organization. The original CCP was derived from observations of nineteenth-century Sotho-Tswana and Nguni settlement patterns by Kuper (1982), though Huffman maintains the claim that this socioeconomic-spatial way of organizing Eastern Bantu-speaking communities stretches as far back as the Early Iron Age. He references in support such sites as Broederstroom and Kwagandaganda (5th-7th c. AD, South Africa) as well as Kgaswe (11th c AD, Botswana). Hoewver, even though the Central Cattle Pattern addresses dynamics at a site-specific level, and while the spatial component of the model does seem to agree with the layout of multiple archaeological sites dating as far back as the first millennium AD (including those referenced above), for all that Huffman claims an understanding of an Early Iron Age 'worldview', the model does not incorporate much discussion of networks of exchange and interaction. Its application across many temporal and geographical contexts of Southern Africa without accounting for regional factors has provoked a number of critiques, suggested alternative interpretations, as well as calls to reassess the CCP. Lane (1995), for example, raises important theoretical critiques regarding the applicability of ethnography to understandings of prehistory, especially the lack of a direct historical approach in the case of the Early Iron Age. Mitchell and Whitelaw (2005) present a number of Early Iron Age sites whose layouts either do or do not fit well with the model. (Badenhorst (2011, 2012) and Sadr and Rodier (2012) both take quantitative approaches to evaluating the faunal component and stone wall layouts, respectively, of Iron Age sites with regard to their ranges of variation. While Badenhorst concludes that the layout attributed as the CCP may in fact have originated as a functional means of protecting livestock, Sadr concludes that a range of variation exists for Early Iron Age spatial layouts, of which the CCP is only one. Greenfield and van Schalkwyk (2006) specifically address intra-site layout at Ndondondwane, and theirs is one of the few studies to do so in more than descriptive terms. Their study raise the concerns that taphonomic effects as well as long-term occupation may affect what is interpreted as one condensed site layout. Importantly, Denbow (1979, 1982, 1984, 1986) has established a framework for addressing dynamics of landscape use and settlement processes in eastern Botswana for the Early and Middle Iron Ages which incorporates inter-site and inter-group processes. In sum, while no one voice predominates Early Iron Age research, neither has any one model gained as much currency as the Central Cattle Pattern, which remains widely-applied partly thanks to Huffman's persistent publication record. Collectively, these scholars bring attention to the need to look for alternative investigative methods as well as alternative frameworks for understanding the relationship between site formation, behavior, and worldview.

For the most part, scholars taking a position in opposition, or framing an alternative, to the CCP have done so by addressing various issues within the framework. Some, such as Badenhorst (2011, 2012), have considered the components; some, such as Denbow (1982, 1984, 1986) the location, and some, like Mitchell and Whitelaw (2005) the consistency of the pattern). What needs to be addressed further is the question of regional variation within the Early Iron Age. If regions within Southern Africa, through their exchange and shared cultural referents, together formed a cohesive socioeconomic system, then the role of any one site or region within this sphere and its interoperability as a whole ought to be examined. This is particularly true for questions of socioeconomic and cultural organization, ‘worldview’, and the replicability of studies which address these questions. The studies cited above demonstrate that consideration of regional factors, variation in assemblage, and differences in scale are all crucial to understanding how and why Early Iron Age ways of life were lived in any one place within Southern Africa. This work also underlines the need to do the foundational work of interpreting processes, such as regional subsistence patterns, before something as fluid as social or ethnic identity can be addressed.

The work conducted at Thabadimasego and the surrounding landscape has sparked an interest in an area which many archaeologists researching the Southern African Early Iron Age had previously considered marginal (Reid and Segobye 2000; Daggett, Wood, and Dussubieux, in press). This research, building upon the framework established by previous fieldwork in the area (as detailed in the following sections), asks how settlements in the South Sowa area may be understood when placed in the same comparative framework as other regions of Early Iron Age Africa. In so doing, this ongoing investigation also sheds light on the specific social and economic strategies pursued by inhabitants of the South Sowa area, instead of continuing to rely solely on models for these behaviors developed out of work in other regions of Southern Africa. More specifically, the data collected for this project are one of the few high-resolution spatial datasets for Early Iron Age sites in Southern Africa with attention to the site's comprehensive set of material culture components (instead of only the major traditional components of fauna, ceramics and stonewalling. As such, it stands to contribute to the ongoing scholarly discussion on the relationship between site organization and socioeconomic organization, with an additional perspective on the impact of taphonomic processes (including erosion, deflation, and animal activity) on the spatial patterns used to make these inferences.

The purpose of this research is to gain a comparative understanding of socioeconomic processes in different locales within Southern Africa at the time of early state-level developments, and to understand the influences these locales had on one another. The research begins with the assumption that Sowa Pan agropastoralists represented a frontier of a widespread trading system, which was controlled to some extent by an incipient stratified state-level society such as Bosutswe (Denbow 2002; Denbow 1999; Denbow et al. 2008; Reid and Segobye 2000a) or Schroda (Calabrese 2000; Calabrese 2007; Hanisch 1980). If Sowa Pan was a frontier of this system of exchange, for example, then some key questions arise:

1) What information about tool use, floral and faunal exploitation, and settlement patterning can be discerned at sites on the southern margin of Sowa Pan, an area thought to be peripheral to burgeoning polities of the era, and do these behaviors change over time?
2) Can the presence of hunter-gatherers be established in the South Sowa area for this time period, and if so, what was the nature of their involvement in agropastoral society - and if not, why? Furthermore, what does a comparison of these possible interactions and socioeconomic practices with those of incipient hierarchical societies, like Schroda say about the nature of the Southern African Iron Age, or rather, about the effects of environment, social agency, or the presence of other communities on what has long been thought to have been a tightly integrated 'package'?
3) Is change over time discernable in resource utilization, trade volume, and spatial organization? If so, what does this say about the changing subsistence goals of the Sowa Pan agricultural and forager communities?
4) Is use of space within known walled sites representative of total activity patterns in the area? Can additional information on subsistence behavior be obtained from investigation of the areas outside these walled sites?

Because documentation of cultural material concentrates especially on identifying features like hearths, tool production areas, grain bins, middens, and other foci of economic activity, this research project will provide information not only about diet, storage practices, tool use, and production and use of other goods for trade, but also where within sites and on the broader landscape these activities happened. These activities themselves are important indicators of daily life at South Sowa settlements, and provide a basis of comparison for these settlements with their contemporaries elsewhere. A comprehensive understanding of daily life at less-researched places such as South Sowa is a necessary first step to an understanding of how places within Southern Africa related through trade, migration, and/or political and cultural influence.

Likewise, the spatial component of these activities is also significant because spatial organization has been a key component of many interpretations of Iron Age settlements, not only regarding intra-site organization and its social implications as with the Central Cattle Pattern (Huffman 2001), but also regarding inter-site patterns of landscape use, especially topography and access to natural resources (see Denbow 1984; Mookodi 2001). The settlements in this study are already known to cluster along the steep edges of the Mosu Escarpment overlooking Sowa Pan. As the remnant of an ancient lakeshore, the escarpment is a unique geological feature, and therefore site distribution in the area does not conform geometrically to any current landscape use model for the Southern African Iron Age. However, a GIS visualization of material distribution and patterning across this landscape may indicate regularities. Quantitative records of spatial patterning recorded at and around the site provide a measurable indication of regularity, randomness or clustering with the excavated material samples. This spatial analysis may perhaps also establish a baseline of comparison for similar analyses at other sites in the South Sowa area in the future.

Additionally, the nature of relationships South Sowa had with other communities will be inferred from the types and distribution of items typically understood to be trade goods. Following the expectations laid out in archaeological core-periphery models like those of Hall and Chase-Dunn (1993) and Stein (1998), trade of bulk, as opposed to luxury, goods indicates different kinds of relationships between peripheries and cores. Furthermore, it may be possible to infer the amount of political or sociocultural control a core has over its peripheries through the identification of spatial differentiation in land use and layout of settlements and restriction of quantities and distribution of luxury goods at peripheral sites. In particular when placed in the context of contemporary sites within both the Mosu Escarpment and other Southern African spheres, glass trade beads excavated at Thabadimasego offer the potential for tracing movement and economic influence (see, for example, Wood 2005; Wood, Dussubieux, and Robertshaw 2012).

Expected research contributions include an improved understanding of settlement processes in the South Sowa area for both the Later Stone Age (LSA) and the Early Iron Age. Later Holocene archaeology in Botswana has been said to be 'in its infancy' as of only fourteen years ago (Sadr 1997). Though research programs have been growing since then, most archaeological research in the country still takes place in its well-populated areas, near present-day cities, as well as Tsodilo Hills (Walker 1998; Mitchell 2002). As such, this research project will contribute vital information about an under-researched area of the country with a known Iron Age settlement history. Increased archaeological coverage in areas such as South Sowa will provide increased understanding of the settlement processes of the Iron Age within Botswana, whose research programs and models are largely inherited from South African schools of thought, but whose distinctions in environment, social history, and other aspects demand understanding in their own right (Segobye 2005; Mitchell 2004; Mitchell and Whitelaw 2005). On a broader scale, this research project also provides, through its high-resoluation dataset, a basis of comparison for location-specific manifestations of Iron Age settlement processes in Southern Africa, as well as how these locations interacted with and affected one another. This issue draws upon fundamental theoretical arguments about relationships between material culture, economic traditions, and the maintenance of social identity. Some scholars argue that presence of certain ceramic styles, or type of wall construction, indicates an importation of an entire social, cultural, and economic package (e.g., Hodder 1982; Kuper 1982; Huffman 1986; Huffman 2001). Others argue that processes of group or individual agency, environmental change, or other as-yet unaccounted-for factors play roles in restructuring or altering these supposed cultural packages of the Iron Age (e.g., Kinahan 1996; Kinahan 2001; Kusimba 2005; Thackeray 2005; Smith 2005; Humphreys 2007). Extensive data collection through fieldwork and laboratory analysis will provide the information needed to untangle these complicated processes. In raising the issue of variations in social and economic organization of agropastoral communities, in conjunction with their involvement with foraging communities, this project speaks to the tension that has long existed between this predominant structuralist interpretation of Iron Age sociopolitical organization, such as the Central Cattle Pattern (see Huffman 1986, 2001) and attempts at alternative explanations (e.g. Lane 1995; Badenhorst 2009a; Chirikure and Pikirayi 2008). The research thereby stands to offer a local perspective on the broader issue of material versus ideological influences on human behavior, one of the fundamental issues within anthropology.

1.2 Environmental background

Present day

Climate and physical environment

The Mosu Escarpment consists of a series of bluffs, hills and plateaus stretching east-west for about 50 km just south of Sowa Pan, in northeastern Botswana. For a map of this area, see Figures 1 and 2. The escarpment itself is part of the Thlabala Formation, a rock outcrop of Karoo basalt and sandstone dating to about 185,000 BC (Thomas and Shaw 1991; Ringrose et al. 2009) and are part of the system of strandlines surrounding the entire Makgadikgadi Pans that resulted shore formation from during the Paleo-lake Makgadikgadi phase (Ringrose et al. 2005).

The bluffs rise about 55 meters from the lowlands to their immediate north at the point where Mosu village sits. They stand at about 990 - 1000 meters above sea level (Sowa Pan, at its lowest, is 890 meters above sea level). The slopes tend to be quite steep (about 75 degrees, in some cases) and access to the top of the escarpment must be carefully negotiated via winding footpaths. The escarpment edge, when viewed on a map, has the uneven appearance of a fjord: the many crevasses and rocky protrusions forming the edge would, if stretched into a straight line, be much longer than the extent of the escarpment itself. Archaeological sites tend to occupy the larger, flatter protrusions. These are separated as the crow flies by only one or two kilometers, but the distance grows much longer if one follows the escarpment edge. Implications for both past and present-day navigation of the local terrain abound: one decide whether to drive over the uneven, eroded lowland as close to one's destination on the escarpment as possible, and hope for a reasonable climbing path upwards, or to climb up in one place and cross the escarpment, either along the edge (where it is easy to keep one's sense of direction) or along whatever footpaths may exist south of the edge. Regardless of route, an intimate knowledge of the terrain is essential for navigating through the dense vegetation both uphill and down on the plateau.

From the unruly fjord-like edges overlooking Sowa Pan, the escarpment slopes generally and gradually downward to the south for several kilometers along a broad sandstone plateau. This plateau has been cited as the best in the area for both arable and grazing land, as it is free of the salinity of the pan and has soil generated from its base rock (Field 1977; Samuel 1999; Reid and Segobye 2000a; Center for Research 2010). The plateau also hosts populations of grewia (G*rewia bicolor*), mophane (*Colospermum mopane*), and morula (*Sclerocarya birrea*). Grewia and morula bear fruits edible to (and valued by) humans and animals alike, while mophane trees are not only good foraging for herds in winter months; they also are the source of phane worms (*Gonimbrasia belina*), a seasonally important protein for local communities. The area referred to as the escarpment base by Samuel (1999), leading from the foot of the escarpment north to the edges of Sowa Pan, is in reality more accurately referred to as a gently sloping floodplain, as it shows no more than 10 m change in elevation in the 1-5 km distance it spans between the escarpment and pan margins. Like the escarpment, the floodplain, where not cleared for human settlements, roads or other infrastructure, is covered mostly in acacia and mophane savanna. Occasional stands of real fan palms (also called *mokolwane* locally; *Hyphaene petersiana*) also dot the

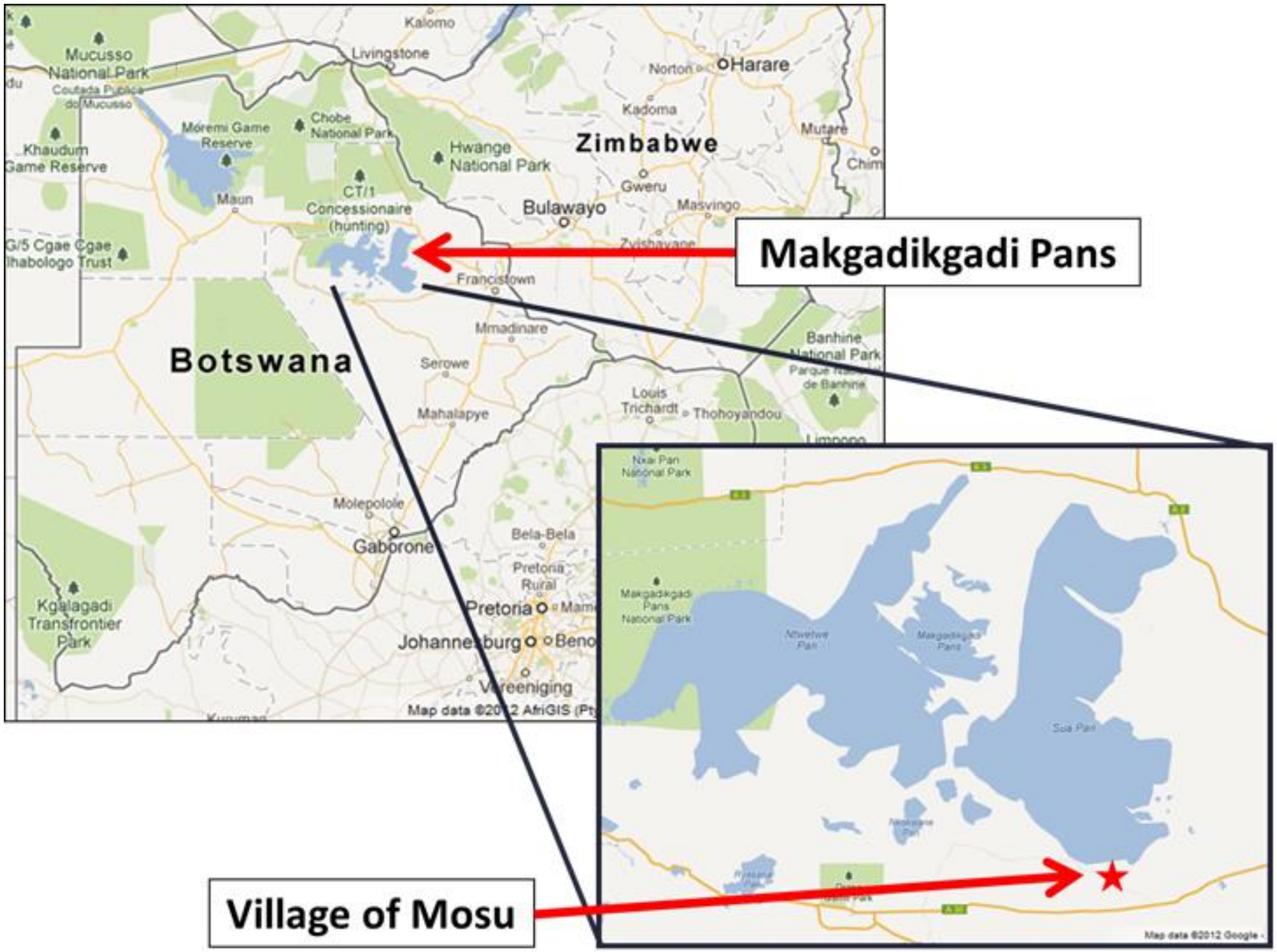

Figure 1 Location of Sowa Pan in Botswana

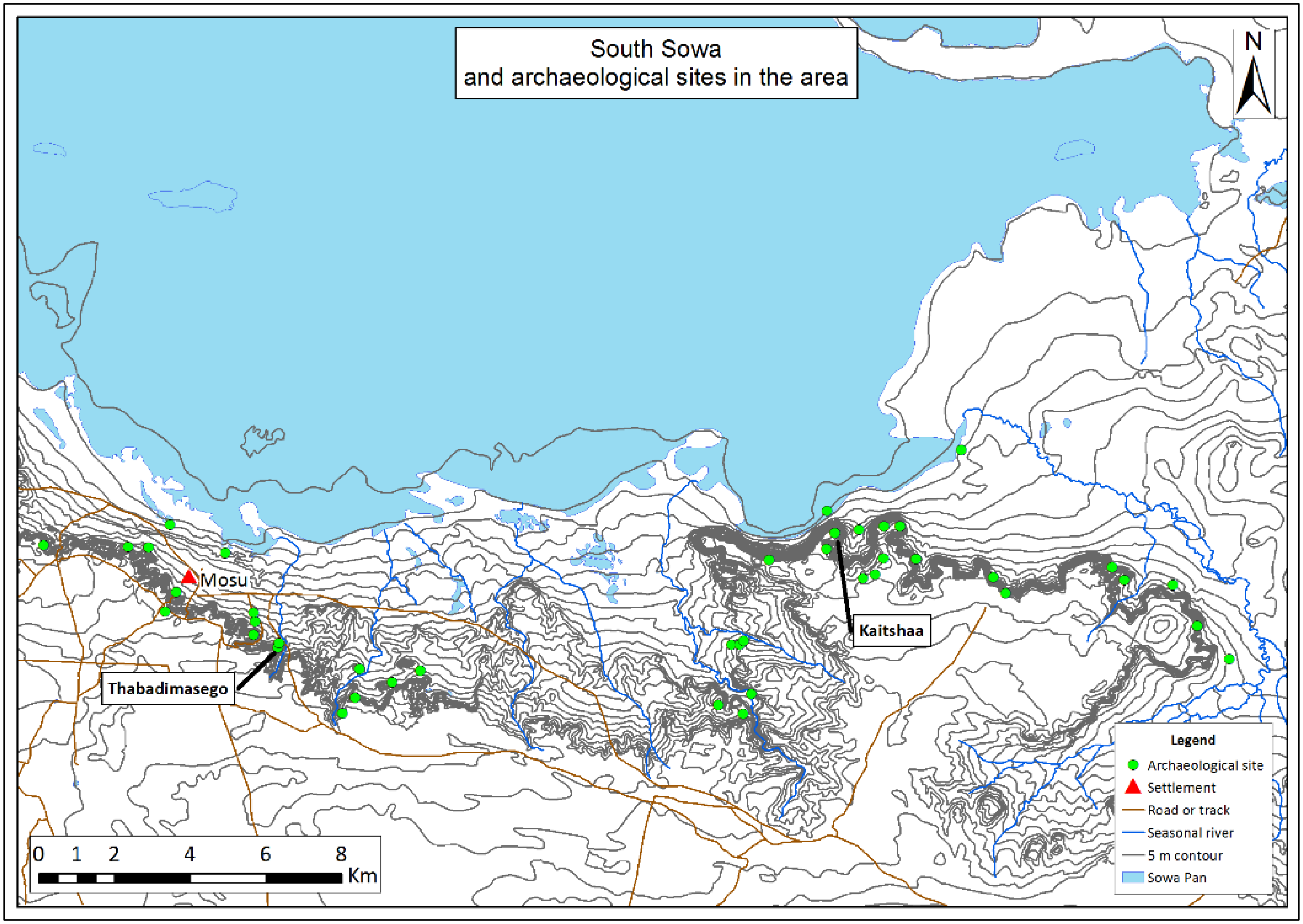

Figure 2 The South Sowa area and its known archaeological sites

area; these highly visible tall trees seem to cluster where water is closer to the surface, such as dammed springs and reliable boreholes, and are known to grow well in saline, seasonally flooded soil (Setshogo and Venter 2003). This species has many potential uses for human and animal populations alike. Real fan palms produce numerous spherical fruits, the nut of which is edible (and, according to at least one safari guide site, is popular with elephants: http://www.botswana-safari.net/botswana_trees.html). The sap of the tree can also be collected and distilled into a type of alcoholic drink called *muchame* (although doing so is highly destructive to the tree), while the leaves can be used to make baskets (Setshogo and Venter 2003).

Substantial portions of the soil surrounding the village of Mosu (especially to the south-west and west along the escarpment, and west/ north-west along the pan edges) consist of extensive clay deposits. These are well known to the residents of Mosu and several locations are frequently visited by individuals who collect clay for both domestic and commercial use. At present, there are no known compositional analyses of these clay beds. While, furthermore, it is not yet known whether this clay is used to make cooking vessels in present day, the clay is used by residents of Mosu Village for other purposes, including making decorative ceramics and as house paint (personal observations).

Within the village and to its east, the soil tends to be much sandier. Both types of soil are susceptible to the erosion and sedimentation processes resulting from seasonal rainfall (discussed more in detail below) though the sandy soil is less stable. Gullies and dry riverbeds up to about 10 feet deep crisscross the landscape. Those which cross the main road have permanent concrete bridges constructed above them, and a few of the larger gullies that run in and around the village have been paved with cement and stones to facilitate draining during the rainy season. The soil beds themselves, in addition to human and livestock disturbance around Mosu village, are prone to collecting slopewash from the escarpment edges above during the rains (small-scale landslides may also occur where vegetation cover is thin or non existent), so deposits are much deeper below the escarpments than on top, and deposits may also be much more prone to soil-movement disturbance (shifting, settling, redistribution) as well.

The margins of Sowa Pan represent a somewhat distinct set of resources from that surrounding the village, floodplain and escarpment. Tree and bush savanna grows more sparsely in the increasingly saline sediment, and cease completely where elevation dips low enough that seasonal pan infill threatens to waterlog their roots (with the exception of baobabs, which grow frequently along the pan margins and some of the nearby hills). Instead, robust yellow-brown stands of grass span the edges of the salt flats. Like the grasses elsewhere (in the floodplain and escarpment, which compete at a losing advantage with the trees and shrubs), these deciduous grasses have long roots to reach groundwater deposits and while the roots go dormant in the winter, importantly, they don't die, which make them a year-round resource for grazing herds (Silitshena and McLeod 1998).

The surface of Sowa Pan itself is a vast flat duricrust composed primarily of sodium carbonate and sodium chloride evaporite deposits formed from the annual cycle of inundation and drying (Thomas and Shaw 1991:84). Nothing grows on the pan besides a few expanses of grass at the edges where the duricrust is shallow; beyond that the interior of the pan is featureless save for trails left by vehicles and cattle herds. Visibility across the pan is very high; on a clear day (which is most of them) it is possible to see the shadowy outline of Kubu Island on the northeastern horizon from various points along the escarpment at a distance of about 50 km. The pan is, of course, a natural source of both soda ash and salt. Residents of communities surrounding Sowa Pan have a long history of harvesting and processing the salt of the pan for personal consumption and trade at least as far back as the eighteenth century AD, as documented by Matshetshe (2001). It is unconfirmed archaeologically if, or to what extent, salt harvesting, processing and trade may have played a role in Early Iron Age economies of South Sowa, but the potential has been noted by Reid and Segobye (2000a), and Wilmsen et al. (1990) cite historic sources discussing traditional San ownership and control of highly valued salt mines in Sowa Pan. It is a logical possibility that salt was a known and well-exploited resource long before its use was documented by

Europeans.

Fauna

The South Sowa area hosts a wide variety of wildlife including both predators and historically valuable prey animals. The Makgadikgadi Framework Management Plan (Center for Research 2010) lists species for the entire Makgadikgadi Wetlands System (MWS) in a table. It is important to note, however, that species distribution varies throughout the MWS according to season, carrying capacity, and human intervention as discussed more in detail below. Map #14, 'Wildlife Total Biomass', from the Central District Land Use Plan (Central District Land Use Planning Unit 2000) shows South Sowa as an area of low wildlife biomass for both the wet and dry seasons according to aerial survey conducted in 1995. Notably, however, several of the species listed as inhabitants of the MWS represent large proportions of Botswana's overall populations for those species; for example, the count of 42,844 Burchell's Zebra observed during 2001-2006 is attributed as 42.6% of the mean total of the national population for the same time period (Center for Research 2010, Chapter 5).

Other wildlife found in the South Sowa area include leopards and baboons (both of which favor the high reaches of the escarpment) and lions. No reports of hyenas, jackals, wild dogs or elephants were made in the reports for human-wildlife conflict for either Mosu or Mmatshumo for the years covered by the Makgadikgadi Framework Management Plan (Center for Research 2010, Chapter 5). Additionally, numerous smaller species of fauna inhabit the area such as lizards, scorpions, snakes, venomous centipedes and landsnails of the genus *Achatina*, whose empty bleached shells can be found frequently throughout the escarpment. The shells of these snails, which only inhabit the wetter parts of Botswana (as well as many other parts of tropical sub-Sub-Saharan Africa), were used during the Early Iron Age to make beads nearly indistinguishable from ostrich eggshell beads; these beads are found at archaeological sites across Botswana and South Africa; as is discussed in Chapter 4, there is a distinct possibility that *Achatina* specimens were exploited as a food source as has been shown to be the case in historic times elsewhere in sub-Saharan Africa.

Water

Sowa Pan lies within the Nata catchment, so that its water inflow comes not from the Boteti River on the west side of the Makgadikgadi, but from the Nata, Semowane, Mosetse, Lephashe and Mosope Rivers on the Pans' eastern edge (Central District Land Use Planning Unit 2000, Map # 10; Burrough, Breman, and Dodd 2012). The water is saline owing to the sediment of the pan, but most human and livestock communities living around Sowa Pan drink from boreholes which draw naturally-filtered groundwater from aquifers in the sandstone surrounding the pan (Silitshena and McLeod 1998:43). The recharge of both the pan and the boreholes is dependent upon rainfall, which can vary by up to 35% from year to year (Silitshena and McLeod 1998:38).

People living in built-up villages with centralized infrastructure such as Mosu share from publicly-owned water taps, while cattle post occupants must hire a surveyor and dig their own, which even today can be an expensive and timely process. One cattle post owner consulted by the 2012 fieldwork team reported that it took him three months to dig his well, which was about 10 m deep, and that he had to use dynamite to get through the bedrock. A few natural springs exist in South Sowa area as well, some of which are dammed for year-round livestock watering. Though it may not appear so at first glance, this region is relatively water-secure for Botswana; Silitshena and McLeod (1998:46) list it as lying within the "regular recharge of water" and "fair and uniform" zones. The local geology is crucial to the accessibility of the water table: not only does the MWS overall occupy the zone with the shallowest water table within Botswana (40 m or less below surface according to Silitshena and McLeod 1998:46), but locally, the porous sandstone of the escarpment encourages infiltration and the formation of springs and pools. Reid and Segobye (2000) report that the existence of "perennial springs along and behind [i.e., south of] the escarpment" was a major attraction for prehistoric settlers such as Early Iron Age populations, although no historical or archaeological sources are cited to confirm the presence of these. Additional geomorphological and paleoenvironmental studies may be necessary to confirm the truth of this.

Seasonality

Seasonality in Botswana as a whole is marked by annual wet and dry cycles, and there are basically three major seasons: summer, or hot/wet (November - March); winter, or cool/dry (April - August); and spring, or hot/dry (September-October). Definition of the exact demarcation of the seasons will depend on the author, but for a thorough discussion of the factors affecting seasonality in Botswana, see Silitshena and McLeod (1998:31-34). In northern Botswana, the annual temperature may range between -5 and 40 degrees centigrade (Silitshena and McLeod 1998:34). Officially, it is a semi-arid tropical climate. Sources also disagree somewhat on figures for annual rainfall, as estimates for the entire country may range from 250-650 mm per annum (Silitshena and McLeod 1998: 38) to 300-500 mm per annum (Republic of Botswana Map #2). Either way, the Makgadikgadi Wetlands lie within the middle of this range, making its annual rainfall somewhere around 350-450 mm per annum. As noted earlier, however, the actual amount per year may deviate from the mean by as much as 35%. (Silitshena and McLeod 1998:35). Additionally, rain is prone to falling in heavy, short-lived storms, which result in flooding and evaporation; the annual potential evapo-transpiration rate for South Sowa is approximately 49% (Central District Land Use Planning Unit 2000, Map # 3). The great majority of this rain falls in one short season from about October through December during the hottest part of the year. This has implications not only for growing seasons and crop yields, but for soil and landform stability as well. The escarpment edge is prone to slope wash erosion, putting the sandy clay soils of the lowlands surrounding the pan shores at high risk for flash floods and minor landslides from the runoff. Seasonal streams may fill up the usually dry gullies and ditches which are so common across the landscape, and the usual navigation paths of both people and animals must be renegotiated. In 2012 the Department of Environmental Affairs initiated a program to attempt to manage the water flow by cutting north-south channels though the mophane savanna from the escarpment to the pan.

Up on the promontories of the escarpment, one is much more directly exposed to the elements than in the low-lying areas. Strong winds gust frequently, no landforms are available to block the rain, and few trees large enough to provide shade are able to grow in the thin, rocky soil cover. The soil cover, which at its deepest was 50 centimeters on Thabadimasego, is more prone to slopewash where vegetation is thin, either on the edges of the bluff or where constant treading has worn it thin. For these reasons, it seems highly unlikely that arable fields were kept on the promontories in prehistory just as they tend not to be at present.

To sum up, the features of South Sowa's physical environment presents numerous natural resources suitable for human occupation as well as some which complicate that occupation. The escarpment and Southern plateau host natural springs, edible plants such as grewia berry and morula, mophane and acacia for grazing livestock, and arable land for growing crops. The floodplain contains large beds of raw clay, stands of real fan palms which offer multiple uses, and additional grazing land. Sowa Pan and its margins possess additional beds of clay, baobab groves, and of course, salt. Wild animal conflict is historically low relative to other parts of the Makgadikgadi (as is wildlife biomass overall). As already noted by Reid and Segobye (2000a), Silitshena and McLeod (1998) and Field (1977), the area offers a strong 'balance of resources' and a high carrying capacity for human and livestock populations. It is presumed to have been appealing to prehistoric communities for these reasons, and in the following section human and livestock interactions with the landscape in the past will be considered.

Paleoenvironmental reconstructions

Work done in recent years by, e.g., Burrough et al. (2012), Ringrose et al. (2009), and Riedel et al. (2012)on the geomorphology and paleoenvironmental reconstruction for the late Quaternary of Botswana and especially of the middle Kalahari has in many cases used data from Makgadikgadi geological formations. Focus within these research programs has been on clarifying wet/dry periods, lake events, and dating shorelines, which are, of course, interrelated topics. Unfortunately, due partly to the scale of the investigations, and partly to the nature of the data themselves, very little info about recent (late Holocene) prehistory has been salient from this body of research.

Some archaeological research has addressed issues of environment for the last few thousand years (Huffman 2008, for example), but are not specific to the Middle Kalahari (central and northern Botswana), so while these are generally useful for broad climatic trends for the late Holocene, they apply less precisely to areas such as the Makgadikgadi. Just as in the present day, where at the same time the weather in Cape Town and Harare could be dramatically different, climate for various regions of Southern Africa for prehistory ought to be understood in a regional context (particularly if one is going to interpret that prehistory from a human perspective) because of the high degree of variation in biome and terrain throughout the subcontinent. This is demonstrated by the regional data cited by Thomas and Shaw (2002). For a detailed description of extant knowledge on past environments of the Middle Kalahari, see, for example, Thomas and Shaw (1991, 2002).

Evidence which does come from the Middle Kalahari largely focuses on the Pleistocene and earlier periods, and is often problematic. Thomas and Shaw (1991) note a lack of agreement on dates for the Holocene in particular; what evidence there is comes via the proxies of radioactive isotopes from calcretes and shells. Interpreting the "extraordinary geomorphic puzzle" that is the Makgadikgadi geological sequence is further complicated by an "absence [at least at time of publication] of accurate altimetric data," as well as widespread deflation and redistribution of aeolian and fluvial soils on a seasonal basis (Helgren 1984:299).

Much of what is known for Holocene climatic sequences concerns the formation of year-round, permanent lakes and is based upon dated samples taken from the strandlines that now surround the pans as ridges and escarpments. Within the Holocene, there are two known lake events. Within the context of developing a climatic sequence for the middle Kalahari for the last 300,000 years, Burrough et al. (2009) document the last Mega-lake Makgadikgadi event at 8300 BC. Another lake (Lake Thamalakane) may have formed around 500 BC. Thomas and Shaw (1991:177). One final lake event in what are now the nearly permanently-dry salt pans may have occurred around 1000 AD, as indicated by the distribution of baobabs at Kubu Island (Riedel et. al 2012).

This find correlates with other data, also cited by Riedel et al. (2012:72), which suggest that a switch from wetter to drier conditions (analogous to the present) may have occurred in these areas right around 1000 AD Specifically, this study reports that after 1000 AD, a “dramatic switch from grass- to sedge-dominated vegetation systems” occurred, which was more likely related to increased grazing and use of fire than to drier conditions.” These data do not apply precisely to the period with which my research is concerned (which is more like 850-950 AD), but the possibility that a drying trend began around 1000 AD would mean that the climate during the occupation of Thabadimasego was, in fact, wetter than present day.

For the purposes of the archaeological sites of the Mosu Escarpment, it remains safest to rely on the faunal and botanical assemblages (for those and geographically related contemporary sites) as primary lines of evidence. This seems to be the approach taken by, *inter alia*, Denbow et al. (2008), Badenhorst (2011), and van Zyl et al. (2013). Opportunities may yet present themselves for geoarchaeological or paleoenvironmental approaches to the Mosu Escarpment as well. Additionally, the ongoing work by Burrough et al. (2012), Ringrose et al. (2009), and others represents a substantial leap forward in our understanding of the Middle Kalahari’s past environments overall from previous decades. There is good reason to expect that continued refinement and expansion of paleoenvironmental knowledge will continue in the future as this work continues.

Site description

Thabadimasego is one of several Early Iron Age sites located on the Mosu Escarpment in northeastern Botswana which form a settlement complex that is only beginning to be understood (Samuel 1999; Reid and Segobye 2000a; Reid and Segobye 2000b; Main 2008; Denbow, Klehm, and Dussubieux, n.d.). The significance of the site is that it is one of only a small handful so far excavated in the Mosu Escarpment cluster and even across the entire Makgadikgadi Pan region. These sites are still poorly understood, especially in the context of the widespread Early Iron Age system of villages that populated the well-watered parts of the Southern African subcontinent beginning around 200 AD. This area in general has the potential to add substantial information to our understanding of Early Iron Age settlement and trade networks, gain new, or enhance existing, paleoenvironmental data, further develop understanding of how Botswana's Iron Age processes and cultural material differed (and were similar to) those of other areas within Southern Africa, and ask questions about how landscape and environment/ resources shape or are shaped by cultural process.

Thabadimasego in particular was chosen after I surveyed the Mosu archaeological area on foot in 2008 as a member of a National Museum survey team. It is one of the area's Early Iron Age sites with comparatively high-density surface scatters and visible remains of a stone wall. Like most sites in the South Sowa area, it sits on one of the most prominent finger-shaped bluffs of the Mosu escarpment and overlooks Sowa Pan. In that sense it made a good comparison to the other two sites previously excavated in the nearby area, Mosu I and Kaitshàa (as described below). Based on survey records it had the characteristic assemblages of an Early Iron Age site, but had not yet received any research attention, and had a high chance of decent preservation as it was not close to any current cattle posts or the village of Mosu. For these reasons, the site offers an opportunity to investigate the way that cultural and economic processes are reproduced, modified, or negotiated in a region widely considered peripheral for the Early Iron Age.

Like Thabadimasego, most sites in the area exist on small promontories along the escarpment edge and are most easily accessed in present day by climbing up from the base below. Only a very few archaeological sites can be approached even partway by vehicle, where local National Museum staff have worked to establish permanently cleared dirt roads suitable for 4x4 trucks (and even then the rest of the trail needs to be completed on foot, but usually it is a comparatively easy, if long, climb). From the main body of the escarpment, which from the south (starting roughly at the Orapa-Francistown road) is really just a gradually north-sloping plateau (as described in Samuel 1999) that ends abruptly in the escarpment edge, each promontory is most easily accessed by navigating along the slope edge, which increases the walking distance, but avoids the undulating, low-visibility confusion of the thickly-vegetated back area. At present it is not known just how present-day ground cover for this area compares with that of Early Iron Age occupation or whether settlements in the area would have maintained clear paths throughout this back area. Presently only a few cattle tracks can be found wherever cattle posts are located.

The site is fairly small – approximately 12,000 square meters, or 1.2 hectares, whereas by comparison, Kaitshaa and Mosu I, the two other excavated sites in the South Sowa area, are 12.4 and 2.4 hectares, respectively. Thabadimasego occupies the whole of the relatively flat surface of the promontory (Figure 3, below). Ground cover on the site consists of shallow-rooted grass, dense stands of acacia thornbushes and a few scattered trees. A careful eye will frequently spot a ceramic sherd or ostrich eggshell bead lying among the grass or in a bare sandy patch where cow wallows have worn the grass away. The site is encompassed by steep slopes on nearly all sides (about 300 degrees) save at its southwest corner. Most of these slopes are too steep or too unstable for humans to climb at present. Towards the south-western portion of the site, the promontory connects to the main body of the Mosu Escarpment via a narrow 'neck' of land. Remains of the stone wall remains stretch across this connecting point and gradually disappear into the natural rock formations curving along the west and south slopes. A gap in the wall exists at one point in the 'neck.' Two additional stone features were identified on the hilltop during the course of fieldwork - both are small (one to two meters in diameter) stone piles or cairns, one along the southeastern corner of the site near the slope, and the other just north of the most southerly stretch of the remnant stone wall. A few dozen meters southwest of the wall and the neck, additional cultural materials were located in a small clearing. This scatter appears to be an extension of the hilltop site.

From the promontories of the Mosu Escarpment, visibility to the north of the low-lying floodplain and Sowa Pan itself is excellent, especially right on the edge of the slopes. Ground cover tends to be quite thick except in areas of very thin soil/ near-to-surface rock protrusions, or (as at Thabadimasego and other nearby hilltop sites), where sub-surface cultural deposition has affected soil density. It is not known at present how fully a promontory like the one Thabadimasego occupies would have been cleared of its vegetation during active settlement (for the sake of either visibility of the surrounding landscape, communication with other settlements, or just for living space on the site). However, one would assume that it was substantially clearer than at present. At least in present day when much of the landscape is covered in dense thornbush savanna, visibility is comparably poor down on the floodplain (being out on the pans, obviously, as the exception). It can be really tricky to navigate footpaths or even driving paths (not counting the state-built gravel and tarred road that connects to the highway) when one loses sight of the nearest escarpment portion, as the paths wind around to compensate for extremely uneven terrain (produced by seasonal flooding and riverbeds) and large trees that people prefer to navigate around instead of cut through when making a path.

1.3 Chapter overview

The remainder of the dissertation is organized as follows. Chapter Two reviews the literature relevant for understanding Thabadimasego in its archaeological and theoretical contexts, situating this information at a number of scales (regional, local, etc.) that affect the interpretation of this chronology. Chapter Three describes in detail the research design as well as the methods used during fieldwork. Chapter Four discusses methods and results of the post-excavation analyses, including glass bead typological classification and compositional analysis; shell and metal object classification; and ceramic identification. Chapter Five addresses methods and results for spatial analysis. Chapter Six approaches the social and spatial interpretations of the results, including the implications of diet, activity, and spatial use (both on the site and on the landscape) as they compare with typical characterizations of Early Iron Age ways of life, and offers some thoughts on further implications for this research.

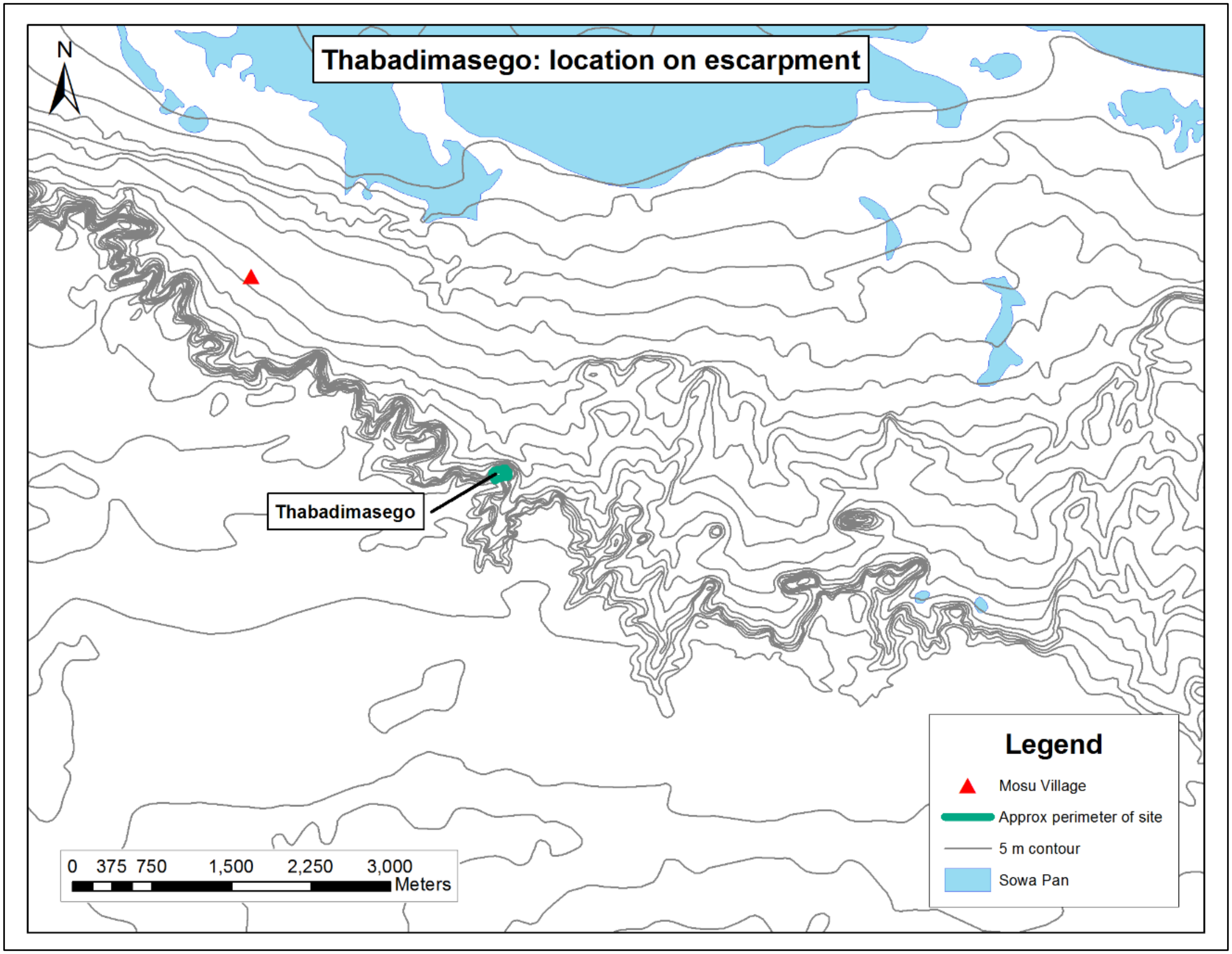

Figure 3 Thabadimasego site location

Chapter 2 <u>Pertinent archaeological background and theoretical considerations</u>

The South Sowa archaeological record can be framed as part of a series of nested, though not neatly interpolated, spatial scales due to the way work has been conducted in local, national, and subcontinental contexts. In order to be fully understood, it has to be approached in this comprehensive perspective and each scale, with its history of research and predominant trends, considered. Each scale of research has somewhat different research concerns, methodology, terminology and chronological definitions, and in one form or another they inform each other as is the case in many parts of the world (e.g., Bevan and Conolly 2006; Ridges 2006; Andrews, LaBelle, and Seebach 2008; Lawrence, Bradbury, and Dunford 2012).

The broadest of these is the subcontinental scale; the research trends discussed in Chapter One connect and theoretically engage sites all over Southern Africa and have been the predominant structure of the research paradigm for both the Later Stone Age and the Early Iron Age. Many of these trends need to be placed in the historical context of Southern African archaeological research in order to comprehend fully their current foci and debates. Closer to home, a program of archaeological inquiry specific to Botswana has grown especially in the last four decades with the support of the National Museum and the University of Botswana. It is helpful not only to consider what more specific trends happen in the archaeological record on a national scale, but also because a good amount of fieldwork within Botswana occurs independently of the academic research framework as it is conducted by CRM firms, and may develop its own typologies and use somewhat different methodologies, as will be discussed below. This kind of work often gets published in 'gray literature' such as archaeological impact assessments or environmental impact assessments, printed in small quantities by government or contract firms and available only in hard copy at archives like the National Museum and the National Archives. This work, while very important for documenting the material record of Botswana especially in light of rapid development in the better-populated areas of the country, does not always make its way into broader scholarly discourse, and often can only be accessed in hard copy in a few select institutions.

Finally, there is the local scale of inquiry of sites on the margins of the Makgadikgadi Pans, and even more locally, those constrained to the south Sowa area itself. Sowa Pan itself can be considered as a spatially coherent 'scale' because of its unique geological and hydrological attributes as well as for the fact that Iron Age archaeological sites around the pans tend to cluster on its immediate edges, making a unique spatially discrete pattern (Figure 4, below). Archaeological sites in the South Sowa area, particularly those associated with the Early Iron Age, tend to occupy the escarpment edges, and do so in much higher frequency per square kilometer than surrounding areas. For example, according to the Botswana National Register, as of 2008, 57 sites exist on or near the escarpment within three DSM grid map zones, whereas only 29 archaeological sites exist in the next nearest four DSM grid map zones, according to the Botswana National Register, as of 2008. For these reasons, the following sections will consider the archaeological record of the south Sowa area from multiple perspectives, each of which carry their own pertinent theoretical and methodological issues.

2.1 Subcontinental framework: Southern African Late Holocene archaeology

Defining the area

Southern Africa is often defined, for archaeological purposes, as the landmass south of the Kunene and Okavango (Cubango) Rivers to the west, and the Zambezi River to the east. For the purposes of archaeological research and heritage management, this can be a problematic definition for a number of reasons. For example, the Zambezi River cuts through current political boundaries of Zambia (leaving the majority of that nation outside of the Southern African landmass) and through the middle of Mozambique; it also does not include Madagascar. However one chooses to define it, countries whose material records most frequently contribute to a body of knowledge on Southern African archaeology include South Africa, Lesotho, Swaziland, Namibia, Botswana, Zimbabwe, and Mozambique. Defining the region for archaeology is a tricky balance between maintaining geographic authenticity for pre-modern

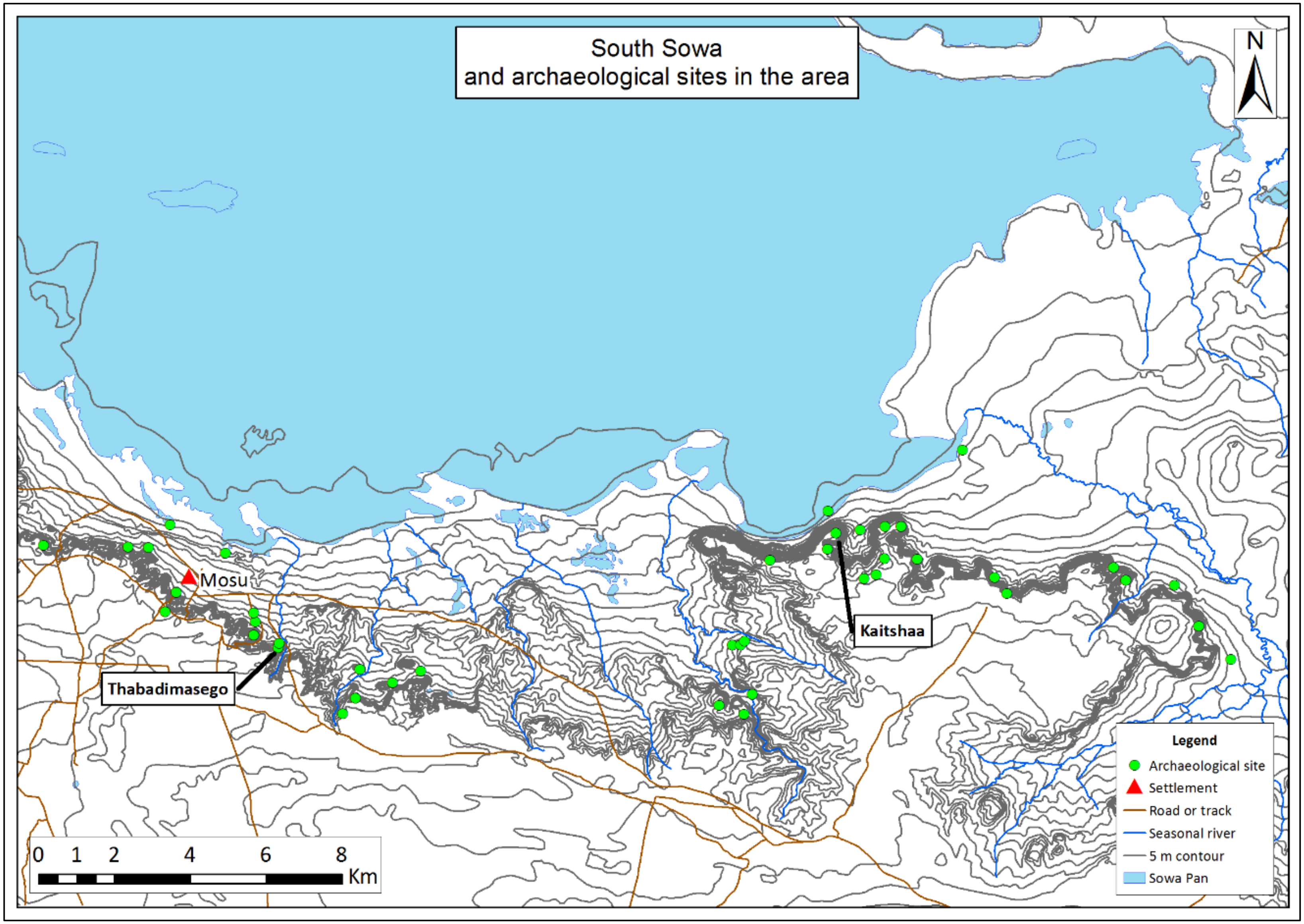

Figure 4 Archaeological sites in the South Sowa area

purposes, and practicality: permits are needed, political factors are at play, consistency is required by the various heritage agencies, etc. The country in which one conducts archaeological research has a strong effect upon one's program of research (via heritage policies and laws, institutional structure, access to sites, archived materials, and the like), and because how one scholar defines the subcontinent may vary from another's description, so what ends up being included in literature on Southern African archaeology is influenced both by contemporary geopolitical factors, and scholarly preferences for definitions of the geography of the subcontinent. For example, within Botswana, Iron Age sites tend to have much higher visibility and preservation than Stone Age sites, and for this reason, as well as the fact that Later Iron Age populations were ancestral to current Tswana and Kalanga residents of the country, Iron Age research tends to gain higher status and visibility than Stone Age research. This is especially true for the Later Stone Age, given its ancestral connection to present-day San communities in Botswana whose status as first peoples is denied by the Botswana government. Research which carries the potential to legitimate San claims of indigeneity and which can be tied in, if only tangentially, with contemporary self-determination efforts of San peoples, has met in the past with resistance by permit-seekers (R. Hitchcock 1996; Schweitzer, Biesele, and Hitchcock 2000). In addition, the nature and intensity of all types of archaeological research in Botswana is also heavily influenced by the criteria of agencies funding the projects. In other words, some sites are more likely to contain the kinds of data capable of addressing those problems considered high priority by a funding agency (ultimately based on anonymous reviewers and the nature of proposed research topics). For example, Later Stone Age and Middle Stone Age surface scatters without associated fauna will not draw research attention and funding, while stratified sites such as caves and shelters that have good bone preservation, dating contexts, and so forth are magnets for research. Iron Age sites typically have good preservation and tend to be highly visible on the landscape, and as such are seen as valid opportunities for answering theoretically significant questions.

Another aspect to consider for Southern African archaeology is that South Africa's national research program has overwhelmingly set the tone for the subcontinent as a whole (see, for example, Deacon and Deacon 1999; Mitchell 2002; Mitchell and Whitelaw 2005). This has implications for interpretation in other areas- for example, major chronologies are developed from type sites (and related sites) in South Africa, and may not always be appropriately 'translated' to the local archaeological sequences in other places, but are instead adopted wholesale at times. South Africa produces the greatest number of archaeologists working in the subcontinent; it is easily the best-funded country in Southern Africa with longest history of archaeological research, and the most extensive as well as oldest scholarly infrastructure, so it is the best-represented in the relevant literature.

Naturally, a number of reasons exist why a broad unifying framework should exist since Southern Africa is typically defined as a geographically coherent area. First of all, a unifying framework does much to provide a needed comparative and integrative approach to each region. Furthermore, physical and environmental conditions, such as the widespread presence of tsetse, may have presented barriers to the entry of domesticated animals into Southern Africa until much later than the rest of the continent (Gifford-Gonzales 2000; Gifford-Gonzalez 2005). The Southern Bantu language group includes those languages spoken almost exclusively in Lesotho, Swaziland, South Africa and Botswana (Holden 2002), while the many linguistic as well as genetic studies of San peoples of Southern Africa demonstrate their very deep history of occupation of the subcontinent (Elphick 1985; Watson et al. 1996; Behar et al. 2008; Stynder 2009; Irish et al. 2014; Morris et al. 2014). Despite these, there still exists considerable justification to take caution when moving 'between scales' (i.e., considering how information from one area of the subcontinent fits in with that of another part). Furthermore, the degree of biodiversity and climatic variation across the subcontinent, as well as the sheer scale of the place - several distinct biomes, from true desert to montane forest, range across an area of approximately 3.8 million square kilometers (Mitchell 2002). Complications of addressing the complex nature of Southern African archaeology with a multi-scalar approach must be acknowledged; for example, doing so may highlight issues such as contradiction between existing regional and local chronologies, the tendency of some areas to predominate in terms of both data and theory, or a lack of consistency or unification between areas, etc. Despite these problems, the growth of the discipline within Southern Africa will not be possible on a global scale without working to resolve our understanding of these issues.

Defining the period

In chronological terms, the period of concern for this research is the late Holocene, or approximately the last 2000 years. The beginning of the late Holocene is marked by the appearance of domesticates, which marks a significant shift in Southern African subsistence, ecology, and, to some extent, demography as well. The term 'late Holocene archaeology' will be used for the purposes of this chapter to reflect the fact that no one culture-historical term encompasses all of the cultural traditions of the last 2,000 years; this period is, however, commonly called the 'Iron Age' in Southern Africa. The late Holocene also includes the last few millennia of the Later Stone Age, which itself began to manifest during the late Pleistocene by at least 20,000 BC; the Iron Age itself, whose assemblages begin to appear approximately at 200 AD, a 'ceramic stone age' of pastoral communities, and the colonial and post-colonial periods. Broadly speaking, therefore, late Holocene archaeology in Southern Africa can be characterized as the study of four separate but related trends: hunter-gatherer, herder, and farmer, and colonial archaeology since the appearance of the first domesticates on the subcontinent. Additionally, in many cases these groups appear as variations across a spectrum of mixed subsistence instead of discretely bounded cultural types (A. B. Smith 2001; Kusimba 2005). Hunting, gathering and fishing – i.e., the use of wild food resources - is a common part of the subsistence practices of many agropastoral peoples in Africa during the historic period as well as the present. For example, Bantu-speaking farmers both in prehistory and in recent centuries hunted both for subsistence and for animal products that could be traded. A number of examples of hunter-gatherer societies acquiring sheep and goats, and in some cases managing herds, have been recorded in Namibia and Botswana during history (Jill Kinahan 2000; John Kinahan 2001;

A. B. Smith and Lee 1997a; Richard B Lee and Hitchcock 2001).

Cattle, sheep, and goats are the primary domesticated fauna which appear earliest in the African archaeological record. Sheep and goats are traditionally thought to have spread into northeastern Africa from southwest Asia beginning around 4000 BC (Barker 2006)**,** while domestication of cattle (*Bos taurus*) in the Eastern Sahara is dated to 8000 BC (Marshall and Hildebrand 2002). However, there is some evidence that attempts at domesticating ovo-caprids may also have occurred independently in the Central Sahara. An accumulation of dung and remains of Barbary sheep (*Ammotragus lervia*) dating to 7000 BC, along with woven basket fragments containing wild seeds, have been recovered from Uan Afuda, a rockshelter in southwestern Libya, which suggests intentional penning of the animals and an "incipient herd management" event. (Barker 2006:295). By 4000 BC, morphologically domestic sheep, cattle and goats were present, along with evidence for wild seed harvesting, at several sites in Libya, Algeria, and Niger, while barley and emmer wheat were fully domesticated along the Nile during the same time frame (Barker 2006: 292-299).

While *Bos taurus* appears to have been domesticated from local wild cattle, another cattle species, *Bos indicus*, spread into Africa from Southwest Asia some time after its domestication around 8000 BC, introducing genetic admixture among African cattle populations (Fuller 2006). The growth of pastoral subsistence in the Sahara has been linked to environmental transition to a drier climate during the Mid-Holocene; as desiccation grew in the Sahara, pastoral peoples moved southwards. Domestic cattle were present in the Lake Turkana basin of East Africa by about 4,000-4,500 years ago (Gifford-Gonzalez 2005). Why another 2000 years passed before pastoralism spread south of the Zambezi River is a question still being researched, but at least one hypothesis posits that the widespread existence of tsetse-carrying flies in that area acted as a barrier preventing southward migration (Gifford-Gonzales 2005).

While no domestication events occurred within Southern Africa itself as far as the extant body of evidence shows, about 2,000 years ago (or possibly earlier in the instance of sheep – see Henshilwood 1996; Pleurdeau et al. 2012), a number of domesticated plants and animal species began to appear in Southern African contexts. Caprines (sheep and goats) dominate the early domesticated record and are present in both rock shelters and open-air contexts at various locations (see below for more detail). These early remains are associated in some instances with flaked stone tools and pottery, which taken together has been interpreted as indicative of a mobile pastoralist way of life (A. B. Smith et al. 1991; John Kinahan 1995; Sadr 1998; Reid, Sadr, and Hanson-James 1998). Around 200 AD, the earliest known evidence for crop farming alongside animal herding began to manifest at sites occupying the better-watered areas along the Indian Ocean coast in Mozambique, Zimbabwe, and South Africa. These sites include Silver Leaves in the Limpopo Province of South Africa (Klapwijk 1974), Matola in Mozambique, and Eiland and Mzonjani (Mitchell 2002:264-267). Actual organic remains of domesticated plants are scarce in these contexts, but what has been recovered includes pearl millet, finger millet, cowpeas, and sorghum (Jonsson 1998; Barker 2006) in addition to grindstones with long, narrow grooves perfect for these kinds of grains (T. M. Maggs 1984; Huffman 2007). Importantly, these domesticated species were in many cases incorporated into a subsistence economy that also involved the exploitation of wild resources such as fish and shellfish (Kiyaga-Mulindwa 1993), wild game, and wild plants (Jonsson 1998). This should be of no surprise given that comparative contexts worldwide of early/ transitional food-producing economies often used domesticates side-by-side with wild species, in some case for thousands of years (Barker 2006).

There is no simple way to characterize early food-producing trends across the whole of Southern Africa, as the communities they represent co-occurred, intermingled and at times saw conflict in various contexts. In the drier western two-thirds of Southern Africa (Namibia, the Northern and Western Capes, Namaqualand and the Karoo), where for the most part arable agriculture remains in the present day impossible without borehole irrigation, sheep- and goat- herding communities began to appear in the last centuries BC. These earliest instances of direct evidence for domesticated caprines in Southern African contexts appear not neatly clustered in any one geographic region, but dispersed across the drier third of the subcontinent; caprine remains have been dated to about 300 BC at Leopard Cave, Namibia (Pleurdeau et al. 2012), 0 AD at Blombos Cave on the Southern Cape of South Africa (Henshilwood 1996), 60 BC at Spoegrivier on the Western Cape (Vogel et al. 1997) and 100 BC at Toteng I in northwestern Botswana (Robbins et al. 2005). Page 8 of Pleurdeau et al. (2012) displays a very useful map of early caprine finds in Southern Africa, which distinguishes between directly- and indirectly- dated finds.

In addition to the difficulty narrowing down an earliest point of entry for livestock into Southern Africa, scholars still debate the routes and modes of livestock acquisition for a number of other reasons. One school of thought (A. B. Smith 1990; A. B. Smith 1998; A. B. Smith 2006; A. B. Smith et al. 1991) claims that the introduction of livestock must necessarily have been the product of demic diffusion because of fundamental differences in the social and economic organization of herders and hunter-gatherers. Smith (1990), for example, argues that hunter-gatherers' egalitarian exchange mechanisms would have prevented them from acquiring personal property such as livestock, and if they were to do so, it would be on a marginal basis as clients of the stock-owning herders (Smith 1998). Further work by Smith et al. (1991) and A. Smith et al. (2001) supports this claim in the archaeological record by drawing a distinction between the ceramic and lithic assemblages of pastoral peoples and those of contemporary, spatially related hunter-gatherer communities, even when hunter-gatherer assemblages may contain domesticated faunal remains.

A number of interpretive issues arise with this perspective, however. Mitchell and Whitelaw (2005), for example, note these scholars' tendency to map the sociocultural attributes of ethnically Khoe historic herding populations (such as private ownership of goods and resources) onto prehistoric herding sites, even where the archaeological data for these prehistoric herding communities, such as their ceramic facies, do not accord well with historic Khoe traditions. Sadr (2003) questions whether hunter-gatherers would have been kept apart from the bodies of knowledge and production that accompany the herding lifeway for the entire duration of this period of prehistory. Sadr (2008) goes as far as suggesting that archaeologists stop classifying first millennium AD ceramics by their culture-historical 'Age' altogether and instead focus on their functional and behavioral contexts.

Just as researchers are working out the full implications of various ceramic, lithic and domesticate assemblage signatures in the west, similarly complicated questions occur for the Kalahari and the better-watered eastern portion of Southern Africa. While, for example, in the eastern third of South Africa, farming settlements rapidly populated riverine and coastal landscapes beginning in the first centuries of the first millennium AD, work by (e.g.) Jolly (1996) and Mitchell et al. (2008) in the highlands of Lesotho and van Doornum (2005) in the Shashe-Limpopo confluence demonstrate the persistent presence of hunter-gatherer communities well into a "post-lithic", domestic-dependent cultural horizon. Importantly, the work of these authors further highlights the necessity of understanding the nature of hunter-gatherer presence within a specific Iron Age temporal and geographic context; contra the arguments of the 'Kalahari Debate' of the 1980s and 1990s, this archaeological research has demonstrated the wide array of potential interactions that dissimilar socioeconomic groups may take on. Within agricultural settlements, particularly for the first millennium AD, the role of wild game as a contributor to subsistence has also been noted, adding to the complexity of the picture of life at the time (see, for example, Denbow et al. 2008, Badenhorst 2009, etc.). The south-eastern margins of the Kalahari (in what is now Botswana) were populated with agricultural villages by the middle of the first millennium AD, while a few seemingly isolated agro-pastoral settlements appeared elsewhere in places such as the Tsodilo Hills, the Okavango Delta and Sowa Pan, where water is more readily available than elsewhere in the desert (Robbins et al. 1998; Reid and Segobye 2000a; van Zyl et al. 2013). As famously documented in the many ethnographies of the Harvard Kalahari group and subsequent scholarly endeavors (such as Lee and deVore 1968; Howell 2000; Tanaka 1980; Tobias and Biesele 1978; Biesele 1993), hunter-gatherers collectively known as San peoples continued to practice a hunting and foraging lifestyle until the twentieth century in several (often remote) parts of the Kalahari. Situated periodically amongst these communities, however, are also herding communities whose presence in the Kalahari archaeological record, scarce, ill-defined and infrequent though it may be, stretches back to at least 100 BC at Toteng (Robbins et al. 2005). The occasional find of pierced-lug ware (Sadr and Sampson 2006) or Bambata ware (Huffman 2005), both of which are potentially associated with pastoral peoples, at sites across the northern Kalahari likewise indicates material and behavioral traditions whose nature has yet to be fully determined.

That multiple modes of subsistence and production, technological traditions, as well as the social and organizational group dynamics which contained them, overlapped for what appears to be centuries within well-defined spaces implies a set of complex behavioral dynamics that scholars are only beginning fully to understand. Overall, although it encompasses numerous strands of research, late Holocene archaeology in Southern Africa can be said to be the study of communities since the introduction and adoption of food production strategies, as well as the study of how those strategies affected the dynamics of communities who both practiced food production and/ or hunting-gathering. This includes hunters and herders, hunters who herded, farmers who hunted, and any other variation on this theme. As such, research on this time period necessarily incorporates a wide array of literature and theory as well as material culture traditions. Most scholars naturally focus their work on one horizon within the late Holocene (such as the Late Iron Age); even so, such a horizon may encompass the use of flaked microliths, hand-forged iron and copper jewelry and tools, as well as European milled goods. Therefore, it is of utmost importance to be both precise and thorough in evaluating material and its context, while at the same time placing it in a broader comparative framework.

The Later Stone Age - in broad strokes

The Later Stone Age (LSA; ca. 40,000 BC – 0 AD) in Southern Africa is characterized primarily by a diversification in the array of tools at the disposal of hunter-gatherers, as well as the environments that they exploited. LSA communities are frequently linked as directly ancestral to present-day Khoisan populations, especially those living in northern Namibia and Botswana (see, for example, Lee 1979; Mazel 1989; A. B. Smith and Lee 1997b; Deacon and Deacon 1999; Mitchell 2004; Mitchell 2005). Speaking very broadly, an LSA assemblage would be likely to include some combination of the following: flaked microlithic tools (typically less than 25 millimeters long); bored 'donut' stones (digging stick weights); grooved stones (for polishing beads and straightening shafts); beads and pendants of ostrich eggshell, shell and bone; engraved or decorated shell and bone items; tortoiseshell bowls; polished bone tools such as eyed needles, awls, linkshafts and arrowheads (J. Deacon 1984; Walker 1998; Deacon and Deacon 1999; Mitchell 2002; Mitchell 2005). These items reflect the increasingly complex and diversified subsistence practices as well as social traditions developed throughout the Later Stone Age as compared to previous eras throughout Southern Africa. In some cases, evidence is found for marine exploitation (shell middens) or fishing (hooks, gorges and sinkers), whereas in conditions of exceptional preservation, organic materials such as plant remains, string, leather and wood; bows and arrows may even be recovered (Deacon 1984; Mitchell 2004).

Additionally, within the Later Stone Age, evidence for symbolic behavior, including painted and engraved rock art, and deliberate formal burials, becomes increasingly more frequent as well (S. Hall and Binneman 1987; J. Deacon 1984; Lewis-Williams 2002). Within the late Holocene (i.e. the last 2000 or so years), ceramic vessels also become a common component in some LSA assemblages. The implications of this - whether hunter-gatherers acquired pottery through trade or, in some cases, developed a pottery industry of their own - has been the subject of study numerous times (see, for example, Sadr and Sampson (2006) for a discussion of the morphological and functional distinctions between 'hunter-gatherer' and 'farmer' ceramics throughout Southern Africa). Importantly, the prevalence of any of these material components at any given site depends not only on the actual usage and depositional history of that site but of the conditions of preservation as well. The rock-shelter-dotted landscape of the Western and Southern Capes, for example, lends itself well to the kind of deep, temperature-stable occupation sequences that are likely to yield a much wider array of material culture. Later Stone Age sites excavated under other conditions in Southern Africa must necessarily be interpreted with this in mind.

A number of subdivisions or horizons within the Later Stone Age- at least as it was expressed in South Africa in particular - have been assigned based on shifts within assemblages in lithic and organic technology, lithic raw material types, and dietary evidence. Flaked-stone typologies for Botswana's Later Stone Age, as well as for its 'ceramic Stone Age' or co-occurrence with domesticate species in the late Holocene, are less well-defined. A complete discussion of each horizon and its predominant trends would be exhaustive and, indeed, has been done elsewhere (see, e.g., Deacon 1984; Walker 1998; Deacon and Deacon 1999; Mitchell 2004; Mitchell 2005). This review, on the other hand, is primarily concerned with understanding Later Stone Age material in the context of co-occurrence with food producing societies in the late Holocene.

This period of hunter-gatherer prehistory (that is, their co-occurrence with food producers) is typically framed as 'interaction studies' rather than as an extension of the LSA per se; hunting-gathering groups are nearly always framed in relation to the herding, farming or European colonist communities with whom they interacted (Smith and Lee 1997 being one exception). The archaeology of inter-group interaction in Southern Africa is concerned with resolving, via archaeological evidence from locations across the subcontinent, the contention over if, and how hunter-gatherers of the Kalahari had experienced prolonged contact with food-producers prior to their 'discovery' by explorers and anthropologists in the 19th and 20th centuries and what, in fact, the social and cultural implications of this prehistoric contact are. The body of literature stemming from this theoretical dispute has been known as the 'Kalahari Debate' (see, e.g., Denbow and Wilmsen 1986; Wilmsen and Denbow 1990; Solway and Lee 1990; R B Lee and Guenther 1993; Spielmann and Eder 1994; Sadr 1997; Wilmsen 2003).

As it stands today, the question is no longer whether hunter-gatherers experienced prolonged contact with food producers, but rather, what forms that contact took, what were the broader economic, social, and cultural implications of these things for any given community, what is the archaeological visibility of these processes, as well as where such contact did or did not occurred. As a way of addressing these questions, individual studies have looked at a numerous array of material and temporal trends for different locales within Southern Africa. For example, some have focused on documenting local chronologies and defining the specific material sequences seen in those areas (e.g., Humphreys 1988; Thorp 2000; van Doornum 2005; Mitchell et al. 2008), while others ask whether different 'signatures' for food producers versus non-food-producers may be observed in a given time or place (A. B. Smith et al. 1991; Sadr 1997; Tapela 2001; Sadr et al. 2003). Another important focus has been on the persistence of material or social processes of hunter-gatherers in the presence of growing pressure from outside groups (Bollong and Sampson 1999; Sadr 2002; Sadr 2005) and asking what changes in material culture patterns in the face of long-term contact may indicate for hunter-gatherer group identity and social organization (Phaladi 1991; Wadley 1992; Wadley 1996). Furthermore, many scholars recognize the need to 'decolonialize' the typological classifications made within late Holocene archaeology, such as categorizing prehistoric communities as simple cultural historical packages of 'hunter', 'herder', or 'farmer'. Lane (1995), Denbow (1999), Wilmsen (2003), and Reid (2005), for example, discuss the fallacy of using ethno-linguistic communal identities generated within the colonial era (the simple trichotomy of San, Khoe, and Bantu), together with the historically documented linguistic, gendered, political, and ritual traditions drawn from ethnographies of these, to demarcate among what are, they argue, less socioeconomically bounded and more culturally nuanced community dynamics over time. Although the praxis of applying these perspectives to the archaeological record remains a challenge, the need to do so is clear. This is an ongoing discussion within the academic community working in Southern Africa and it continues to inspire, and draw inspiration from, archaeological as well as historical and contemporary social studies (Mitchell et al. 2008; Musonda 2013; Forssman 2013). For a comprehensive critical review of this line of research, the types of evidence it assesses, and the theoretical perspectives it encompasses, see Sadr (1997); Brooks

(2002); Mitchell (2005); and Sylvain (2014).

Later Stone Age in Botswana - Regional trends

Later Stone Age assemblages in Botswana contain more or less similar components to those found elsewhere in Southern Africa, although Walker (1994, 1995, 1998) identifies three regional trends within Botswana for the 'late LSA', or approximately the last 4,000 years, which comprise the clearest and best-represented material record for Botswana at this time. Tool types and attributes vary for the western, north-western, and eastern portions of Botswana, and indicate cultural ties between the tools' makers and corresponding LSA communities across the borders in South Africa, Zambia and Zimbabwe, respectively (1998:76). This speaks to the regionalized and interactive nature of socioeconomic traditions even prior to the arrival of food producers in Southern Africa - as well as the need to use care when developing or using typologies from region to region.

Later Stone Age sites during the late Holocene in the south Sowa area would belong, in all likelihood, to the eastern/ Zimbabwe-related lithic tradition, if the regionalized generalization may be proved to hold true in the subsequent years since Walker's (1994, 1995, 1998) publications. It must be acknowledged, however, that Walker's excavations centered on LSA Rock Shelters in the Matopos Hills of Zimbabwe and therefore the assemblages may cover a greater timespan and represent adaptations to differing environmental conditions than those observed in eastern Botswana. While LSA sites have been observed in relatively high frequency along the western reaches of the Makgadikgadi Pans and the Boteti River (Helgren 1984; Masundire et al. 1998), very few stand-alone LSA sites have been observed for the south Sowa area; those that have been documented are surface scatters (see, e.g., Main 2008). None have been excavated to date. Whether or not these sites represent pre-food-producer occupations or not remains to be clarified, and the technological as well as behavioral implications of the lithic assemblages will need to be explored once this has happened.

Rockshelters (and, therefore, their associated deep, well-preserved deposits) are uncommon in

Botswana and occur only in the few places such as the Tsodilo Hills where bedrock rises above the sandveld as towering hills. Most Later Stone Age sites, unlike in South Africa, exist as open-air surface scatters which are often disturbed (Walker 1998; Brooks 2002). Walker (1998) makes note, however, that even such sites offer opportunities for insights into social and economic adaptations in arid and wetland environments as made manifest in evidence for exchange, style change, and territoriality. This is especially relevant for studies of the late Holocene, when (according to Walker 1998:75) Later Stone Age site frequency increased markedly in Botswana (with the introduction of pottery and the availability of domesticated animal products), although the precise reasons for this are unclear.

The antiquity of livestock herding at sites like Toteng is undisputed (Robbins et al. 2005), and the presence of peoples such as Khoe and Bakgalakgadi, characterized as historically traditional herders in histories and ethnographies of the 19th and 20th centuries (e.g., Hitchcock 1978; Cashdan 1987), has well-documented historical depth. Even so, for the early settlement history of pastoral traditions in Botswana, particularly for the first millennium AD, and the nature of their technological and social processes over the course of the late Holocene, much remains to be understood. Some work has been done towards this end in the interest of parsing out differences between material culture traditions for specific locales within Botswana, with a general emphasis on understanding the changing nature of hunter-gatherer society in the face of food producing societies' increasing control over land and resources (Phaladi 1991; Sadr 2002; Sadr and Sampson 2006).

Still, historical examples of hunter-herder (or hunter-farmer, etc.) interaction are understood not from the perspective of a single locus of interaction, but by characterizing regional patterns of land use, resource access, and social dynamics from a number of documented group interactions over a specified period of time. Therefore, it stands to reason that archaeological frameworks for understanding similar forms of interaction will best be approached not by examining material change or resource use at a single site, even over a prolonged time period, but at multiple sites across a landscape in a comparative context, using multiple lines of evidence. Bollong and Sampson (1999) and Sadr et al. (2003) provide useful examples of this approach.

The chronology of early food production by arable farmers and their settlement systems is no less complicated. While much work has been done to characterize the major attributes of early food-producing settlements in Southern Africa as well as establish a timeline for their introduction to the subcontinent, questions remain about at what scales those attributes accurately represent a constant and consistent whole 'package', and to what extent that 'package' can be interpreted in different social and environmental contexts. Likewise, the continued presence of multiple modes of subsistence such as hunting and gathering throughout the Iron Age, as discussed in this section, implies another level of social complexity that has yet to be fully incorporated into a comprehensive model for the time period. The following section will address in brief some of the ways that scholars have addressed the behavioral implications of mixed subsistence in a 'culturally farming' context as well.

Early migrations/ settlements - in broad strokes

The Early Iron Age (c.a. 200-1000 AD) is typically characterized in Southern Africa by the appearance of new technological complexes, distinct settlement systems, and food production. It is broadly understood as product of demic diffusion from East and Central Africa. The major general characteristics of an Early Iron Age settlement, as described by, e.g., Mitchell (2002:259), Phillipson (2005), or Huffman (2007:331-340), include the presence of domesticated plants and animals (primarily sheep, goats, cattle, sorghum, millet, and cowpeas), regional pottery traditions, metal tools and metal production, sedentary villages with permanent structures such as round huts and grain bins, and distinct patterns of landscape exploitation. These will be discussed in greater detail below. This discussion of the Early Iron Age is largely concerned with contextualizing Thabadimasego (the primary focus of this research) and the rest of the South Sowa archaeological landscape. For a comprehensive review of the archaeology of the Early Iron Age, see e.g. Deacon and Deacon (1999); Mitchell (2002); Mitchell and

Whitelaw (2005); Stahl (2005); and Huffman (2007). Different regions within Southern Africa (e.g., the Eastern Cape, Kwa-Zulu Natal, Gauteng/ Northern Provinces, the Shashe-Limpopo Confluence, Zimbabwe and Southern Mozambique) have their own regional concerns. Here, I am concerned with what is most germane to situating South Sowa and its relevant issues.

The term 'Early Iron Age' itself is not without problem and is not uncontested (Mitchell and Whitelaw 2005, in their review of recent Early Iron Age research, refer to early food-producing communities for both herders and farmers, while Sadr 2008 argues for an 'Age-less' view of late Holocene archaeology in Southern Africa). For example, the forging and use of iron tools, while thought to have been culturally important (Calabrese 2000; Miller 2002; Chirikure 2007), was not necessarily an economic mainstay of communities at the time. Iron ore deposits, while not uncommon in Southern Africa, varied highly in terms of quality and distribution (Mitchell 2002:279) and access to or exploitation of any given source of iron ore would likewise have varied. Copper metallurgy is also known from early sites such as Broederstroom (Denbow 1999); while copper ore deposits, primarily found in Zambia, are far less widespread than iron in Southern Africa (thus making copper ore an object of exchange over distances up to 200 kilometers - see, e.g., Herbert 1984; Denbow 1990; Denbow 1999; Killick 2009). Evidence of iron and copper smelting and smithing (in the forms of tuyères, forge bases, slag heaps, etc.) is likewise far less common than the final products themselves. Iron as well as copper items of jewelry comprise the majority of metal assemblages from such notable Early Iron Age sites as Divuyu, Nqoma, Broederstroom and Kwagandaganda (Denbow and Miller 2007), while as Mitchell (2002:276) observes, actual agricultural implements such as hoes, spades, sickles or adzes are rare finds. Chisels, awls, and points are better represented, but metal-working by-products such as slag and bloom fragments are more typical finds (Miller and van der Merwe 1994; Miller 1995; Denbow 1999; Mitchell 2002). Whether the low proportions of utilitarian iron items, and particularly those typically associated with agricultural tasks, can be attributed to a reduction in observable frequency due to recycling of old tools as raw material for smithing (as described in Miller 2002), taphonomic processes, or is representative of actual frequencies, is a question still under discussion. During the second millennium AD, gold objects (including beads and gold-foil-covered sculptures) became increasingly prevalent as well, particularly in the settlements of the Shashe-Limpopo Basin (Killick 2009). In fact, the beginning of exploitation of the gold deposits in south Africa during the 9th century AD has been explicitly linked to formation of trading relationships with Islamic societies via the Indian Ocean network (Killick 2009), while the control of gold objects within Southern Africa has been cited as a factor in the development of centralized hierarchical polities beginning in the 11th century AD (Woodborne, Pienaar, and Tiley-Nel 2009).

The social role of metal-working and metal items for first-millennium settlements is, likewise, worth exploring. Calabrese (2000), Denbow et al. (2008), and Huffman (2000; 2008), for example, suggest that metal-working may have been associated with ritual power and elite status for early second millennium sites. They predicate this idea based on the central placement of many smithing, smelting, and forging areas within settlements, coupled with the higher presence of metal decorative items in elite burials (also centrally placed within settlements). A number of studies have likewise documented the ritual significance of iron working for historic Bantu-speaking communities in many parts of sub-Saharan Africa (Chirikure 2007). While such patterns are far better documented for the early second millennium than for the first, it is worth asking what corollaries explain the frequencies observed in first millennium metal assemblages. Compared to the second millennium especially (Miller 2002), metal objects are, on a whole, a very small portion of Early Iron Age assemblages (and in many cases, are not present at sites), even at Nqoma which (according to Miller) has yielded the largest collection of iron artifacts in Southern Africa.

For the reasons stated above, maintaining a focus on this one aspect of the time period encourages not only a slanted, single-component-oriented perspective, but a strongly cultural historical one as well. In the view of the author, an ideal terminology would approach this period of Southern African prehistory with the goal of characterizing its archaeology from a behavioral standpoint instead of an object-oriented one, in order to emphasize the entire set of nuanced processes which shaped this time period. Even so, despite these issues, the fact remains that the term 'Early Iron Age' is both commonly used and understood to describe early 'waves' of arable agricultural settlements in the eastern third of Southern Africa in the first millennium. Apart from the shared material culture attributes, the concept of the Early Iron Age also generally describes the time period before centralized political and economic control took shape in early states such as Mapungubwe (Meyer 2000; Huffman 2008) and Toutswe (Denbow 1986; Segobye 1998). For these reasons, I choose to continue using the term 'Early Iron Age', acknowledging all the same that it is a problematic one.

Although (as discussed earlier in the chapter) it is a problematic interpretation, the majority of scholars agree that that characteristic components of the Early Iron Age were brought in as a 'package' of behaviors and technologies with the migration of Bantu-language speakers as modeled (linguistically) by, e.g., Ehret (1982) and Holden (2002). The linguistic 'homeland' of Bantu-speaking peoples is currently thought to be in Central Africa in or near present-day Cameroon (Vansina 1995). The ways in which the archaeological record may support or contradict the linguistic model continue to be poorly understood for this region, thanks to political and economic instability in the area for the last few decades, as well as poor preservation conditions (Eggert 2005). Based on reconstruction of a hypothetical proto-Bantu language, the speakers of this early language are thought to have emerged at least 3000 years ago (Phillipson 2005). The nature and means by which subsequent migrations occurred from this homeland is still very much debated, although one prevailing theory is that early emigrants followed the courses of rivers through the equatorial forest (Barker 2006). That Bantu speakers represent a coherent group within Southern Africa appears to be supported by evidence of genetic influx into the subcontinent around 2000 years ago (Behar et al. 2008; Pickrell et al. 2014). However, as discussed in detail by, e.g., Phillipson (2005:188-192) and Huffman (2007), the distribution of multiple 'streams' of ceramic facies across central

(Angola), south-central (Zambia), and East Africa (Kenya, Tanzania) and their convergence within Southern Africa suggest that at least three independent population movements occurred over the first centuries of the first millennium AD as a part of the 'Bantu migration.'

Called, respectively, the Kalundu, Nope and Kwale branches of the eastern Bantu 'Chifumbaze Complex', the western, central and eastern streams were initially distinguished by Phillipson (2005) not only by their relatively discrete geographic distribution and distinct ceramic styles, but also by other attributes fundamentally connected to those particular landscapes, such as the exploitation of marine protein instead of livestock in many Kwale settlements. Phillipson's characterization of each of the three streams has never fully been explored in terms of its ability to explain variability in economic or social processes in the Southern African Early Iron Age. In recent years the same terminology has been re-employed by Huffman (2001, 2005, 2007) to differentiate specifically between the ceramic sequences within each of the three geographic regions. This has had a considerable effect on the way in which the Chifumbaze Complex and its many component horizons are interpreted as a whole within Southern Africa. The overwhelming emphasis on pottery typology as a way to trace movement and temporal change, while it has established an important chronological framework, has also lent this one line of inquiry greater methodological priority than intended within Phillipson's original (1993) Chifumbaze Complex.

It is also worth noting that Denbow (1990, 2014) conducted a series of excavations in the Loango coast of present-day Democratic Republic of the Congo, adding substantially to the poorly-understood archaeological record of Central Africa, as well as suggesting a potential cultural affiliation between settlements in West-Central Africa and northwestern Botswana. His findings include the abrupt appearance at a few sites of Spaced Curvilinear ware pottery, whose decorative motifs and layouts bear a number of resemblances to those recovered at Early Iron Age settlements in northwestern Botswana as well as Namibia's Caprivi Strip. At the Loango coast, these elements appear during the 7th and 8th centuries AD, while in Botswana they appear slightly earlier, during the 6th to 8th centuries AD at Divuyu in the

Tsodilo Hills (Denbow 2014).

On the whole, pottery facies for Early Iron Age Southern Africa are generally well-provenienced thanks to comprehensive work by Huffman (e.g., 2000, 2005, 2007), who drew on decades of primary research at dozens of sites across the subcontinent (including his own) to create a consistent, replicable framework for describing and comparing vessel attributes. As described in these references, Huffman's typology for each unique facies comprises a combination of decorative elements, layout, and vessel profile. His ceramic chronology, as best described in his 2007 volume 'Handbook of the Iron Age', has been generated by tracing the transitions in these attributes over time and place from one facies to another in cladistic relationships. Additionally, several of the sites he draws on have been independently dated. As already stated, his work provides a highly valuable framework, especially when conducting research in a relatively unknown area such as South Sowa. Often, however, any given facies is also attributed other non-ceramic characteristics and becomes a synecdoche for the entire lifeway of a community. This is especially true for the linguistic groups proposed to have been the makers and users of the various ceramic types - the logic goes that a community, speaking a particular language, makes a certain kind of pot (or pots) representative of its group identity, and as linguistic groups/ group identities diversified and branched over time, so did their material representations (Mitchell and Whitelaw 2005). The constant, unchanging factor across the centuries was the equation of one style of pottery with one group identity and of that group identity with any settlement where that type of pottery was used (or at least observed archaeologically). This over-simplification of both the kinds of information that may be derived from pottery in an archaeological context, and the potential behavioral inferences that can be drawn from that information have already been challenged numerous times (see, e.g., Mitchell 2002:262-264; Pikirayi 2007). Alternative means of characterizing ceramics have more recently been explored and many of these hold great potential. For example, at University of Pretoria, Ceri Ashley is developing a typology of paste types (Ashley pers. comm. 2013) while Wilmsen et al. (2009) have begun to parse out the relationship between temper sourcing and sherd provenience through optical petrography, and a small handful of lipid residue analyses have been conducted for both the Shashe-Limpopo Basin and the Western Cape (Patrick, Koning, and Smith 1985; Copley et al. 2004).

Even so, the morphology-based typology, as it is currently understood and employed, continues to form an important part of the Southern African Early Iron Age epistemological framework because ceramic facies combined with settlement organization patterns form the archaeological basis for the Central Cattle Pattern (CCP) model (see, e.g., Huffman 2001).

As briefly discussed in the introduction, this model views cattle as the heart of Early Iron Age social, spatial, cultural and economic processes. The original Central Cattle Pattern was derived from observations of twentieth-century Sotho-Tswana and Nguni settlement patterns by Kuper (1982), though Huffman maintains the claim that this socioeconomic-spatial way of organizing Eastern Bantu-speaking communities stretches as far back as the Early Iron Age. This claim is predicated on what Huffman sees as the consistent and observable physical manifestation of worldview and economic organization through settlement layout dating as far back as the 5th century in sites such as Broederstroom (Huffman 1990).

Residences organized around a central cattle byre (colloquially known as a kraal), and the presence of smithing facilities, grain bin storage, and elite burials all within the central byre form key spatial and structural elements of this model. Social and symbolic elements include a division of space into public/ male (the byre) and private/ female (residential) (Huffman 2001). Since, the logic goes, the settlement layouts are (presumably) the same or similar to those observed in the twentieth century, so too were the organizing principles behind them. While archaeological sites with similar structural attributes to Kuper's "Bantu Cattle Pattern" (his original term) do, indeed, exist that date as far back as the early horizons of the Early Iron Age, so, too, do numerous sites whose attributes do not fit this model well. Mitchell and Whitelaw (2005:223-224) and Badenhorst (2009) discuss several examples of Early Iron Age sites where, for example, metal-working occurred outside of the central byre, women were buried in the central byre, or the cattle byre was not even located in the center of the settlement. Questions remain as to how best to understand these spatial layouts - as outliers, variations on a theme, or alternatives to a modal expression - as well as what social and ritual significance should be inferred from them.

As with the ceramic assemblages, additional lines of inquiry such as faunal analysis (Badenhorst 2010, 2011; van Zyl et al. 2013) and spatial analysis (Sadr and Rodier 2012) are being pursued in an attempt to understand and explain this variability. While the identification of other components of Early Iron Age sites is hardly a new trend (see, e.g., Denbow 1979; Plug and Voigt 1985; Morris 1992; Plug and Badenhorst 2001; Steyn and Mosothwane 2004), the significance of these recent studies lies in that they directly address the concerns raised by critics of the Central Cattle Pattern. The validity of the correlation itself between highly standardized representations of recent behavioral/ symbolic patterns, and archaeologically observable material patterns, has also met with questioning (e.g., Lane 1995, 1998, 2005), especially given that a temporal difference of up to 1500 years lies between the two. Whether a structuralist approach is even the best means by which to understand Early Iron Age processes of economy and political formation is often debated (see, e.g., Mitchell 2002:283-284), although the predominance of the Central Cattle Pattern as an explanatory model can undoubtedly be credited with inspiring a substantial quantity of research in the decades since its inception. Huffman (2001, 2004, 2012) has responded to critiques of his model by arguing, for example, that with the detailed ethno-historic record for Bantu-speakers reaching as far back as the 16th century (in a few cases), the direct historical approach can be applied to the archaeological record. Since the occupants of Later Iron Age (ca. 14th-18th. centuries AD) sites are, he argues, undoubtedly the ancestors to today’s Bantu-speaking populations in Southern Africa, archaeologists can further trace back their lineage through material and structural analogies, including the linkages provided by the evolution of Chifumbaze ceramic facies as well as residential structural patterns. The heart of his argument is that the same physical forms must have the same social and symbolic significance throughout time. Still, many scholars continue to raise objections to this line of reasoning on an epistemological or theoretical basis (e.g., Greenfield and Miller 2004; Badenhorst 2009). While Mitchell (2002) has noted that one problem with the CCP is that no one has so far managed to formulate a reasonable, widely-applicable alternative to it, calls have been made recently for archaeologically-derived, testable hypotheses with regional foci to explain the distribution of material observed in the Early Iron Age (e.g., Isaacs 2013; Jordaan 2013).

Numerous other scholars focus their work on documenting and clarifying the data regarding particular behavioral aspects or material components of Early Iron Age sites, such as faunal assemblages and their economic significance (Plug and Voigt 1985; Plug and Badenhorst 2001; Badenhorst 2009, 2011, 2012; van Zyl et al. 2013); microtemporal patterns in site stratigraphy and its taphonomic implications (Greenfield and Miller 2004; Fowler and Greenfield 2009); and experimental studies on materials like vitrified dung, which results from accumulated masses of cow dung reaching a critical internal temperature due to intentional burning and transforming into a bubbly, glass-like material (Peter 2001). Additionally, recent paleoenvironmental studies of dry-wet cycles during the late Holocene provide an evidence-based framework for making sense of migrations and settlement patterns (J. Smith, Lee-Thorp, and Hall 2007; Russell and Steele 2009), although their authors are quick to clarify that this is not meant to be a holistic explanation for Early Iron Age socioeoconomic phenomena. These studies support the long-held notion that Early Iron Age communities exploited particular landscapes during cycles of optimal rainfall patterns for tropical cereals like sorghum and millet, and that shifts towards greater aridity over the centuries could have influenced migration patterns as well as, in some cases, political strategies to consolidate power via non-agricultural means (an argument also made by Huffman 2008). These lines of inquiry should only serve to bolster our understanding of Early Iron Age socioeconomic processes via their contribution of bodies of evidence by which to evaluate models like the Central Cattle Pattern. However, because the Early Iron Age for Southern Africa covers nearly a millennium of time, numerous ecosystems and roughly 1,600,000 square kilometers, it is still difficult to put these bodies of data into perspective without some broad-spanning explanatory framework, which is one reason why the CCP remains successfully persistent. Still, the CCP lacks robusticity in that it does not encourage comparison between contemporary bodies of data at multiple scales, or of understanding of process over time. As such, one potential alternative which could be fruitful is a regional focus coupled with a systems perspective (after, e.g., Stein 1998; 1999). This framework would be one way to take a more dynamic look at the same bodies of information.

One such regional focus which has long since been established is Denbow's (1982, 1984, 1986) Toutswe tradition, a three-tiered regional settlement model for eastern Botswana. This model applies to a number of sites occupied between 700-1200 AD, situated mainly on hilltops and hardveld outside the Kalahari sands and near seasonal rivers, including the Tati, the Motloutse and the Shashe. This general area is located about 300 kilometers northwest of the Shashe-Limpopo Basin region often referred to in Southern African literature as a major locus of Iron Age settlement (e.g., Pikirayi 2001; Calabrese 2007; Huffman 2008b; Figure 5, below). Using photos taken in aerial surveys over the eastern hardveld of Botswana, Denbow (1979) demonstrated that in this region *Cenchrus ciliaris*, or buffelgrass, tends to cluster on hilltops formerly used as settlement locations. This grass species grows on vitrified dung, and is an indication that cattle were being kept on these hilltop sites. Using this and the extant archaeological record of the area as starting points, Denbow developed the Toutswe model as a cattle-based model of centralized political economy which took advantage of specific features of the landscape, particularly water sources and arable land. He posits a centralized dynamic of power and economic influence between settlements in the area with three regional capitals, and numerous secondary and tertiary-level sites. Denbow (1984) elaborates on the structuring the exchange of goods and resources, particularly cattle herds, between sites as fundamental to development of local political centralization. At the time of his earlier writings, Shashe-Limpopo settlements were less well-researched than they are today (Denbow 1984) and therefore a broader supra-regional contexualization of these processes in terms of their contribution to overall Southern African political and economic trends is still not entirely fleshed out (current work, such as Denbow et al. (2008), tends to focus on second-millennium phases of occupation). However, Denbow makes the point consistently via his eastern Kalahari data that "[w]hen dealing with complex socio-economic and political systems… interdependent activities may be regionally and structurally differentiated" (1984:36).

Because this model incorporates considerations of landscape, environment and other local factors, and also adapts Southern African models of process to a specific region, it makes a useful heuristic device. Additionally, even though when it was developed it wasn't specifically framed in opposition to the CCP, the Toutswe model provides an alternative way to frame economic, social and political processes for the early to middle Iron Ages. As such it is a good starting point for asking questions about scale, environment and process for the Southern African Early Iron Age. One additional limitation of the Central Cattle Pattern, when used as a catch-all socioeconomic model for the Early Iron Age, is that the CCP operates almost exclusively at the scale of the individual site, as the above discussion of the Toutswe settlement model highlights. The CCP does not discuss processes of exchange and interaction for the Early Iron Age, which limits its explanatory power (as well as spatial logic) for social and political organization of this time period. Various regions within Southern Africa have distinct patterns of landscape and resource exploitation during the first millennium. For example, sites with Mzonjani pottery (an early representation of the Kwale Branch dating to roughly 450-750 AD) exist for the most part within six kilometers of the Indian Ocean shoreline of KwaZulu-Natal. As described by Mitchell (2002:273-274), close proximity to iron ore sources and higher coastal rainfall are cited as probable reasons why settlers chose this area. Furthermore, although Mzonjani sites meet the criteria for inclusion within the Chifumbaze Complex in other ways (exploitation of domestic crops; production and use of Kwale pottery; and metallurgy), no evidence has been found among the numerous array of sites in this area for livestock herding; instead many Mzonjani sites contain shell middens consistent with the exploitation of marine

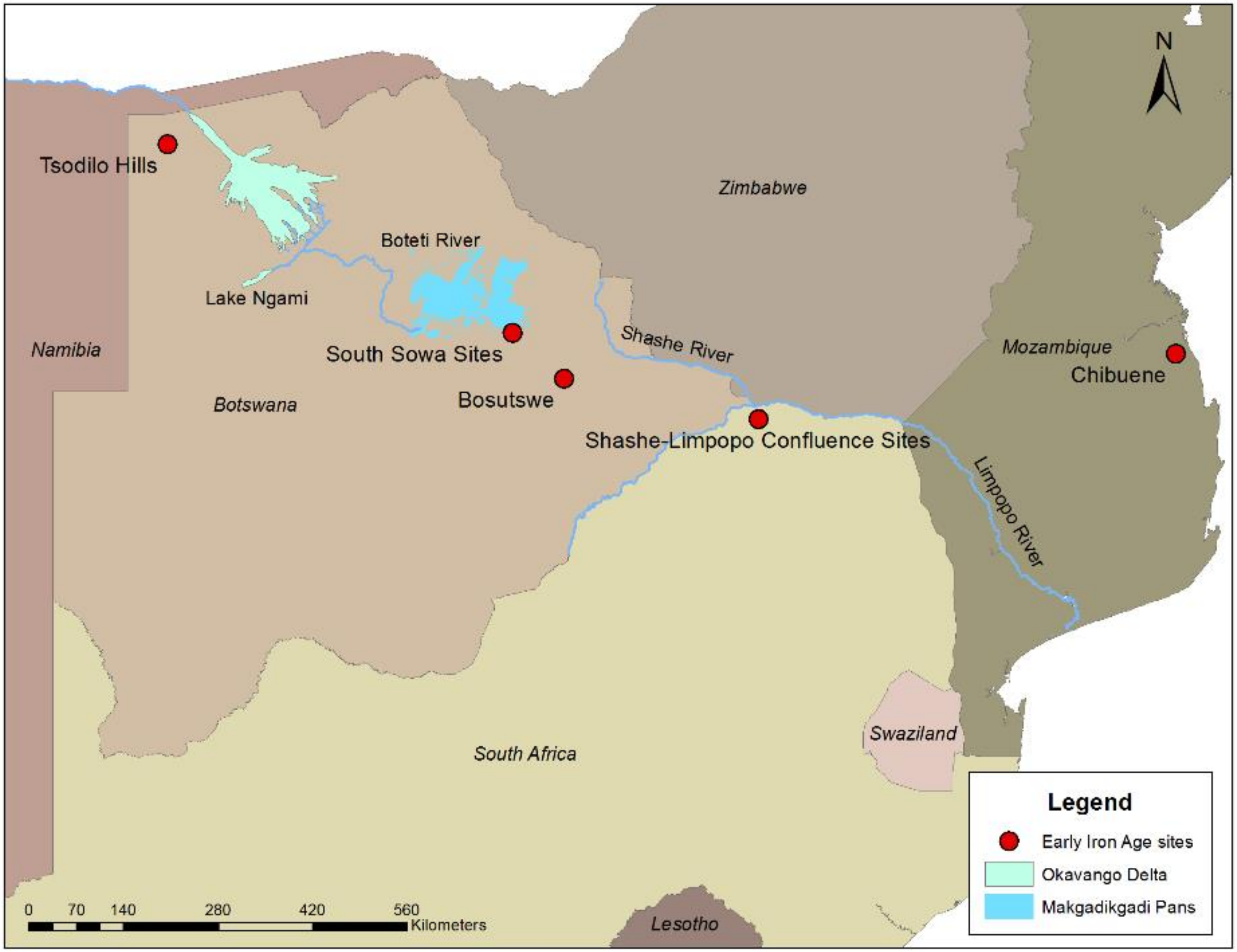

Figure 5 Areas mentioned in the text

protein sources. This overall picture contrasts strongly with depictions of cattle-dependent economies and, like Denbow (1982, 1984), the Mzonjani settlement system provides a frame for understanding the dynamic of an entire subregion for a substantial period of time within the Early Iron Age. Like the Mzonjani sites, other regions within Southern Africa witnessed distinct patterns of land and resource use within the first millennium, particularly the eastern Kalahari (see Denbow 1986; Mitchell 2002:275); this information is essential when building a comprehensive understanding of Early Iron Age social and economic organization.

Regional variation and other explanatory factors do tend to get underplayed overall in subsistence strategies for the Early Iron Age - not only in terms of which domesticated species were used where and when, and the socioeconomic and environmental contexts thereof, but also additional presence of wild foods and non-dietary resources such as trade goods. Mitchell (2002:275), for example, discusses the presence of differential patterns of livestock utilization within the same ecological zones during the Early Iron Age, providing examples from KwaZulu-Natal such as Wosi and Ntshekane. This may also be due in some part to a lack of identifiable organic remains at many sites, particularly for botanical remains. Very few cases exist in which domesticated botanical remains excavated in a Southern African Early Iron Age context have been identified through comparative macrobotanical analysis (or other, micro-scale techniques) by a qualified archaeobotanist; one such example is Jonsson (1998)'s study in Zimbabwe; see Neumann (2005) for further discussion on the complexities of archaeobotanical analyses in sub-Saharan Africa. Currently, no archaeobotanist working in Southern Africa specializes in plant species extant during the Iron Age, domesticated or wild.

Additionally, wild game and wild plant foods make regular appearances in Early Iron Age contexts. At Bosutswe, for example hunted game contributed up to 60% of the faunal assemblages for the Early Iron Age (Taukome and Zhizo horizons) period within the western part of the site (Denbow et al. 2008). Presuming non-differential taphonomic processes or discard behaviors for wild and domesticated remains, we can assume that these proportions represent a behaviorally significant proportion of the overall diet for these settlements. Incorporation of hunted and gathered foods could imply any of a number of things: the presence of hunter-gatherer communities nearby which traded with the settlement (Thorp 2000; Mitchell et al. 2008), incorporation of hunter-gatherers into the settlement (Wadley 1996; S. Hall and Smith 2000; Sadr 2005), or the maintenance and use of those bodies of knowledge, and dedication of regular time and resources to so-called 'hunter-gatherer' pursuits by members of Early Iron Age communities themselves (which is a much more contested line of thinking, but not out of the realm of theoretical possibililty; see, e.g, Odell 2001; Schiffer et al. 2001; Eerkens and Lipo 2005). The same is true for material culture (such as flaked and ground stone tools, bone tools, and shell beads) typically ascribed to hunter-gatherer makers and/ or users. Numerous cases of these types of materials deriving from Early Iron Age contexts exist at sites such as Bosutswe (Dubroc 2010), Schroda, Mosu I (Reid and Segobye 2000b; Tlapela 2001), Thabadimasego, Nqoma and Divuyu (Robbins et al. 1998; Reid 2005), and many others. While the specific contexts of the material must be considered in each case as this may yield additional vital information (e.g., stratigraphic integrity and a secure chronology; mixing in or clustering of the 'LSA' items relative to 'Iron Age' items or structures, etc.), if provenance of the materials is established well enough to imply association between the two cultural 'types', then some implications for those materials become important to consider. For example, specific bodies of knowledge are required to produce and maintain these items, procure the resources needed to make them, and one may assume that tools (lithic and bone points, digging sticks and weights, for example) and non-utilitarian items (shell beads, etc.) alike have ascribed social and cultural functions and meanings (see, e.g., Weissner 1983) which designate specific uses and users for these items. To what extent these functions and meanings would have been modified or otherwise recontextualized by their placement in Early Iron Age, as opposed to 'classic; pre-contact Later Stone Age, contexts, is another question worth considering.

Early Iron Age settlements have in the past been framed as self-sufficient in terms of subsistence (including domesticates, production of basic technology, etc.) and political organization (T. M. Maggs 1984). However, substantial evidence for trade throughout the areas occupied by Chifumbaze settlements brought to light in recent decades has shown that many settlements across the subcontinent were unquestionably interconnected. Through coastal entrêpots such as Chibuene in Mozambique, settlements of the Early Iron Age across Southern Africa had access to products of the intercontinental trading network throughout the Indian Ocean which connected south Asia, the Middle East, and much of sub-Saharan (and Nilotic) Africa (Popelka et al. 2005; Robertshaw et al. 2010; Sinclair, Ekblom, and Wood 2012). These goods, which primarily included glass beads, are present at coastal sites as well as interior ones, including Matlapeneng and Nqoma in western Botswana, by the 8th century AD (Denbow 2011; Wood 2011; Wood, Dussubieux, and Robertshaw 2012); Chibuene's assemblage also contains foreign goods such as Omani glazed ware dating to as early as the 6th century (Sinclair et al. 1993; Mitchell 2002:288). Based on this evidence, multiple scholars argue for the possibility that such foreign goods, in addition to being items of personal adornment, likely played the role of prestige goods in economies of redistribution and served as one mechanism of political power consolidation towards the end of the first millennium AD (Mitchell et al. 2002:288-289; Calabrese 2007). Items that may have been produced for export to the Indian Ocean trade network include animal products such as carnivore furs and ivory bangles. The 9th century Shashe-Limpopo site of Schroda has produced unusually large quantities of carnivorous faunal remains as well as ivory-working by-products (Mitchell 2002:289), while 9th century Mosu I, in the South Sowa area of Botswana, has also produced a number of finished and partly-worked ivory bangles (Reid and Segobye 2000b).

Trade of goods and resources originating from local Southern African contexts also occurred among Early Iron Age communities as well. In fact, exchange of resources such as iron and copper ore may have been vital to the maintenance of an 'Early Iron Age' way of life in those regions lacking ore deposits. While iron ore deposits are relatively numerous within the eastern third of Southern Africa, the quality and vitality of each source varied (Mitchell 2002:279). The ability to transform ore into usable end-products via smelting and smithing procedures seems likewise to have been variable, based on spotty evidence for furnaces and metallurgical by-products such as bloom and slag (Miller 2002), although it remains unclear whether this was due to uneven distribution of expertise or to variation in chemical attributes of the ore itself. As mentioned previously, copper ore sites are somewhat rare in Southern Africa (Miller 2002), and copper items appear in Early Iron Age assemblages hundreds of kilometers from the nearest accessible ore site. Copper items are relatively infrequent and appear only as finished products. However, finds of iron bloom and/ or slag at Divuyu and Nqoma, as evidence of metallurgical activities taking place on those sites, also allude to the transmission of the knowledge and technology for this type of metallurgy (Miller and van der Merwe 1994; Denbow 1999, 2002; Miller and Killick 2004). However, Denbow and Wilmsen (1986) report smithing at Tsodilo but not smelting.

Numerous additional subsistence-oriented material has been demonstrated to move between Early Iron Age regions and settlements on a regular basis; these include riverine fauna from the Okavango Delta and Boteti River found at Nqoma (Denbow 1990). These include whole ceramic vessels and possibly individual ceramic fragments as well (Edwin N. Wilmsen et al. 2009), marine shells from the Indian ocean coast found at numerous inland sites (Denbow 1990; Mitchell 2002), and specular hematite from mines in the Tsodilo Hills (Robbins et al. 1998; Wilmsen et al. 2013). That these items begin to appear as early as the 6th century and consistently make appearances in Early Iron Age assemblages implies regular contact between several regions across the subcontinent, even if the specifics of that contact (e.g., routes, nodes, hubs, technology/ transportation, and the mechanisms and social contexts of exchange itself) have yet to be substantiated.

While, therefore, descriptions of typical Southern African Early Iron Age assemblages (e.g., Segobye 1998; Mitchell 2002:259; Huffman 2007:335-338) usually refer to their ‘common’ diagnostic elements like ceramic vessels or figurines, metal tools/ jewelry, livestock remains, structural remains from storage or residences, kraal remains, and burials, it is in no way unusual for such assemblages to contain elements acquired via trade or contact with 'foreign' (non-farming) communities. These 'foreign' elements may include shell (ostrich and *Achatina*) beads, wild game remains, and lithic and bone tools. 'Trade' elements may include glass beads, ivory, riverine faunal remains, marine shells, and possibly such items as specular hematite and metal ores. The presence of intersite-contact and exchange has long been acknowledged (e.g., Denbow 1990; Denbow and Wilmsen 1986; Martin Hall 1988; Pwiti 2005; Chami 2006) and its potential importance for political and economic consolidation towards the turn of the millennium has been raised (e.g., Denbow 1984; Huffman 2000, 2008). The movement of people, goods and resources, and information between different subsistence-based communities, among regions within Southern Africa, and between Southern Africa and the broader sphere of first millennium world (especially other places within sub-Saharan Africa), likewise come as no surprise. Bantu-speaking, metal-using farming communities of the first millennium AD in Southern Africa were themselves, after all, the result of migratory communities from east and central Africa, and ample evidence from archaeology as well as genomic studies demonstrate how frequently and widely populations of Africa, the Near East and south Asia in the last few thousand years shared not only goods and information but genetic material as well (Hellenthal et al. 2014; Pickrell et al. 2014). Given the prevalence of 'foreign' and 'trade' items and the important social and economic roles that they often likely played within Early Iron Age community dynamics, it seems a worthwhile effort to attempt to reframe our general definition of Early Iron Age structures and processes to consider how these inter-site dynamics may have systematically affected the patterns of material and spatial organization observed on the scale of a single site. That this has already been done to effect an explanation for late-first-millennium political consolidation and its contribution to the rise of early second-millennium states should not exclude the possibility of doing so for the several centuries of Early Iron Age occupation prior to this consolidation as well as those regions of Southern Africa which were, presumably; outside the immediate reach of these effects during the time of consolidation.

To be clear, to synthesize so many streams of data across so many places, even for any given point within the first millennium AD, is a rather lofty goal which would obviously necessitate multiple very long-term collaborative, interdisciplinary research projects. However, it is towards such goals that archaeologists ought to aim, if truly our enterprise is to understand behavior and change in a comprehensive and systematic way. On a more pragmatic note, one way that individual researchers can contribute is by approaching regional concerns and processes, but with broader theoretical questions structuring their praxis, in an attempt to understand variability as well as change over time. With these issues in mind, the next section takes a look at some regional concerns within Botswana.

2.2 Regional (Botswana) framework: localized chronologies and socioeconomic trends, etc.

The Early Iron Age in Botswana deserves some consideration on its own both because of the national research trends which shape the bodies of data produced from the archaeological record, and because of certain unique aspects of the regional chronology, which will be discussed below. Archaeological data collection in Botswana is frequently conducted by both professionals and students in training for non-scholarly venues. For example, cultural resource management (CRM) firms are often hired to conduct archaeological impact assessments for government development projects (Thebe 2011). Numerous sites around the country are also the subject of fieldwork for University of Botswana field schools and bachelor’s or honor’s theses (e.g., Samuel 1999). The data collected from this work often becomes ‘gray literature’, published in non-peer-reviewed, limited-print media such as government reports, bound copies of manuscripts, field reports, and University of Botswana undergraduate theses. This literature, which for the most part is accessible only in hard copy at institutions such as the University of Botswana library or the National Museum, contains vital detailed information about the national archaeological record which does not always make its way into the more widely-accessible, and therefore more widely-consumed and replicated, peer-reviewed literature on the same archaeological record. For example, numerous Environmental Impact Reports (EIAs) prepared by CRM firms as part of pre-construction mitigation studies are full of survey and excavation details from projects all across Botswana; these reports are only available in hard copy in a few locations, such as the National Museum's library, or (presumably) if one knows the author of the report one may ask for a copy.

While information from the gray literature may be easily accessible and commonly referred to on a local (i.e., national, institutional and university) level, at the same time it may not be incorporated on a timely basis into the broader theoretical arguments being made for Southern African Iron Age trends on a whole which draw from data in Botswana. University students and field technicians do eventually gain access to the theoretical interpretation of the materials that they themselves may have worked on, but only after it's been filtered through the larger sphere of academic discourse and brought back to the local arena through now-dated teaching and reference materials. There are happy exceptions to this rule, of course, such as when CRM firms are directed by post-graduates actively engaged with the literature or when university students are actively brought into the theoretical realm by their mentors. For the most part, however, there seems to be a disconnect between those practicing archaeology in Botswana on an everyday basis and those consuming the archaeological data for research purposes. This issue is, of course, not isolated to Botswana (see, e.g., Huffman 2012b; Kinahan 2013). While this is probably inevitable to some extent, the ramifications for what information ends up in scholarly literature are twofold. First, the bodies of data as presented in the scholarly literature become much more restricted, and that data furthermore becomes seen as representative of the country's archaeological record as a whole instead of as just the well-represented subset that it is. Second, because the scholarly literature is for the most part published in South African and pan-African or international venues, the terminology and classifications used to describe the data are frequently of South African derivation. As discussed above, it is important to have a broad comparative framework, but on the other hand, the possibility for local ceramic and/ or lithic sequences, or other material trends, to be subsumed or go altogether unrecognized remains high when such a top-down approach prevails (Wilmsen pers. comm, 2013). As has been discussed to some extent in previous sections of this chapter, these issues are already known and are being addressed by some researchers such as Wilmsen et al. (2009) and Ashley (pers comm, 2013).

One aspect of Botswana's archaeological record which has relevance on both national and subcontinental scales is the fact that Botswana is one of a few places in Southern Africa where Kalundu, Kwale and Nkope ceramic facies have all been documented. Naviundu ceramics of the Kalundu tradition are represented at Nqoma and Divuyu (Denbow 1999); Taukome and Zhizo ceramics (Nkope tradition) are found at numerous sites in the eastern part of the country, and early Kwale ceramics may be found at some sites in south-eastern Botswana contemporary with Broederstroom (Mitchell 2002: 264). If one accepts the premise that these three 'streams' represent three different population movements originating from three separate areas of sub-Saharan Africa (Mitchell 2002:264-271; Phillipson 2005; Huffman 2007), then the high probability that communities representing these streams interacted during their respective overlapping waves of settlement (e.g., Tsodilo Hills to Lake Ngami, Boteti River to Sowa and Tswapong Hills, etc.) suggests a number of interesting behavioral implications. If these ceramic groups (and their subdivisions) do represent distinct language groups (Vansina 1984; Holden 2002) with distinct community identities, then the production of both identities and boundaries, the maintenance thereof, as well as the negotiation of goods, resources and information across those boundaries (along with the eventual transformation of those identities into those observed in later eras of the archaeological record), all remain potentially fruitful avenues of research (Stein 1998; Brooks 2002). The possibility remains that Botswana was a locus of settlement not just for the Early Iron Age in the sense of one coherent, typologically-consistent cultural horizon, but for multiple interconnected societies which also negotiated boundaries and the exchange of resources with indigenous hunting and gathering communities (Walker 1998; Denbow 1999; Reid 2005) as well as pastoralist populations (Cashdan 1985; Reid, Sadr, and Hanson-James 1998; Sadr 2005).

One further feature of Botswana's archaeological record that is worth discussing, particularly for its northern regions, is the possible existence of a salt trade during the Early Iron Age. The Makgadikgadi Pans are known for their extensive salt deposits (as discussed in Chapter 1). Exploitation by local communities, and particularly of San communities, of these deposits at specific locations within Sowa Pan has been recorded for the 19th and 20th centuries (Matshetshe 2001), and possibly the 18th century as well (Cashdan 1979). Sowa Pan is credited as the major source of dietary and preservative salt for populations of the Northern Kalahari throughout this time period (Matshetshe 2001), meaning that those involved in its extraction, refinement and transport participated in a highly valued trade network whose extent reached as far as Bulawayo. The decline of this trade network is attributed to the introduction of European-sourced, industrially-produced salt into the area via the growing formal commerce sector sometime around 1965 (Matshetshe 2001).

No direct confirmation of a similar process exists for the Early Iron Age in Sowa Pan or the Northern Kalahari generally; however, Denbow (1999) reports that ceramic strainers that may have been used to strain salt have been recovered at both Divuyu and Matlapaneng, with dates ranging from the 7-10th centuries. Denbow (2002:356) furthermore argues that salt is a likely option for a trade good, as evidence regular trade in "luxury items of local manufacture," such as shale, ostrich eggshell beads, *Achatina* and mussell shell beads appears at nearly all sites throughout northern Botswana. Both Denbow (1999) and Reid and Segobye (2000a, 2000b) suggest that Early and Middle Iron Age sites located around Sowa Pan (such as Tora Nju, Thitaba, Lekhubu, Kaitshàa, and Mosu I) were settled deliberately in order to take advantage of the availability of salt deposits and the economic benefits they offered. While this would be difficult to prove per se, it is conceivable that the knowledge and ability to extract and refine salt from the pans would have existed among Early Iron Age populations or their contemporaries, and the resource itself certainly existed in no small amount at the time. Salt exploitation, while intangible in the archaeological record of Sowa Pan, seems like a viable working hypothesis (or part of one at least) for what drew farming communities to the pan's shores in the late first millennium AD. Still, much remains to be learned about in what social contexts that exchange may have taken place (see, e.g., Stein 1998; T. D. Hall, Kardulias, and Chase-Dunn 2011). This same holds true for the cluster of sites along Sowa Pan's southern margins in particular. Settlement there by Early Iron Age communities is documented as early as the 9th century AD and continued periodically for several centuries (Reid and Segobye 2000a), but much remains to be understood about the local settlement system and its role in a wider political economy. The next section will take a detailed look at the chronology of the South Sowa area and the history of work in that area with an eye towards relevant theoretical and methodological questions.

2.3 Local archaeological record: the south Sowa 'cluster'

Prior work in the area

Although stonewalled sites in that area and elsewhere across Sowa Pan may have been included in folklore and oral histories of Botswana, archaeological sites in the south Sowa area were first documented by Denbow (1985) for the British Petroleum Soda Ash archaeological impact assessment survey. Denbow (2002:353) makes mention that Kubu Island was offered up by mid-twentieth century South African media as a fabled 'Lost City of the Kalahari,' although there is little else to support this claim apart from the imagination of the popular media. Further site location surveys were conducted by avocational crews in the early and mid-1990s (Campbell and Main 1991; Main 2008). These surveys led to the documentation and registration of over 50 archaeological sites along the south and south-eastern margins of Sowa Pan (see figure 4 in Chapter 1). Professor Tom Huffman provided identification of pottery types surface-collected from both surveys (see, e.g., comments in Main 2008) which allowed for assignment of preliminary cultural associations for most of the sites. Common facies included Zhizo and Khami, while tentative additional identifications of Leopard's Kopje pottery and Later Stone Age lithic material were also made. From this, the interpretation was formed that occupation of south Sowa likely reached as far back as the mid- to late first millennium AD and that additional occupations likewise occurred around the middle of the second millennium, prior to the arrival of Tswana, Kalanga or other historically-documented communities now present in the area.

An early date (9th-10th c. AD) was confirmed by Reid and Segobye (2000a, 2000b) through radiocarbon samples for Mosu I, a site located about 5.5 km west of Mosu village on a portion of the escarpment. Materials recovered through excavation at Mosu I, including glass trade beads, carved ivory bangles, livestock and Zhizo ceramics indicate that not only was this settlement a contingent of the Early Iron Age way of life, but also that it participated in the exchange network which connected much of Southern Africa to the Indian Ocean coast at the time. Further excavations at Kaitshàa, a stone-walled escarpment site contemporary to Mosu I located 15 km northeast of Mosu village, provided similar information during the 1990s and again in 2010 when Denbow (pers. comm) returned to find a huge cache of glass trade beads as well as copper jewelry items at the site (figure 6, below). These finds indicated that the south Sowa area, while geographically peripheral to the Iron Age settlement system of Southern Africa overall (as discussed by Reid and Segobye 2000b), nonetheless maintained important economic connections for the duration of the community's existence.

Reid and Segobye (2000b) suggest that iron-using agricultural communities closely related to contemporary hierarchical polities such as Toutswe settled along the escarpments to exploit the water sources of the area as well as the plentiful wildlife. Based on the extant distribution of diagnostic ceramic material, they further suggest that occupation of this area by food-producing, ceramic-using peoples occurred from approximately 900-1400 AD, with the peak at around 1000 AD. They, along with Matshetshe (2001) and Denbow (2002), argue that the Sowa Pan settlements would have played a role in a cross-Kalahari trade network as a source of salt and wild game products, as well as ostrich eggshell beads which they assume were produced by local hunter-gatherer communities. They further suggest that the hunter-gatherer communities would have been incorporated to a significant extent in the trading network by collecting and providing salt and game in exchange for milk and meat products, and that such movement prompted increased social complexity and the development of new forms of social and economic organization among local hunter-gatherer communities. Flaked lithics and ostrich eggshell beads, trademarks of the LSA, have been found repeatedly in association with ceramics during surface survey (Main 2008), lending some support to this claim, but the lack of excavated LSA sites with well-dated sequences in the immediate area makes it difficult to know yet how hunter-gatherer communities were affected by the presence of agropastoralists in the area.

Further survey by Samuel (1999), conducted for his bachelor's thesis at the University of Botswana, confirmed the initial observations by Campbell and Main (1991) that the majority of archaeological sites in the south Sowa area are located at or near the escarpment edge. The twenty-one transects of his pedestrian survey, which went from north to south from the Francistown-Orapa road to the escarpment edge and which covered a total area of 198 square kilometers at intervals of one kilometer, located 53 previously undocumented concentrations of archaeological material. It is worth noting that, although Samuel refers to these concentrations as sites, his criteria for defining an archaeological site differ from other studies in the area. While Main (2008) does list the occasional isolated surface find or surface scatter as a site if the material is unusual in nature (an Early Stone Age hand-axe, for example), he restricts his site listing primarily to locations with built stone structures and/ or dense concentrations of cultural material. Samuel (1999), on the other hand, appears to have listed every instance of cultural material encountered on his survey, whether it is one potsherd or multiple stone cairns.

As will be discussed in greater detail in later chapters, the nature of distribution of archaeological material throughout the escarpment is such that isolated finds commonly occur at the foot of the escarpment as the result of post-depositional processes, particularly seasonal slope wash. Samuel's findings, therefore, must be taken with this in mind. However, although the degree to which his survey contributed new locations of archaeological sites remains unclear, his study does confirm that cultural material in the south Sowa area concentrates by and large near the escarpment edge, with only a small number of sites or scatters occurring either south of the escarpment along the plateau (what Samuel calls the 'valley') or north of the escarpment on the floodplain or pan edges (which Samuel and his crew also surveyed on foot as a training exercise prior to beginning the official survey). Samuel's finding is significant in terms of (archaeologically visible) landscape use.

The majority of documented archaeological sites in south Sowa range from Early, Middle and Later Stone Age surface scatters to Later Iron Age and early historic stonewalled structures. These sites, which may vary in extent from a single isolated surface find to multiple square kilometers, as has been reported in the National Museum site register. The sites also tend to occupy similar parts of the landscape (the escarpment edge in particular) and in many cases, multiple chronological components may be reported for a single site. Site 16-A1-12, for example, which was foot-surveyed by the author's crew in 2012, is listed as having Later Stone Age and Leopard's Kopje components in the site register. Observations collected during survey confirmed that the site had no visible stone features, but very dense ceramic scatters (which likely comprise multiple facies) as well as ostrich eggshell beads and numerous flaked stone items. Some lithics appeared morphologically comparable to typical Middle and Later Stone Age material observed in the museum's collections, but many other pieces were amorphous, irregular or unidentifiable. These may have actually been the product of thermal spalling from exposure to natural or human-controlled fire (Staurset, pers. comm. 2013); in some cases, perhaps they were the product of informal or experimental manufacture. Little can be said with any certainty without other similar contexts for comparison. Potential references for comparison include Phaladi 1991; Weedman 1993; and Walker 1994; however, even lithic studies comprise samples from only a few sites around the country. However, importantly, all of these components appeared on the surface of the site, and what this implies for the occupation history of this place - whether it represents a palimpsest, the end-product of displacement of the stone tools, or something else - would need careful study of the site formation processes.

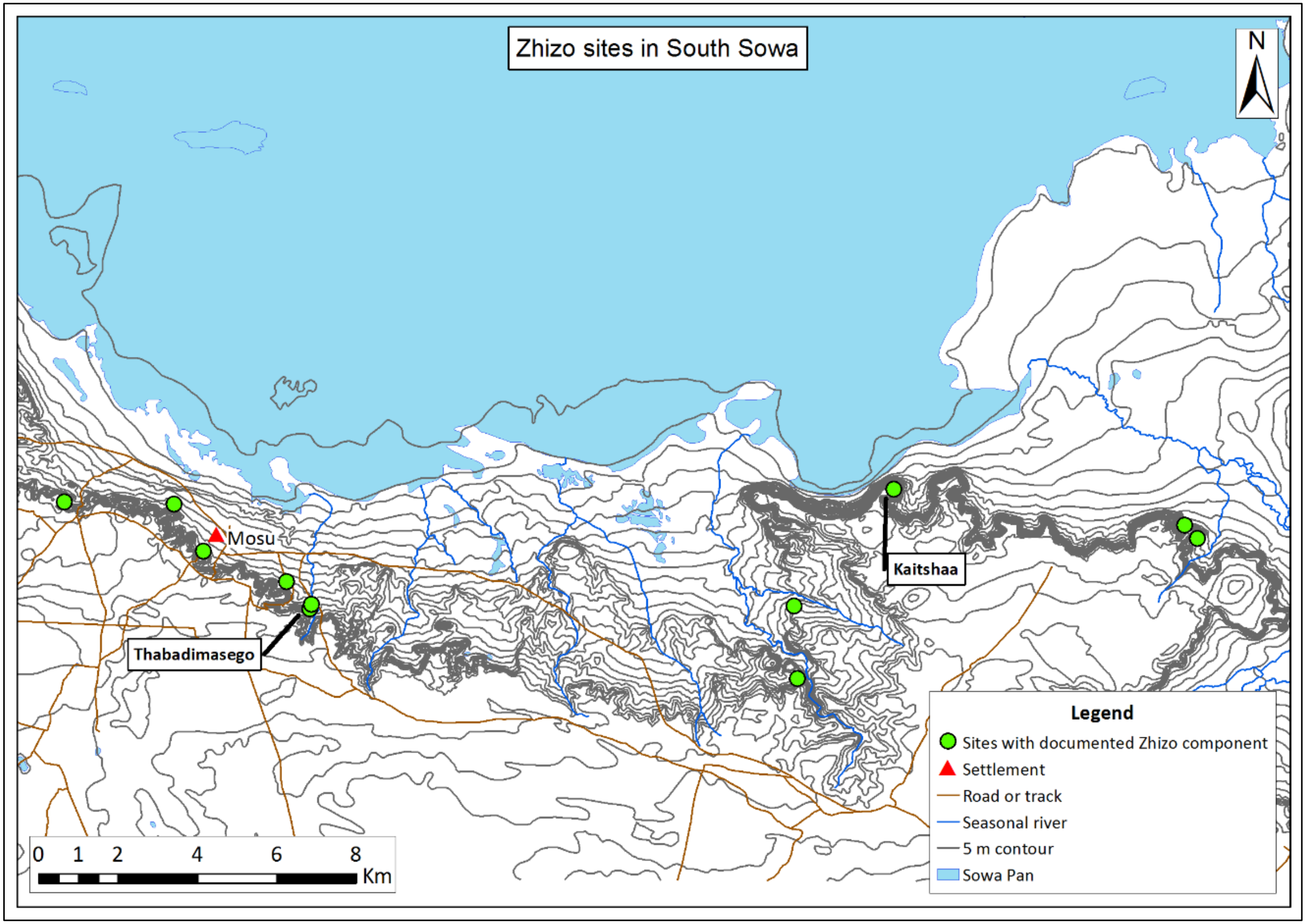

Figure 6 Zhizo sites in the South Sowa area

For those sites which have been reported as containing Early Iron Age components, a number of pertinent issues that could affect the interpretation of any one of them come to mind. First, Early Iron Age sites with other chronological components are common. For some sites where, for example, both Zhizo (ca. 7th - 9th century) and Khami (ca. 14th - 16th century) components have been reported, confirming provenance should generally be a matter of determining stratigraphic integrity. Doing so may not actually be a simple process on hilltop sites with a shallow soil matrix, animal burrowing, and high erosion factors, but with enough subsurface testing, the stratigraphy should be understandable. In other cases, however, particularly those reported by Main (2008) as "Later Stone Age plus Early Iron Age", or as having multiple Early Iron Age components (such as Zhizo and Leopard's Kopje), an additional complication is introduced of determining whether these components represent discrete horizons, some form of coexistence, or whether they even represent distinct components in the first place or should be evaluated by other criteria.

Most site descriptions in the National Museum site register (as well as those sites listed in Samuel's survey, not all of which may have been placed on the register) derive either from small surface collections, few of which are curated in the museum's storage facilities today, or from notes and photographs of the surface scatters taken during field surveys (Samuel 1999; Main 2008). In many cases, then, the cultural components were identified by amateur scholars (while Professor Huffman did identify the ceramics from several of the sites surveyed by Main's crew, the question remains as to whether the ceramics collected by the crew consist of representative samples from those sites). This issue is not raised to discount the existing site designations out of hand, but as a point of caution. For most of the 20-plus sites in the south Sowa area designated as 'Early Iron Age', this designation relies on a very small amount of information derived from a body of evidence largely collected by non-experts well over a decade ago which is now inaccessible. Little in-depth information exists in each site report, and the ability to return to each site location for verification and further fieldwork is complicated by the imprecision of each site's provided location (generally, Universal Transverse Mercator, or UTM, coordinates are precise to the nearest 100 meters, which may be a distance larger than the extent of the site itself) and the density of ground cover along the escarpment and lowland plateau in most areas.

Additionally, because the great majority of these sites are identified only by relative means, the precision in determining settlement patterning for the area is currently low. A good deal more research, including the collection of a series of radiometric data, would be needed at multiple sites before their relationship to one another can confidently be established. These sites, which could potentially range in age from approximately the 7th to the 11th centuries AD, have the potential to offer invaluable insight on a unique settlement system in a unique landscape, the density and extent of which in the Botswana archaeological record is only paralleled by the Toutswe pattern as described by Denbow (1982). Pertinent questions about settlement history for this area include whether settlement occurred in pulses, or was continuous. Whether sites with similar date ranges, such as Mosu I, Kaitshàa, and Thabadimasego, represent separate, co-existing villages, short-lived serial occupations, or Interlinked, differentially functional locales (in the manner of field, kraal and village) is another issue; the uses for each site based on their features and deposits still remain to be thoroughly compared as well.

The following chapter will discuss how these issues, particularly those of scale and process, have been brought to bear in methodological design for this research project as well as how prior studies in south Sowa and Botswana generally have aided in developing expectations for the archaeological fieldwork.

Chapter 3 <u>Field Methods</u>

3.1 Introduction

This chapter describes the methods of data collection used in fieldwork for this research project, as well as the post-excavation inventory conducted prior to analysis of the assemblage. The categories of information as well as methods used to collect them are described in detail for both fieldwork and the subsequent post-excavation cataloguing process. Additionally the methodological justification for these procedures and their relevance to current research trends is discussed. I also describe the methods of analysis used to make observations about these datasets and why these analytical procedures were used. Methods fall into two main categories: data collection and analysis.

Fieldwork was conducted over a period of three months from July to October 2012 with a team of three professional field technicians who were recommended through faculty at the University of Botswana. Additional help was provided at times by University of Botswana volunteer undergraduate students as well as staff from the local National Museum (NMMAG) office. Several phases of data collection occurred, a few of which depended on feedback from a previous phase to make decisions about coverage or sample size. The fieldwork was broad in scope in no small part due to the fact that so little in the way of archaeological (or other relevant historical, geographical matter) is published about the South Sowa area; therefore, a substantial portion of the fieldwork ended up being exploratory.

In brief (roughly) chronological order, the phases are as follows:

I. Thabadimasego survey and excavation

- Site survey
- Ground-truthing/ confirmation of site location
- Thabadimasego site gridding and surface collection
- Thabadimasego perimeter mapping
- Test units (3)

- Thabadimasego subsurface (test pit) survey
- Unit excavations: purposive units (locations based on subsurface survey) - 17 on hilltop
- Tape- and-compass stone wall mapping
- Additional test pits

II. Thabadimasego Periphery survey and excavation

- Periphery test pits
- Periphery test unit

III. Escarpment survey

- Surface survey of foot and edge of escarpment between Thabadimasego and site 33
- GPS documentation of surface scatters

IV. Additional sites

- Site 12 perimeter, surface collection and test unit
- Site 33 perimeter, surface collection, and test unit

V. Visits to previously excavated sites

- Mosu I perimeter mapping
- Kaitshàa perimeter mapping

VI. Landscape survey

- Visits to clay mines west of village
- Visits to cattle posts and dammed natural springs

3.2 Goals for fieldwork

There were five major goals for this fieldwork. These do not neatly tie into the chronological phases of the data collection, since, as mentioned above, in numerous cases the work was exploratory and the same kinds of information was often collected at varying scales (for example, distribution of surface scatters across both the site and across the landscape). However, each part of the fieldwork was designed with one or more of these data collection goals in mind, and as a whole therefore the phases of fieldwork inform the goals quite well. The data collection goals were as follows:

1) Collect information relevant to understanding site formation processes in this particular physical landscape and climate, such as stratigraphy, taphonomy, and site integrity.

2) Collect information about surface and sub-surface material distribution (including type, frequency, and co-occurrence) at two scales (intra-site and inter-site) as they inform use of space (and our understanding of how archaeologists define a 'site').

3) Collect stratigraphically-secure cultural materials (such as faunal remains, ceramics, trade goods, iron or stone tools) that inform understanding of economic and social processes as elaborated in the research questions posed in Chapter 1.

4) Collect radiometric samples from relevant depositional contexts to provide an absolute chronological framework against which to compare the results of laboratory analyses.

5) Document locally-available natural resources (and geographic features) that might be relevant to understanding economic behaviors and use of space on the landscape (such as tool-making, wild fauna or flora availability, or water availability) for local Early Iron Age settlements.

3.3 Hypotheses

A number of hypotheses were generated based on the extant body of knowledge for the area as discussed in Chapter 2, as follows:

- Surface and sub-surface material distribution (type, frequency, co-occurrence) at two scales (intra-site and inter-site) will not be random, nor will they align neatly with the attributes of the Central Cattle Pattern.
- Type, frequency, co-occurrence of material distribution within and between sites will inform understanding of spatial organization, social behaviors and economic processes as they were expressed in the Early Iron Age.

- Type, frequency, co-occurrence of material distribution will not align neatly into clearly-defined ethno-social 'types' such as 'hunter', 'herder,' or 'farmer' as characterized by the classic culture-historical typologies.
- Placing the local archaeological record into the context of its geophysical landscape will substantially affect interpretation of processes at the site-scale as well as the inter-site scale (as compared to when conducting site-level analysis only).

The following section describes in detail the methods used for data collection during these phases of fieldwork.

3.4 Data Collection (Fieldwork)

Phase I - Thabadimasego (main site)

Ground Truthing

The fieldwork phase (July - October 2012) of research was comprised of surface survey, subsurface (test pit) survey, and excavations. The first few days were spent foot surveying the hilltops to confirm the locations of the intended sites of excavation, and to verify that surface scatters were in fact confined to the bluff edges and hilltops as reported by previous researchers (or whether a more continuous scatter along the entire bluff formation might be observed). A map depicting the locations of all foot survey conducted in 2012 can be found below (Figure 7). Once the sites were confirmed, test excavations commenced at the main targeted site (listed in the grant proposal as site 16-A1-31, but confirmed by ground truthing to be site 16-A1-13, which was later named Thabadimasego). This site was chosen for study because it was listed on the National Museum (NMMAG) site register as one of the few single-component Early Iron Age sites in the Mosu area, making it a useful unit of analysis for comparison with other contemporary settlements.

On-site survey

Once the site was confirmed and partially cleared, we established a site datum and grid (Figure

8). The site datum was spatially referenced to a universal coordinate system with handheld GPS, both north-south and east-west baselines counted out at 10-meter intervals, and a local coordinate grid was marked with pin flags at 10-meter intervals across the entirety of the site from the stone wall (which coincides with the natural 'pinch-point' of the escarpment protrusion) to the northern, Southern, and eastern extents of cultural material surface distribution (which more or less coincide in most places of the bluff-top with the elevation drop-off where it becomes too steep to walk easily on the slope).

Before conducting extensive sub-surface investigations I wanted to gather information about the correlation between surface and sub-surface cultural material, as little information about sub-surface depositional history is available for sites in this area, sites are primarily identified by a sampling of surface materials collected from prior surveys (e.g., Samuel 1999; Main 2008) and therefore an on-site comparison of the two could be highly relevant for interpreting the integrity and occupation history of the site. As a measure of this, 100% of the surface material visible was collected in each 10x10-meter grid square in the western third of the site closest to the wall. The material from each grid square was bagged separately and is presently curated in the collections at the National Museum. It may be worth noting that my crew protested at the collection process, saying it was standard practice in Botswana to leave surface material on-site so that future visitors could recognize the location as an archaeological site. To address this concern, we refrained from collecting materials in the eastern two-thirds of the site, which left hundreds of sherds visible to potential visitors. As it was, however, this collection did allow me to gain a picture of the extent to which the site was covered in cultural material as well as the range of that material. Additionally, the perimeter of the entire hilltop site as it is defined by the limit of surface material distribution was walked and track-logged using the handheld GPS unit (this is depicted in Figure 8 as the 'approximate site perimeter'). This provided further observations relevant to ground cover, slope and taphonomy.

A number of surface features were observed on the site, such as the remnants of a stone wall

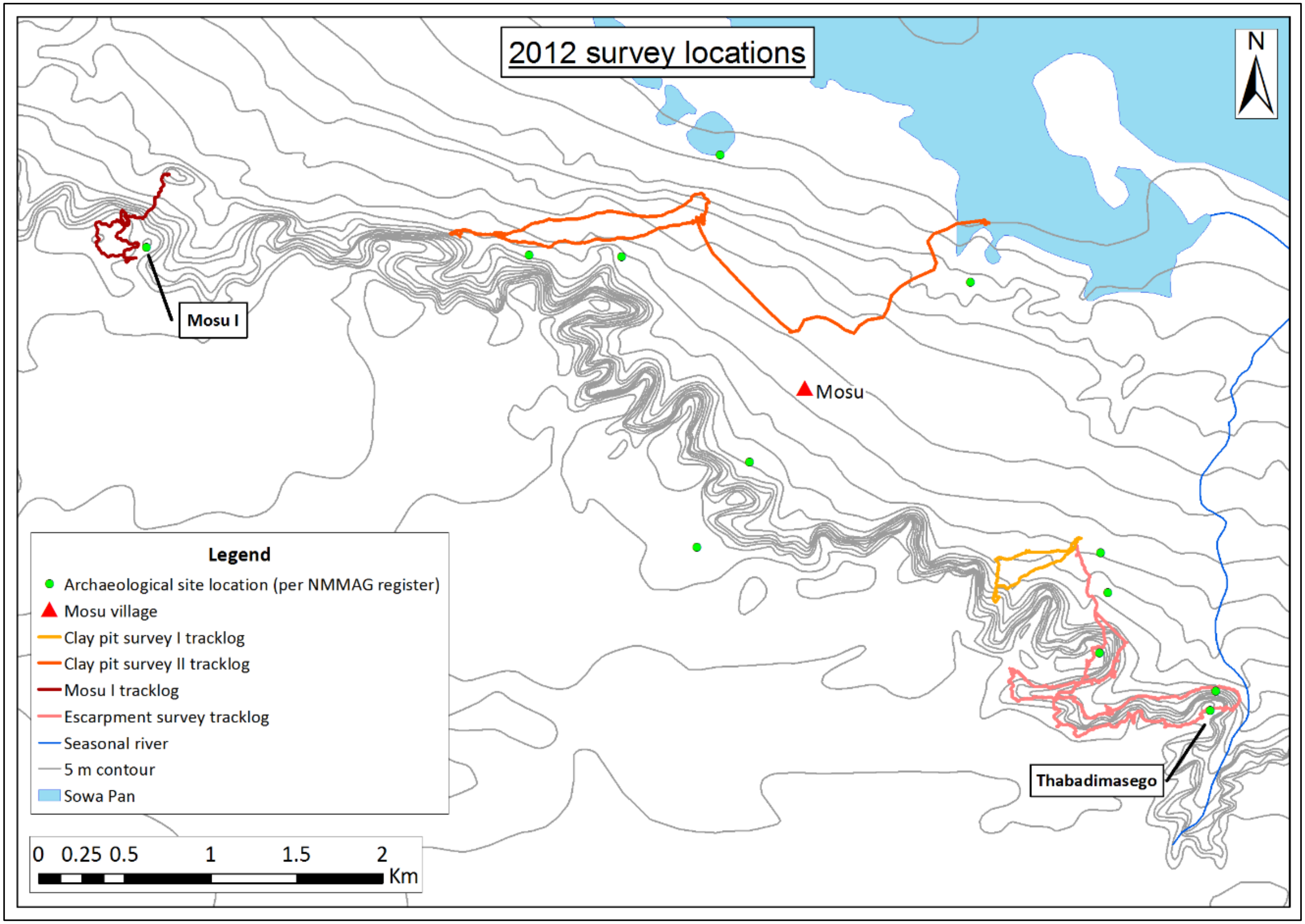

Figure 7 Areas surveyed in 2012

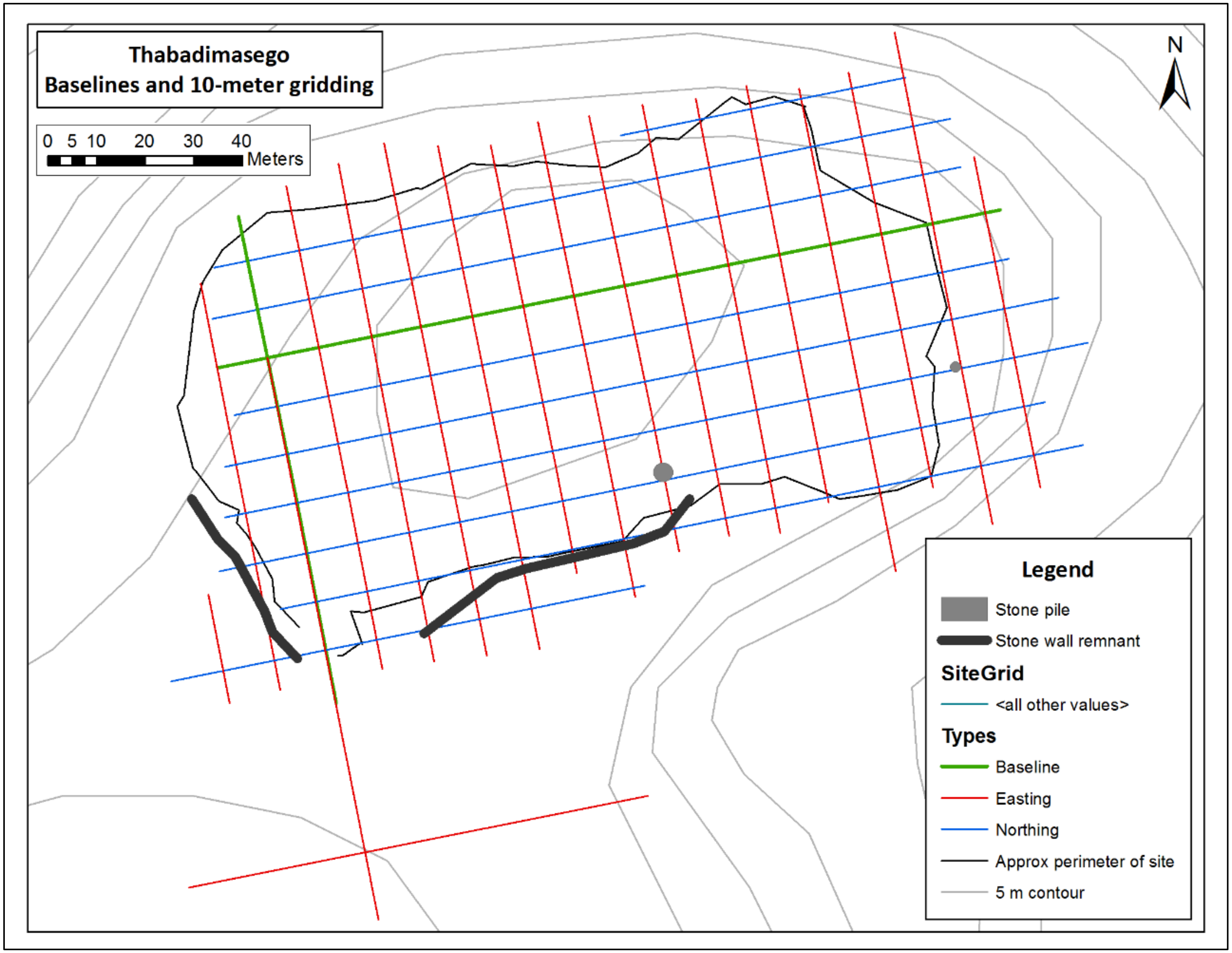

Figure 8 10-by-10-meter grid on Thabadimasego marking the connecting point between the hilltop promontory and the rest of the escarpment, as well as two small stone cairns. To record the location of these features, a tape-and-compass survey was conducted using the geotagged site datum and grid as reference points. In the case of the stone wall remnants, pin flags were placed at short intervals along the center line of the wall along its entire observable extent. For each flagged point, the distance from the last point was measured with a tape and bearings were taken with a compass. The width of the wall was measured at these points as well, although it was clear that the entire wall had been very much damaged and knocked down, so the accuracy of these dimensions is probably unreliable (see chapter 5 for further discussion of the walls). The starting point of this survey was one of the grid coordinate locations, and the information recorded by the survey is therefore easily reproducible as a georeferenced set of measurements for inclusion in the site GIS. The other stone features on the site were recorded in similar fashion, although since they were much smaller, they were measured end-to-end and cross-wise, with at least one flagged point referenced to the grid coordinates. Photographs were taken of each feature as well.

Test pit survey

Following this, my crew and I proceeded to dig small (30x30-cm) test pits at 10-meter intervals (generally placed at the grid pin flags) across the entire site wherever cultural material was visible on the surface and at least 10 meters in any direction beyond this as well. For each test pit, soil color and consistency was recorded, and finds were bagged according to pit. Unfortunately, in retrospect, not sorting out the finds from each pit according to the soil horizon in which they were recovered means that I am unable to directly compare this assemblage of finds, in terms of artefactual and depositional associations at the same resolution, with the excavation units and later 'stratified' test pits. However, (as discussed later in this chapter), the main goal of this initial test-pit survey was accomplished, which was to get an idea of both the stratigraphy and sub-surface material distribution across the site, as well as to identify any activity areas or soil anomalies for further investigation.

Excavation

A total of 20 1x1-meter units were placed on the main hilltop site, with one additional unit placed on the escarpment outside/ southwest of the stone walls (see Figure 9). Three of these were placed prior to the test pit survey described above, in order to gather information on stratigraphy near the north and south portions of the stone wall (units 1 and 2) and in the central clearing (unit 3). These units revealed the difference in soil deposition in these areas as well as the high cultural material content of the central clearing as found in unit 3. Combining the information on depositional history gathered from units 1-3 and the test-pit survey (as described in the section above), an additional 17 1x1-meter excavation units were placed within the site at locations identified to be 'of interest'. These units were intended to be a purposive sample of the site aimed at gathering the highest-priority information within the given time and resource constraints for completing the fieldwork. Although it appears to be common practice in Southern African archaeology to open one or two large trenches in the central area of an open-air site as the main method of data recovery and as a way to focus on the primary locus of deposition (see, e.g., Denbow et al. 2008; van Waarden, Mosothwane, and Waarden 2013), standalone 1x1-meter units were chosen as a sampling method for this project. This was done in order to be able to cover ground across the entire site while maintaining high informational resolution and the ability to open a bigger trench if needed (further implications of the different excavation methods will be discussed in Chapter 6). The location of these units was guided by findings in the test pit survey. Due to the process of elimination a substantial portion of the hilltop could safely be ignored, as it was either disturbed or sterile ground (or both). Activity areas and structural remains were the focus of the excavations. Given the 10-meter interval coverage of the test pit survey, it seems safe to say that a high proportion of both of these were located and excavated. As will be discussed in the following section, additional coverage was also given to a few areas deemed of interest with another test pit survey, in order to delimit further the extent of these features.

Units were excavated in arbitrary 5- or 10- centimeter levels, depending on the context (the great majority of levels were 5 centimeters, but occasionally after one or two low-productivity levels we would revert to a 10-cm level to finish out the unit). Soil was screened through 1-mm mesh and all finds were bagged. Planviews were recorded for levels and at least one wall profile was recorded for each unit. In addition, photographs were taken of each profile and of several level floors. Upon completion of excavations, all units were backfilled and markers of modern disturbance included (i.e., we threw a little garbage that would be easily recognized as modern onto the floor of each unit before backfilling to mark it as an excavated unit).

Stratified test pits

In order to increase fine-grained coverage of certain portions of the site and to check the extent of previously identified features, five of the 10x10-meter site grid sections were chosen for an additional 30x30 cm test pit survey. Ten test pit locations were chosen at random within each grid section with a random number generator. Unlike the first round of test pits, these were excavated according to the natural strata with finds from each strata bagged separately. This was done so that information from these test pits would be more comparable to the excavation units (in that cultural material would be tied to a particular depth and soil horizon). There seemed to be differentiation in material distribution between the different types of soil strata and I thought this could perhaps map on to different uses of the site, or phases of site use. A total of 50 test pits were placed in this stratified survey, for a 10% sample of each of the chosen grid sections. As before, pits were dug to sterility and/ or bed rock. Depth, color and consistency of each soil horizon was noted.

The stratified test pits helped to confirm distribution patterns of material culture across the site. While it could be argued that opening additional excavation units in the vicinity of buried structural remains would have been a preferable use of time (to describe these remains' extents and attributes), rather than focus on delimiting potential features across a broader area of the site, at the time my goal was to sample from the total extent of all types of features instead of enumerating specific ones. It was

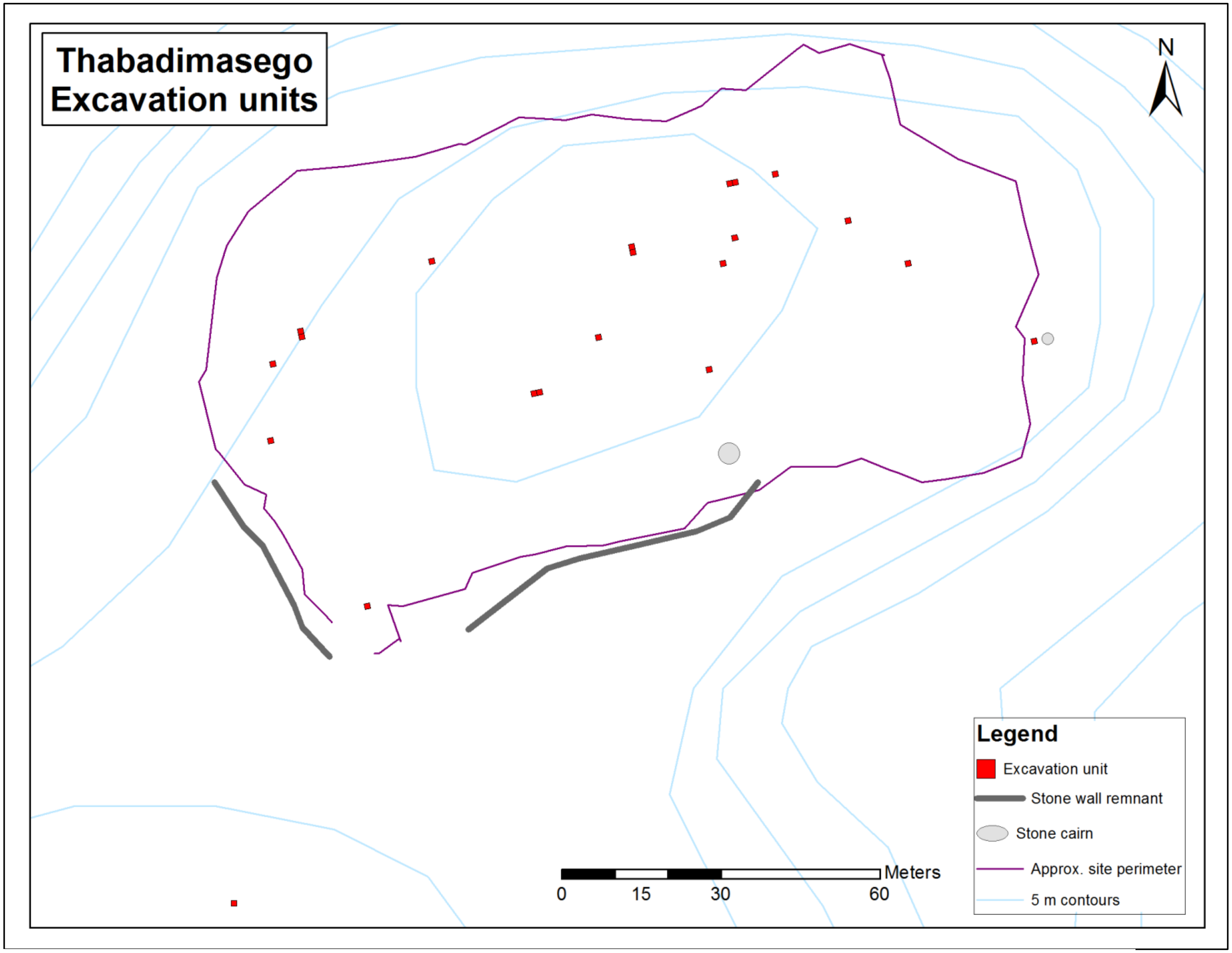

Figure 9 Location of excavation units at Thabadimasego

felt that these test pits were the most efficient way to do so in the limited time remaining on site. Future work at this or similar sites along the Mosu Escarpment has the potential to address the question of high-resolution study of specific structural types using area excavation.

Radiometric data collection

During the stratified test pit survey and unit excavations, several radiometric samples were collected. Any charcoal flecks or fragments over approximately 5 millimeters long were collected as an aggregate sample per level (or test pit soil horizon). The density and context of charcoal deposits, including associated features, cultural finds and soil type, was noted in order to inform selection of samples for AMS processing. Clustered concentrations of charcoal were included in planview and profile recordings as well. While these clusters did not appear to be part of any clearly evident hearth feature, they did frequently co-occur with cultural materials including pottery and beads; this admixture may instead indicate small middens. Additional organic material including carbonized seed clusters, pottery sherds with charcoal temper, and ostrich eggshell, was recovered during excavations. OES has been determined as a reliable source of dateable organic material; (see Vogel, Visser, and Fuls 2001), but was not selected for AMS processing.

In addition to the charcoal samples, two consolidated bulk sediment samples were collected for OSL analysis as independent confirmation of depositional integrity. Both samples were collected following the recommended procedures provided by the University of Washington Luminescence Laboratory (http://depts.washington.edu/lumlab/about_seds.html). Both samples were collected from different depths of the same vertical column of a centrally-located unit so that they would be comparable in terms of site use.

Phase II: Thabadimasego periphery

As described in Chapter One, the hilltop on which the main site of Thabadimasego rests is a sort of oblong protrusion from the rest of the escarpment (see Figure 3). The slopes of the escarpment here are steep and full of scree towards the drop-off point where the slope becomes an actual cliff. Also, the vegetation cover (mostly acacia thorn bushes and tall grass) tends to be quite dense on these escarpment margins up to the point where the slope becomes too steep and the soil too thin for anything to grow. The central part of the Thabadimasego hilltop was somewhat of an exception to this vegetational density; there overgrowth only existed in patches. About 80 m south-west of the main hilltop's stone wall opening, a small surface scatter of ceramic sherds had been observed and geotagged during earlier exploration of the area during the same field season.

Test pits

Using the geotagged location as a second local datum point, my team and I placed 30 more test pits at ten-meter intervals where ground cover and slope allowed, until test pits repeatedly yielded sterile results (Figure 10). As with test pits on the main hilltop, all finds from this periphery survey were bagged for recovery, and observations were made for changes in stratigraphy. However, little to no soil color changes were evident in this area. Soil composition proved consistently unconsolidated as well (as with the test pits and units excavated on the lower, steeper contours of the main hilltop). As such, these test pits provided little information about depositional history for this area (save, perhaps, that it is disturbed), but the types and quantities of cultural material for each pit were recorded. This perimeter test pit survey did help to confirm that there was significant cultural material presence outside the walled hilltop (more than what would seem random or the result of colluvial deposits), but also demonstrated the limits of its distribution.

Test unit

Following completion of the test pit survey, one 1x1-meter excavation unit was placed near one meter south of the secondary local datum on the site periphery (which turned out to be the general area with the highest concentration of subsurface finds on the periphery). This unit was located in this area for the purpose of gaining depositional information outside the walls for comparison with the units placed

Figure 10 Location of all units and pits, positive and negative, at Thabadimasego

on the main hilltop. As with units on the main hilltop, this unit was excavated to sterility in arbitrary 5-centimeter levels. Planviews for each level and a wall profile were recorded. All recovered finds were bagged.

In-field feedback based on survey results

The NMMAG site register had listed two sites in this general vicinity, so based on the description I decided that these surface scatters were very likely what had been recorded as site 16-A1-31; however, these scatters exist within 100 meters of site 16-A1-13 (Thabadimasego), overlap almost completely in kind with finds from the hilltop, and (as will be discussed later in more detail), additional survey demonstrated that cultural material scatters did not extend further along the escarpment. Given this evidence, it was decided to append this location and its material scatters within the definition of site 16-A1-13, although (as will be discussed in later chapters) differences in both stratigraphy and the aforementioned surficial distribution indicate a probable difference in use of space for this area as compared to the hilltop itself.

Phase III: Escarpment survey

Included among the research goals for this project is the goal of using high-resolution pedestrian coverage of areas surrounding documented sites in order to ground-truth whether surface cultural material distribution really is limited to specific, north-facing promontories of the Mosu Escarpment as described by Samuel (1999). Samuel's (1999) study employed straight, north-south transects at 1-kilometer intervals bearing due south from the Mosu Escarpment edge to the Orapa-Francistown road, which enabled him to sample a large portion of this area and its changing landforms for high-visibility archaeological sites such as stone structures. His survey revealed that the great majority of sites were constrained to the escarpment edge; they were not also scattered across the Southern plateau or the seasonal river valleys which cut through it. This finding accords well with Main (2008)'s series of surveys from the mid-1990s which located a few dozen archaeological sites mostly at or near the escarpment edge, but which had been conducted partly by aerial survey and partly on foot by amateur trainees.

However, during a 2008 site location survey in the area, our crew observed that numerous small artifact scatters were present at the base of the escarpment, sometimes well away from its north-most promontories. Additionally, the NMMAG site register did list a few sites in the area that are not located on the northern-most promontories or isolated hilltops north of the escarpment (but, instead, are located a few hundred meters south of the escarpment edge, or at its foot). The intent was therefore to employ a survey method different from Samuel's, in order to investigate whether a) the escarpment edge sites as they were defined spatially in the site register were accurately described and b) if the material scatters found elsewhere along the escarpment could be explained. The importance of clarifying this point is linked to the understanding of what comprises a site and what uses of the greater landscape can be observed; i.e., if sampling is conducted too narrowly, the potential exists to miss a lot of information.

To address these questions, the 2012 field team conducted a surface survey of the escarpment between sites 16-A1-33/16-1-12 and 16-A1-13. Both the foot of the escarpment (in the first pass) and its edge (on the return pass) were covered, with 10-meter intervals separating each of the four surveyors. Survey transects followed the natural contours of the slopes between the starting and ending points, meaning that the actual distance surveyed was much greater than the bird's-eye straight line one would normally measure between these two points (Figure 11). Ground cover was thornbush forest in the case of both the escarpment foot and its edge above; however, a lack of undergrowth beneath the thornbushes meant that the ground surface itself was highly visible. The goal of this foot survey was to document any surface distribution of cultural material (such as ceramics or lithics as already observed in prior survey and excavation) as well as any natural resources (clay deposits, natural springs, etc.) that would potentially be important to the interpretation of the landscape as a habitable place. The entire path was track-logged with the handheld GPS unit; any cultural finds (and potentially significant natural finds, like clay deposits) were also geotagged. This survey concluded on the plateau of site 16-A1-12, which was marked for further investigation (and whose open, densely-scattered surface was like heaven after pushing through kilometers of thorny brush and finding very little). All in all, a total of approximately 157,000 square meters, covering about five kilometeres in length, was surveyed using this method.

Phase IV: Additional sites

Three other Early Iron Age sites were listed in the NMMAG site register as located within short walking distance (1-2 kilometers) of Thabadimasego. One of these, site 16-A1-31, was determined to be an extension of Thabadimasego itself, as already described in the 'Periphery Survey' section above. The other two sites, 16-A1-12 and 16-A1-33, are both situated along the escarpment about 2 kilometers northwest as the crow flies of Thabadimasego. Site 12 is visible as a dense array of pottery sherds, flaked lithics and the occasional ostrich eggshell bead scattered across a broad, open promontory of the escarpment (these findings are briefly addressed in Chapter 6). This promontory is unique in the area not only for its dense surface scatter but also for its lack of ground cover other than short grasses. Site 33, on the other hand, was recorded in 2008 at the foot of the escarpment (making it one of the few 'downhill' sites in the area) as a surface scatter of pottery sherds located about 100 meters north of the base of the escarpment promontory on which site 16-A1-12 lies. Unlike most of the sites in the South Sowa area, site 16-A1-33 is also situated just south of the local junior secondary school, in a location which experiences daily foot traffic from resident human and domestic animal populations. One of the commonly-used footpaths in this area actually cuts right across the site.

These sites were included in fieldwork for a short survey and test excavation in order to compare stratigraphy between them and Thabadimasego as well as to collect comparative samples of diagnostic cultural materials such as decorated pottery sherds where possible. At each of these sites, as at Thabadimasego, I mapped its perimeter, using the distribution of the surface scatter as a boundary. The perimeter of each site was recorded as a tracklog on the handheld GPS unit. One 1x1-meter excavation unit was placed on each site as well, using arbitrary 5-centimeter levels. At each site, the unit was placed

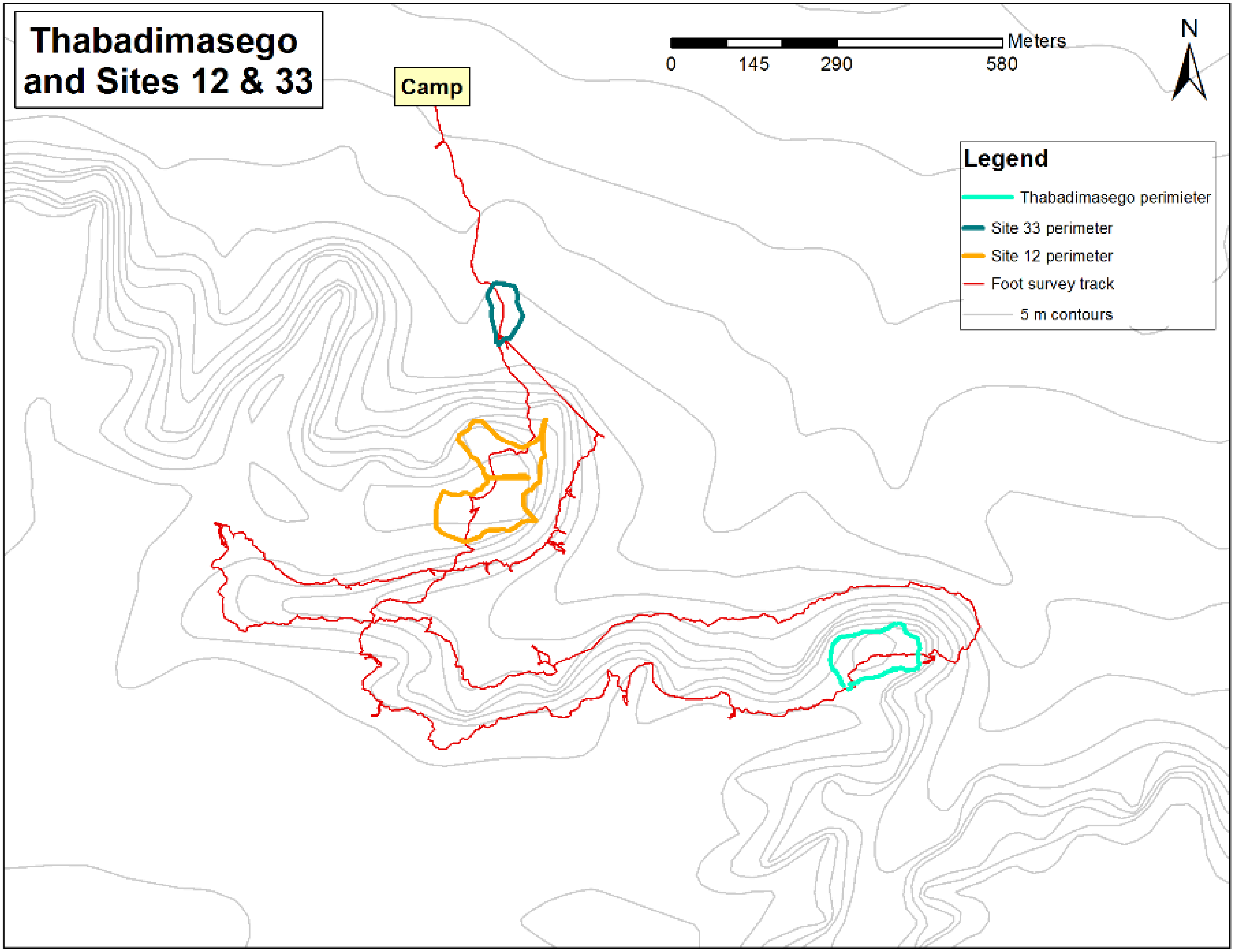

Figure 11 Mosu escarpment survey area

in a central area near a high density of surface material. In the case of site 16-A1-12, the location of the excavation unit was geotagged with the GPS unit. At site 16-A1-33, the location of the unit was recorded in meters north of the permanent NMMAG signpost at the edge of the site, which acted as the local datum. As with units at Thabadimasego, both units were excavated to sterility. Planviews for each level and a wall profile were recorded, and all recovered finds were bagged.

At site 16-A1-33, test pits at 10-meter intervals were also placed (prior to excavating the test unit), also using the NMMAG signpost as a starting point and datum. Investigating this site and its depositional history, as it occupies a unique position on the floodplain, was of particular interest. As with prior test pit surveys, finds were bagged for recovery, and observations were made for changes in stratigraphy. It soon became clear that this site contained a palimpsest of soil deposits that was in all likelihood highly disturbed; the soil horizons were inconsistent across the expanse of the site and shifted frequently below the surface as well. It was decided, based on these findings and based on site 33's proximity to site 12, that site 33 was probably the product of colluvial deposition from site 12.

Phase V: Visits to previously excavated sites

So that I could gain a better understanding of the layout and geophysical setting of Thabadimasego as it compares to previously-researched sites in the South Sowa area, the 2012 field team visited both Kaitshàa (Denbow et al., 2015) and Mosu I (Reid and Segobye 2000a, 2000b) over the course of the field season. Kaitshàa is about 15 kilometers northwest of Thabadimasego on a relatively large promontory directly overlooking Sowa Pan, while Mosu I is further west on one of a series of ridges set a few kilometers back from the pan. In this area, the Mosu Escarpment begins to blend into the surrounding topography. At both sites, the perimeter (as defined by the surface scatter extent) was mapped using the handheld GPS to create a tracklog of each perimeter. At Kaitshàa, as at Thabadimasego, the surface scatter more or less coincided with the contours of the hilltop and decreased in frequency where the contours abruptly increased in steepness at the hill's edges. Mosu I, however, does not lie on an isolated promontory of the escarpment like those two sites, and the ground cover there is very dense as well; for these reasons navigating the site and distinguishing its limits proved problematic. Multiple visible surface scatters were geotagged at Mosu I to accommodate this uncertainty. At each site, photographs were taken of surface finds (which were not collected) as well as of the viewshed.

Phase VI: Landscape survey

The final phase of fieldwork involved conducting searches further afield (relative to the archaeological sites in question) within the South Sowa area for natural resource locations and observations of their present-day uses. The purpose of this was to identify what, if any, natural resources were available in the area that may have been useful to an Early Iron Age community (in addition to those, such as the location of salt and water, which had previously been reported in literature). This information contributes to an understanding of Early Iron Age sites' position within the South Sowa landscape.

Clay deposits

One of the field team members, after talking with some female residents of the village, shared the observation to that the source of the brightly-colored and elaborately-decorated house 'paints' in the village was, in fact, clay deposits found throughout the area. Our neighbor in the village, who was also employed as our camp attendant and cook at the time, agreed to take us around to visit some of these deposits, which are actively mined by village residents and considered a unique and proprietary resource, on the condition that we not disclose their specific locations.

This walking survey was conducted over the course of one day. While visiting the mines (which are in fact shallow pits excavated from the surface), the field team was allowed to collect small samples of the various clays, which range in hue from green to white to purple to yellow to the more usual reds and browns. The field team also talked to several residents of Mosu to ask about how the clay was used (and were granted permission to photograph a few houses painted with the clay). We learned that the clays are used, in addition to house paints, as material to make pieces of art that are sold by women entrepreneurs. We were also told that one woman, who resides in Letlhakane and is related to people in Mosu, uses the clay actually to make fired ceramics, but I was never able to verify this.

Wells, dams and boreholes

During the last few days of our field season, the field team visited briefly with families on two cattle posts to learn about their wells. We also visited two of the dammed natural springs in the area and talked to people about how they are used today. Though brief, these visits yielded the following observations:

- Dammed springs are used by livestock, not people, except in times of severe drought.
- Locations for wells are identified by contracting surveyors, or by observing surface water extents. Wells are dug in dongas (riverbeds) where water is closer to the surface.
- The wells are dug by hand, using pickaxes and shovels, and can take up to 4 months to dig in a relatively shallow water table (about 20 feet down to water). Dynamite may be brought in to breach some of the rock. Water is then pumped up to cattle troughs using a generator.
- The water is not salty (or relatively low in salt) and fairly plentiful; multiple wells can be placed on the same riverbed.
- The wells must be regularly maintained to keep them free from sediment build-up. The mouth of the well is lined with rocks and plaster to keep the soil from washing away during rains.

The cattle posts we visited were west of Mosu, south of the Mmatshumo road about halfway between the road and the foot of the escarpment, on a sloped area with low ridges. Riverbeds themselves tend to be around 5 meters deep, and occur near large rocky outcrops.

3.5 Post-excavation procedures

Summary of post-excavation activities

After the conclusion of the field season, I spent several weeks (October - November 2012) at the archaeology lab of the National Museum in Gaborone on post-excavation tasks, including cataloging, photography, and sample preparation for export. These activities will be described in further detail below.

During the spring of 2013, while back at Michigan State University, I collected additional morphological data from the shell, glass, metal and lithic artifacts I had exported. I also submitted three charcoal samples to the University of Arizona AMS lab for dating: two from units at Thabadimasego and one from site 16-A1-12. In July 2013 I returned to the National Museum in Gaborone to conduct flotation, complete final data collection on shell and lithic assemblages, and prepare the faunal remains for export to the University of Pretoria for further analysis. Arrangements were also made during this time for parts of the assemblage, including glass, faunal and ceramic items, to be analyzed by a number of consultants. In fall 2013 the glass bead assemblage was sent to Marilee Wood for facies identification, while in May 2014, LA-ICP-MS analysis was conducted on the beads by myself and Laure Dussubieux at the Field Museum in Chicago. Further arrangements are being made for the completion of the ceramic analysis. Conversion and 'cleaning' of the spatial data into a standardized digital format compatible with ArcGIS began in early 2013 and continued until late 2014.

Goals for post-excavation

The goals for post-excavation were as follows:

- Prepare materials for long-term storage in the NMMAG collections
- Inventory/ catalog of all recovered finds
- Photograph samples of finds
- Prepare samples for analysis to answer research questions

Cataloging and curation

During fieldwork, a running inventory of recovered finds was kept throughout all survey and excavation procedures. Each batch of finds from a unit level, test pit or [other provenience] was recorded in the inventory, called the lot book, and assigned its own unique lot number. The lot book recorded the provenience, types of finds, date of recovery, and excavators for each batch. Lot numbers were also recorded on artifact find bags and data collection forms where appropriate, for cross-referencing.

Inventory during the post-field phase, therefore, primarily involved rectifying this existing record and collecting new data fields for several find types to increase the specificity of the record. During the fall of 2012 and summer of 2013, the following activities took place:

- Washing select finds, including shell beads, bone, and the remainder of the ceramics. Many of the ceramics had already been washed while still in Mosu by the crew to fulfill their Saturday half-day work requirement (which is considered a standard part of the work week for a field crew in Botswana).
- Sorting level bags into their constituent item bags (i.e., one level bag containing all finds from a level would be sorted into multiple bags each containing one of the following: glass, ceramic, metal; etc. Usually these smaller bags were grouped together into a larger general bag for safekeeping.
- Counting and weighing finds
- Refined description of find categories (i.e., for a find of ‘shell’ or ‘OES’ recorded in the lot book, the catalog would record number of fragments, number of whole beads, number of broken beads, etc.)
- Photographing ceramics, including all decorated sherds and a sample of undecorated sherds. The profiles of all decorated sherds were photographed as well during a return trip in 2014.
- Selecting and preparing radiometric samples
- Procuring export permits for selected materials
- Sorting, description and photography of botanical remains
- Processing of soil samples using a small handheld flotation system

Although the cataloging process itself was fairly extensive and recorded much descriptive information that is useful for answering research questions about diet and economy at Thabadimasego, several categories of artifacts were chosen for follow-up analysis based on their perceived importance to the Early Iron Age way of life. The following chapter covers in detail the analytical methods which were used for the artifacts which were subject to further inquiry.

Chapter 4 Analytical methods

4.1 Introduction – overview of methods

Following the completion of fieldwork and the post-excavation cataloging process, a number of follow-up evaluations were conducted on several components of the artifact assemblage recovered from Thabadimasego. The work on Thabadimasego's assemblage was on many occasions a collaborative one. Some of the work I was not qualified to do myself, such as faunal identification, and some of it was done side-by-side with specialists and research assistants. Where this is the case for a given analytical method, the collaborators' names, affiliations, and roles in the project are stated and the appropriate credits provided. I believe it is a strength of this research project to have offered the opportunity to develop so many working partnerships with a multitude of talented people.

While material was also collected during fieldwork at sites 12 and 33 (the sites adjacent to Thabadimasego), it was not included in subsequent analyses (except for one charcoal sample from site 12 submitted for AMS dating, discussed below). The single 1-by-1-meter unit excavated at each of these sites provided nowhere near enough information to make analysis of these sites' assemblages comparable in detail with the work planned for Thabadimasego. However, sites 12 and 33, and their cultural materials, should be revisited at some future date (and hopefully in some future excavations).

Generally, analysis was done categorically according to the class of artifact – the ceramics, the faunal remains, the glass beads, etc., were all grouped together by their respective material and worked on in batches. Hence, the remainder of this chapter reads as a series of individual reports. The last section of the chapter will offer a brief summary of the results gained from each analysis. Due to its level of detail, the spatial analysis (including a consideration of spatial clustering of specific artifact types) has been placed in the following chapter.

4.2 Ceramic analysis

Archaeologists working in Southern Africa generally accept ceramic facies as an indication of group identity, i.e. of culture groups that are limited to a certain temporal and geographic distributions (Huffman 2005, 2007; Sadr and Sampson 2006), although there is some argument over the nature of what social or ethnic information was intended to be communicated (Pikirayi 2007). As such, identification of the facies present in an assemblage provides a useful point of reference when determining a site's chronology. In Southern Africa, standard methods for identifying ceramic facies include determining the shape/ profile of the vessel, and the type and placement of the decorations. These major attributes together make for different facies, many of which are accepted as diagnostic across Southern Africa. Due to a recent rise in functional and compositional analyses of ceramics, such as the optical petrographic study of ceramic tempers by Wilmsen et al. (2009), lipid residue analysis by Collins (2013), and functional analysis of temper and paste by Ashley (2013 pers. comm.), the current model for characterizing ceramics has the potential to change considerably.

Due to the limitations of time and resources of this study, however, the standard technique of identifying facies has been used. Here, the ceramics are considered as an indicator of cultural type to serve as a diagnostic marker of comparison with other contemporary sites.

Methods

In order to identify the ceramic facies present in the assemblage recovered at Thabadimasego as closely to the standard method as possible, the following information was collected for decorated rims and decorated body sherds:

- Impression type (e.g., comb-stamping; linear incision)
- Motif (e.g., multiple horizontal lines of comb-stamping)
- Layout (position of motif relative to the rim, e.g., upper rim; neck; etc.)
- Presence/ absence of burnishing or paint

This data was collected by the researcher and two research assistants. Ian Harrison, an undergraduate student at Michigan State University who received training in pottery identification prior to participating in this study, and Tsholo Selepeng, a graduate of the University of Botswana who completed her bachelor's thesis on Iron Age pottery. By way of comparison, a sample of decorated sherds from the Kaitshàa surface collection was also examined. Although the ideal characterization of Southern African pottery, according to Huffman's (2007) *Handbook to the Iron Age*, includes reconstruction of vessels to assess their shapes, sizes, and possible functions in addition to examining decoration motifs and layouts, in practice vessel reconstruction is not always possible. In this case, it proved to be beyond the means of the study to attempt a full refit study. Quantitative data, such as sherd thickness and vessel size estimates from rim curvature, was also not collected. Although this information too is of interest for the assemblage, it was not considered critical information for this study because it is not typically incorporated into standard facies determination techniques. The spatial component of the pottery assemblage – that is, where and in what contexts pottery clusters at Thabadimasego, will be discussed in Chapter 5, which covers all the spatial analysis.

A facies designation was assigned to each sherd based on the combination of the attributes listed above, using the images and descriptions of standard facies published in Huffman (2007). Additionally, the face and profile of each rim sherd, as well as a small selection of unusual body sherds, were photographed. A sample of sherds bearing various motifs were also drawn to highlight further the range of decorations present in the assemblage. Each sherd was labeled with its provenience information with permanent ink. Additionally, most sherds were washed, in particular to reveal decoration details and/ or presence of burning, paint, etc. However, a small sample of undecorated body sherds was set aside unwashed for future potential lipids analysis.

Results

A total of 277 decorated rim and body sherds from Thabadimasego were examined, along with another 20 decorated rim sherds from Kaitshàa's surface scatter. It was discovered that 20 decorated sherds from the Thabadimasego assemblage, all of which had previously been inventoried and photographed, were missing from the collection. Despite several searches, these sherds could not be located. However, a tentative facies designation was assigned to them based on the photographs taken in 2013. Another 11 sherds had been stored in the incorrect unit/ level bag (as indicated by the photographs) and could not be reconciled with their correct provenience. These sherds were rejected from the sample. For an overview of quantities of types of sherds present in the assemblage, see Tables 1 and 2 and Figure 12.

Of the 297 sherds examined from both sites, the great majority appear to be fragments of Zhizo-style vessels (Figure 13). The Zhizo facies has been documented at dozens of late first-millennium sites in eastern Botswana, western Zimbabwe, and the Shashe-Limpopo river basin of South Africa. This facies is characterized by the presence of single or multiple bands of comb-stamping, bounded by either horizontal linear incisions or additional lines of comb-stamping, along the lower rim and neck of a vessel (Huffman 2007:145). Graphite burnishing or red paint may also be present occasionally, as was seen in this assemblage.

A firm designation of facies, based not only on impression type and a complete motif but on layout as well, could only be made for 12 of the sherds. The remainder were classified as 'probable Zhizo' (or probable other) given the incompleteness of the decorative motif (in the case of rim sherds) or due to an unclear position relative to the rim (for body sherds). However, these 256 'probable Zhizo' sherds show a strong similarity in both impression and motif to the established Zhizo facies as compared to any of the other facies documented in Huffman's *Handbook*, so even a designation of 'probable' is made with reasonable confidence. Seven of the Thabadimasego sherds (six body sherds and one rim sherd) proved to be unidentifiable based on the low integrity of the decorations present. Another two sherds possessed motif and impression types atypical of the Zhizo facies. The best guess for these are Ziwa and Eiland respectively.

The geographic and temporal ranges of Eiland- and Ziwa-style pottery differ from that of Zhizo-style pottery. Ziwa pottery is associated with very early settlements (roughly 300-550 AD) in central and Southern Zimbabwe (Huffman 2007:137). Eiland pottery has been documented in south-eastern Botswana and north-eastern South Africa for around 1000 - 1300 AD (Huffman 2007:227). Zhizo-type pottery, on the other hand, is primarily documented in eastern and south-eastern Botswana, south-western Zimbabwe, and South Africa near the confluence of the Shashe and Limpopo Rivers, for the period between 750 - 1050 AD (Huffman 2007:145).The Eiland-style rim sherd in particular deserves some attention for its unusual thinness (as well as its unexpected presence in an otherwise uniform assemblage). While the rest of the decorated pottery sherds were about one to two centimeters in thickness, this sherd is about three millimeters thick. Its presence as an isolate raises a few questions about both exchange and site formation (Figure 14).

The predominance of Zhizo-type sherds at Thabadimasego is consistent with both the AMS dates obtained from the site (see Table 5, this chapter) and with contemporary, regionally contiguous sites in eastern Botswana, including Bosutswe's early phase of settlement, Mosu I, as well as Kaitshàa (Reid and Segobye 2000; Denbow et al. 2008; Denbow et al. 2015). A Zhizo assemblage could indicate cultural ties to the east (rather than to the west, with the Kalundu Tradition and with the Tsodilo and Okavango sites. The Kaitshàa sherds, although far fewer in number (and from a less reliable surface provenience), had a similarly consistent range of decoration types. About half of the sherds examined were designated as 'Zhizo/Leokwe' (Huffman distinguishes these as separate facies, but some disagree - Denbow, personal communication) with the remainder designated either as Zhizo (6) or unknown (3). What little has been published about Kaitshàa indicates that its phases of occupation were longer than those at Thabadimasego - its deposits are much deeper and contain greater array of materials, and are associated with a wider range of dates (Denbow et al., in press). Despite the scarcity of definitive information of this type for sites in the South Sowa area, the consistencies in pottery types (as well as radiocarbon dates) support the idea of a related group of settlements occupying the area during the late first millennium AD.

Overall, the pottery from Thabadimasego is quite consistent in style. The few sherds that are inconsistent with the chronological or geographical ranges of Zhizo pottery could benefit from further analysis. Their presence could indicate trade activities, re-occupation of the site at a later date, or some kind of intrusive element. Since, however, they represent such a small percentage of the assemblage, their presence does not much influence the picture of Thabadimasego as a late-first-millennium AD occupation with a Zhizo cultural affiliation.

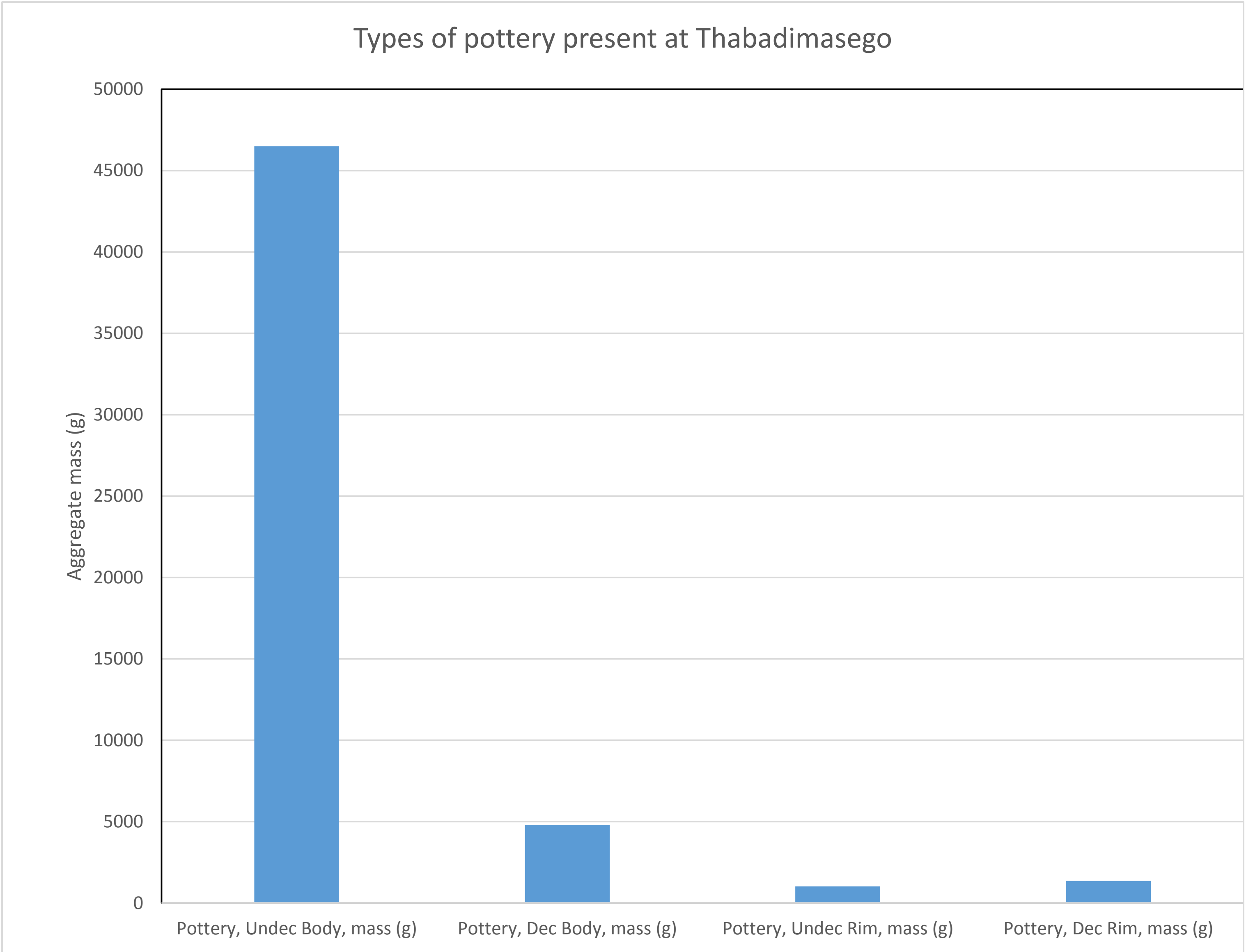

Figure 12 Summary of pottery types present at Thabadimasego

Figure 13 Examples of Zhizo pottery from Thabadimasego

Figure 14 Pottery designated as Ziwa (L) and Eiland (R) from Thabadimasego

Table 1 Counts of sherd types

	Decorated body sherds	Decorated rim sherds	Total
Thabadimasego – units	216	19	235
Thabadimasego – STTPs	37	5	42
Kaitshàa	0	20	20
Total	253	44	297

Table 2 Zhizo sherds

	Zhizo	Probable Zhizo	Other	Unknown
DB (Thabadimasego)	4	242	1	6
DR (Thabadimasego)	8	14	1	1
Thabadimasego total	12	256	2	7
Kaitshàa	6	11*	0	3
		* or Leokwe		

4.3 Shell bead analysis

Ostrich eggshell (OES) beads are typically associated with hunter-gatherer production and use for both archaeological and contemporary populations. OES beads appear in assemblages in both East and Southern Africa as early as the Middle Stone Age (Henshilwood et al. 2004; D'Errico et al. 2005) and are a common find in Later Stone Age assemblages across Southern Africa (Walker 1998; Deacon and Deacon 1999:107-127; Mitchell 2004). The oldest known OES bead In Botswana is a broken blank from Later Stone Age deposits at the Tsodilo Hills White Paintings Shelter. The broken blank was directly dated by AMS to 24,510±300 BC (Robbins 1999:11-16). Historical and present-day San communities of Botswana and Namibia have likewise been known to make and wear OES beads strung as necklaces, headdresses and other forms of adornment (Lee 1979; Howell 2000). Today, shell bead ornaments are primarily worn in special circumstances as part of 'traditional' or ceremonial clothing, and they are also produced for sale to tourists. Examples of some OES and *Achatina* beads can be seen in Figures 15 and 16, below.

Shell beads continue to make regular appearances in LSA assemblages during the later Holocene after the introduction of food production, and are a component of many herder and Early Iron Age assemblages as well (Smith et al. 1991; Tapela 2001; Dubroc 2010). This has given rise to the question of what their presence indicates in the context of herding and farming tradition.

Jacobson (1987) created a provisional typology of OES beads based on bead diameter for several sites dating within the last 3,000 years in central Namibia. He distinguishes three types of beads: one, the smallest, associated with pre-herding LSA assemblages; another associated with LSA assemblages contemporary with herding; and a third, the largest, associated with herder assemblages themselves. Jacobsen draws the further conclusion that style differentiation of bead adornments between the communities may have been a form of persistent social identity differentiation as the two communities coexisted over the centuries (1987:56).

A. B. Smith et al. (1991) draw a similar conclusion for hunter and herder signature assemblages for several sites on the South-Western Cape of South Africa. They also note that size is among the distinguishing characteristics of the OES beads; hunter-gatherer sites have beads with small diameters while herder sites have large beads. Their study, which comprises a series of sites spanning the last three millennia before European settlement, yielded a picture similar to Jacobsen's of separate economic groups with the maintenance of separate cultural identities: hunters and herders who existed side by side in the south-western Cape. The authors use these findings to bolster Smith's premise that hunters and herders would have maintained separate social and ethnic identities during prehistory, despite their co-occupation. This is based on the notion that a herding way of life involves socioeconomic factors such as individually-owned property that would have prevented egalitarian hunting societies from "making the leap" to food production (A. B. Smith 1990).

The bead-size and subsistence-identity line of inquiry was picked up by Tapela (2001) for OES bead assemblages in Botswana for both LSA and Iron Age contexts. Helpfully, the article reviews much relevant literature on OES bead production and presence/frequency in various contexts for the last 2000 years. Tapela (2001: 62) describes the following general trends:

> "Overall, current evidence suggests that in some parts of Southern Africa during the last 2000 years, ostrich eggshell bead sizes were a marker of ethnic and economic identity (southwestern Cape and Namibia). In some parts bead sizes may have increased in time as fashions changed (Namibia). Elsewhere, ostrich eggshell beads seem to have been exclusively produced by Late Stone Age hunters and traded to Iron Age herders (Natal). In other parts ostrich eggshell beads may have been important trade items produced by both hunters and herders (Botswana). In some places bead sizes changed but the significance and meaning of the change remains enigmatic (Zimbabwe)." In addition, a number of large OES beads were recovered in an LSA context at Mogapelwa, a site in northwestern Botswana near Lake Ngami. As Robbins et al. (2009) state, "One of the beads measuring 7 mm in diameter was directly dated by AMS to 2618±43 BC. This large bead substantially pre-dates the arrival of domesticated livestock in Southern Africa."

Tapela's study examined 819 beads were examined from three Later Stone Age sites and 5 Iron Age sites, including Kaitshàa and Mosu I in the South Sowa area. He drew a similar conclusion to those of Jacobsen (1987) and Smith et al. (1991), seeing a statistically significant distinction in bead diameter between Later Stone Age sites and 'small' versus 'large' herder sites (Tapela 2001:67).

These results are not universally recognized, however. In another study of several sites on the Geelbek Dunes in Namibia, Kandel and Conard (2005) found a less-robust trend towards smaller OES beads associated with earlier sites, but also that the tool and faunal assemblages associated with later sites (and their larger beads) obfuscate who was using the beads: at the time of their publication, no domesticated fauna was found in association with the larger beads, and lithic tool assemblages presented similar types and frequencies as at smaller sites. While overall the authors concluded that Jacobsen's model could not be viewed as universal, Kandel and Conard maintain the fundamental connection

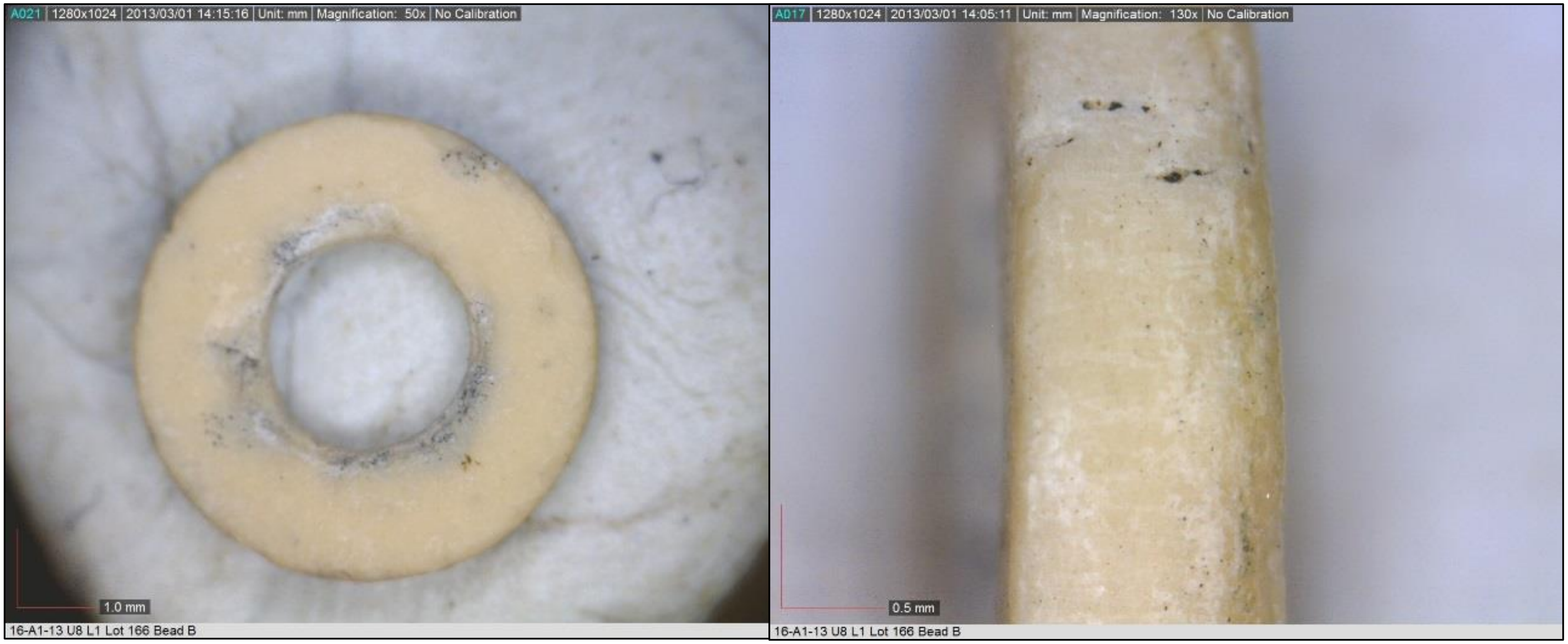

Figure 15 OES beads from Thabadimasego

Figure 16 Achatina beads from Thabadimasego

between hunter-gatherers and small-beads, and the appearance of larger beads with settlement of the area by pastoralists (2005:1720).

Finally, Dubroc (2010) situated the shell bead assemblage from Bosutswe, an Iron Age site, within this discourse. Bosutswe is a hilltop site in eastern Botswana whose occupation spans roughly a millennium from 700 -1700 AD; this period of time includes both early and later manifestations of the Iron Age (Denbow et al. 2008). Like Tapela (2001), this study is concerned with addressing the question of whether bead diameter correlates with other material types significantly enough to make interpretations about the economic practices, and thereby the ethnic identities, of the beads' makers and users (Dubroc 2010:48). Importantly, Dubroc examines not only the ostrich eggshell beads and fragments, but other species of shell as well including river mussel and *Achatina* (a genus of land snail native to many parts of sub-Saharan Africa, including Sowa Pan's margins and other relatively well-watered parts of Botswana). Dubroc finds that every excavation level contained a variety of sizes of OES beads, with "no clear patterning in time or provenance," (2010:48) despite the fact that Bosutswe's well-dated soil horizons indicate an undisturbed depositional history (Denbow et al. 2008). Furthermore, several units on the site contained beads at different stages of production, also in a range of sizes, indicating that beads of all size were produced on the site itself. Dubroc (2010:48-49) makes the further observation that:

> "Many of the smallest OES beads have the largest hole diameters, thinnest walls, and are the most uniform and polished. This suggests that they were worn for a long period of time. I would suggest that these beads were curated and worn by multiple generations before being lost to the soil. For example, a present-day analog would be that in some Southern African Bantu groups mothers remove their beaded adornments at the time of their husband's death and pass them along to their daughters (Carey 1998: 90)…. Many of the archaeologists currently working in Southern Africa fail to acknowledge the role of many artifacts as heirlooms for future generations. One possible reason could be that curated items would test the utility of tight-knit stylistic

chronologies based on bead size. Therefore, explanations concerning the ethnic or cultural makeup of a site's inhabitants centered on the style of items like beads become less stabile or matter-of-fact. The situation becomes even less clear when one factors in the presence of long distance trade and the possibility of a multi-ethnic population".

Achatina species are found widely in Southern Africa. The empty shells dot the Mosu escarpment today, and are sometimes picked up by local residents for use as decorations on house exteriors (personal observation). It is unclear how much of the shell bead assemblages studied by, e.g., Tapela (2001) may in fact be *Achatina* instead of OES; no type of shell apart from ostrich is mentioned in Smith's (1991) study or in Tapela (2001) and Kandel and Conard (2005). To judge from both the Bosutswe and the Thabadimasego shell assemblages, *Achatina* may not be uncommon (at least in Botswana), and other species of shell such as river mussel may be included as well. van Zyl et al. (2013) also makes mention of the presence of *Achatina* remains among faunal assemblage in the Early Iron Age levels at Xaro I, a site on the Okavango Delta in northern Botswana, and notes that they may have been both exploited as a food source as well as a known source of bead material. *Achatina* species in Ghana are, in fact, farmed today and sold as a protein source (A. Logan, personal communication, 2015). Whether different species of shell served different roles or functions in Southern African Early Iron Age contexts, however, remains unclear until further studies address these issues.

Shell components of Iron Age assemblages in general are underreported in that, while shell finds may be included in the initial catalogs and site reports from an excavation, they tend to be excluded from the broader behavioral and cultural interpretations. This is evident from the major survey literature such as Mitchell's (2002) *Southern African Archaeology*; Mitchell and Whitelaw's (2005) "The Archaeology of Southernmost Africa from C. 2000 B P to the Early 1800s: A Review of Recent Research"; and Huffman's (2007) *Handbook to the Iron Age*. Despite this, it seems apparent that the frequency with which they do occur in the Early Iron Age (as reported in Dubroc 2010) merits their consideration as social or economic objects for Early Iron Age communities in their own right, rather than just evidence of hunter-gather presence.

Methods

In light of this, data were collected from the Thabadimasego shell beads following a similar procedure to the one described in Dubroc (2010). Each bead or fragment was identified as to taxa (ostrich, *Achatina*, mussel, or other) using a number of defining attributes such as color and texture. Bead diameters were measured to the nearest tenth of a millimeter (although previous studies used whole millimeters, it was felt that the very small size of the beads (many were 3mm or less in total diameter) warranted a smaller unit of analysis. Unworked shell fragments were measured as well; as these were generally rectangular or triangular in shape, the maximum length and width of each fragment were recorded. Beads were marked as whole or broken, and also characterized by their condition, as either blanks (bead-shaped with sharp edges and no drill hole), jagged (sharp edges with a drill hole), rough (edges smoothed but still irregularly shaped), or finished (edges smooth and circular). Finally, the overall condition of each bead or fragment, whether burned, chipped, worn or otherwise, was noted. For the full results of the data collection, see Appendix B.

Shell beads results

Following classification of the shell beads, exploratory data analysis (in the sense of Tukey 1977) was performed to illuminate trends in the data. Based on the results of prior studies (e.g., Jacobsen 1987; Tapela 2001; Dubroc 2010), particular attention was paid to the internal and external diameters of each bead. These two measurements were converted into a ratio for each specimen so as to compare with other attributes such as degree of completion and burning. Boxplots were produced for bead ratios (by completion, burning, and material type) in order to display the distribution of data as well as identify outliers. Scatter plots were likewise produced for these combinations of variables. Only a few trends were clearly visible in these data displays: primarily, that two overlapping but distinct distributions of bead diameter ratios existed for ostrich and *Achatina* beads. It also became clear that degree of completion (whole or broken) required further subdivision as to whether broken beads had more or less than 50% of the bead present; less than 50% present meant that bead diameter ratios could not be measured since the total width of the bead fragment was a chord of the circumference but not the bead's true diameter.

The ratio of external to internal diameter was calculated for each bead because of the sizable differences in internal diameter lengths for beads of the same external diameter: beads with larger internal diameters have a much lower volume (i.e., they contain substantially less raw material) than those with smaller internal diameters. Presumably these beads were worked longer than the small-internal-diameter beads, and they could be strung on a wider variety of thread/ fibers. It is not known at this stage whether these distinctions are behaviorally or socially significant for Later Stone Age or Early Iron Age peoples. However, as they have the potential to inform variations in both production and use of the beads, these data were collected. Regardless of which metric (external diameter only, or external- to- internal ratio) is used, the differences between ostrich and *Achatina* shell beads remains statistically significant. For the sake of using the most conservative measure, diameter ratio is used in this study for discussion of results.

For further analysis, the following specimens were excluded from the sample: 1) shell beads from Sites 12 and 33 (so as to narrow focus to a single, well-represented site); 2) beads with less than 50% diameter present; 3) irregular or jagged-edged (unfinished) beads; 4) unshaped fragments; and 5) beads of the 'river mussel' or 'other' categories (as the sample sizes from these were too small to be representative). For the remaining sample (which comprised ostrich and *Achatina* shell beads, burnt or unburnt; either whole or greater than 50% present, from Thabadimasego), the specimens were subject first to tests of equal variances and then a student t-test (assuming either equal or unequal variances, depending on the results of the first test) in the following combinations of variables:

- Material type - diameter ratio

- Material type - degree of bead completion
- Material type - burning present
- Diameter ratio - burning present (ostrich shell beads only)
- Diameter ratio - burning present (*Achatina* shell beads only)
- Diameter ratio - degree of bead completion (ostrich shell beads only)
- Diameter ratio - degree of bead completion (*Achatina* shell beads only)

The tests of equal variance as well as the t-tests initially used only whole beads, but were subsequently re-run to include both whole beads and those with greater than 50% present. No differences were found in the results between these two groups, therefore the results discussed below rely on the larger sample (including the broken, greater-than-50% beads).

Summary of findings

Significant results ($p < .05$) from the t-tests were obtained for material type vs. diameter ratio, and for diameter ratio vs. burning present (for *Achatina* shell beads only). Degree of completion did not make a difference: whole and broken beads for both OES and *Achatina* shell had similar distributions. Burned beads had a different distribution for *Achatina*, but not for ostrich eggshell. Considering that only 47 burnt *Achatina* beads were present in the sample, it is not easy to conclude that this differentiation means anything; further comparison with other assemblages would be needed. On the whole, material type clearly accounted for the greatest amount of variation. *Achatina* shell bead ratios have a smaller mean as well as a smaller range of distribution than do ostrich eggshell bead ratios, although a histogram of their distributions demonstrates considerable overlap. The bead size distributions for each type of shell was much more distinct when plotted either for internal or external diameters only, but regardless of which metric was used, *Achatina* shell beads showed a continuous distribution of sizes, while ostrich eggshell beads showed a somewhat bimodal distribution.

It remains difficult to contextualize these findings within comparable Southern African assemblages, since only one other study (Dubroc 2010) addresses the presence of different species of shell among the beads. In terms of bead size, Dubroc follows Tapela (2001) in distinguishing between ‘small’ beads (2 - 6 mm diameter) and ‘large’ ones (greater than 6 mm in diameter). The ostrich eggshell beads at Bosutswe fall into both of these categories with a fairly continuous distribution in diameters (2010:34), which speaks to the fairly arbitrary division between sizes. Dubroc unfortunately does not go into detail about the range of diameters for *Achatina* shell beads.

As for shell items that are not finished beads, the quantities of bead blanks and unworked fragments appear to be much lower than in the Central Precinct of Bosutswe, where these numbered in the hundreds (Dubroc 2010:38). The Central Precinct at Bosutswe is, furthermore, centuries younger than Thabadimasego according to its radiocarbon determinations (Denbow et al. 2008), so it does not make for a close comparison. On their own, the ostrich eggshell blanks and fragments of Thabadimasego do not appear to indicate any kind of long-term bead manufacturing activity. Their presence in small and scattered quantities could, however, be indicative of occasional bead production occurring as an itinerant activity on the site. One further observation can be made about the shell bead assemblage. Whereas, at Bosutswe further to the south, *Achatina* beads would have been ‘exotic’ imports (Dubroc 2010:45), the ready availability of empty *Achatina* shells dotting the Mosu landscape speaks to the local availability of this species for occupants of Thabadimasego.

4.4 Metal analysis

Metal objects and their fabrication, as hallmarks of ‘Iron Age’ culture types, have been studied from a number of angles since the inception of the presently-accepted Southern African chronological sequence (Phillipson 2005). Today, the analysis of metal artifacts may include chemical and micro-morphological studies (Miller and van der Merwe 1994; Miller 2001; Miller 2002; Miller and Killick 2004; Killick 2006; Killick 2009), examinations of the social contexts of metallurgy such as craft specialization

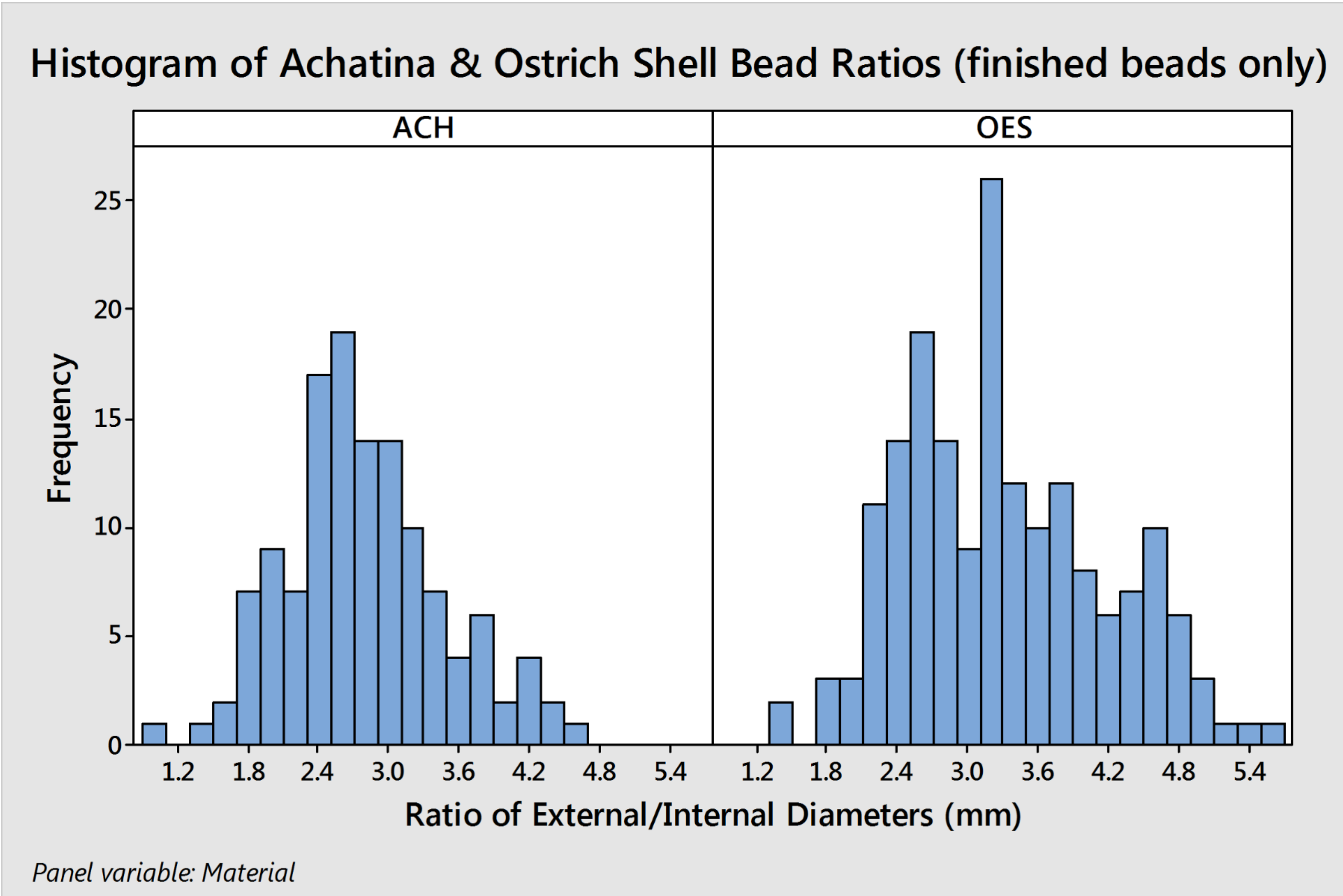

Figure 17 Diameter ratio for shell beads at Thabadimasego

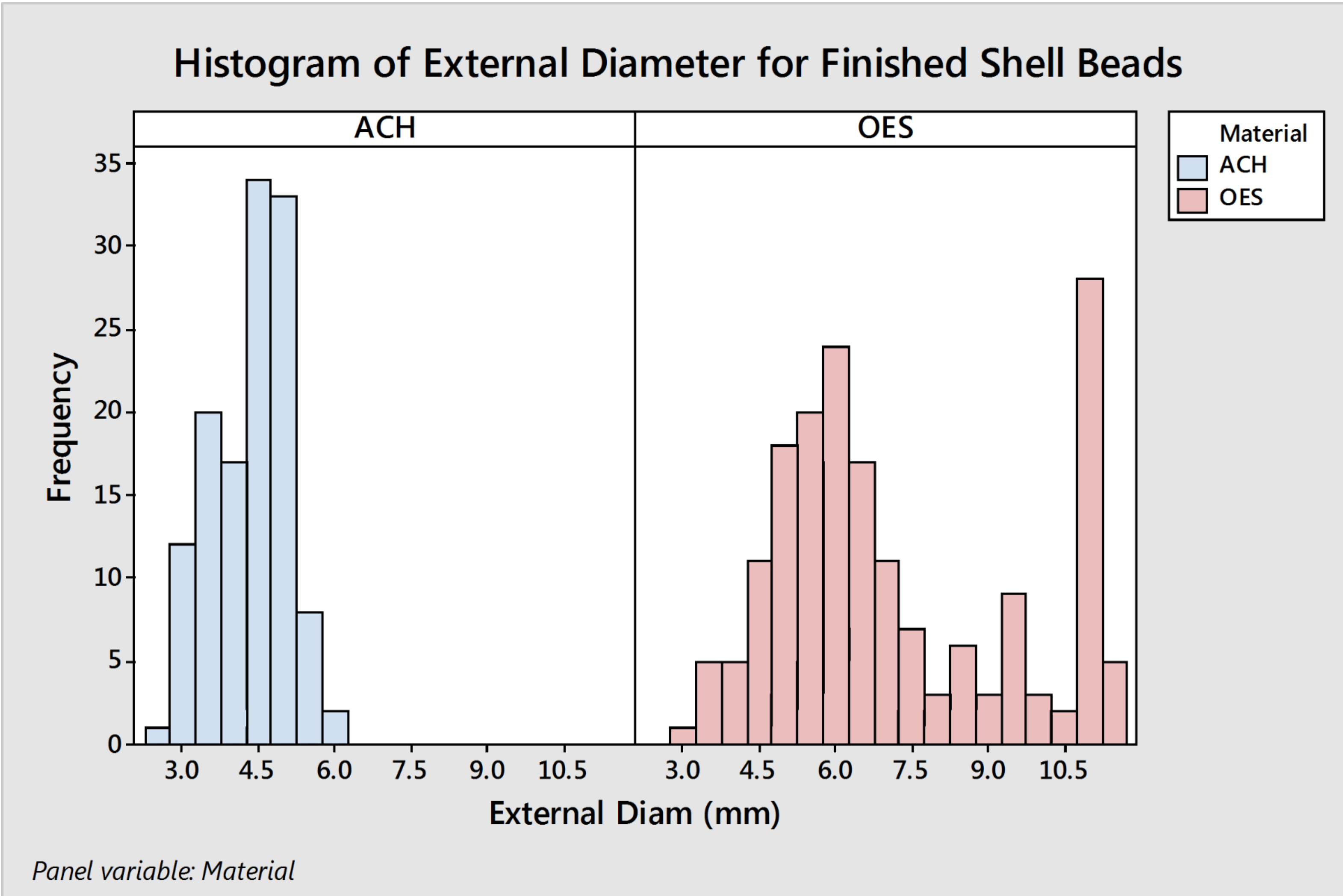

Figure 18 External diameters of shell beads at Thabadimasego

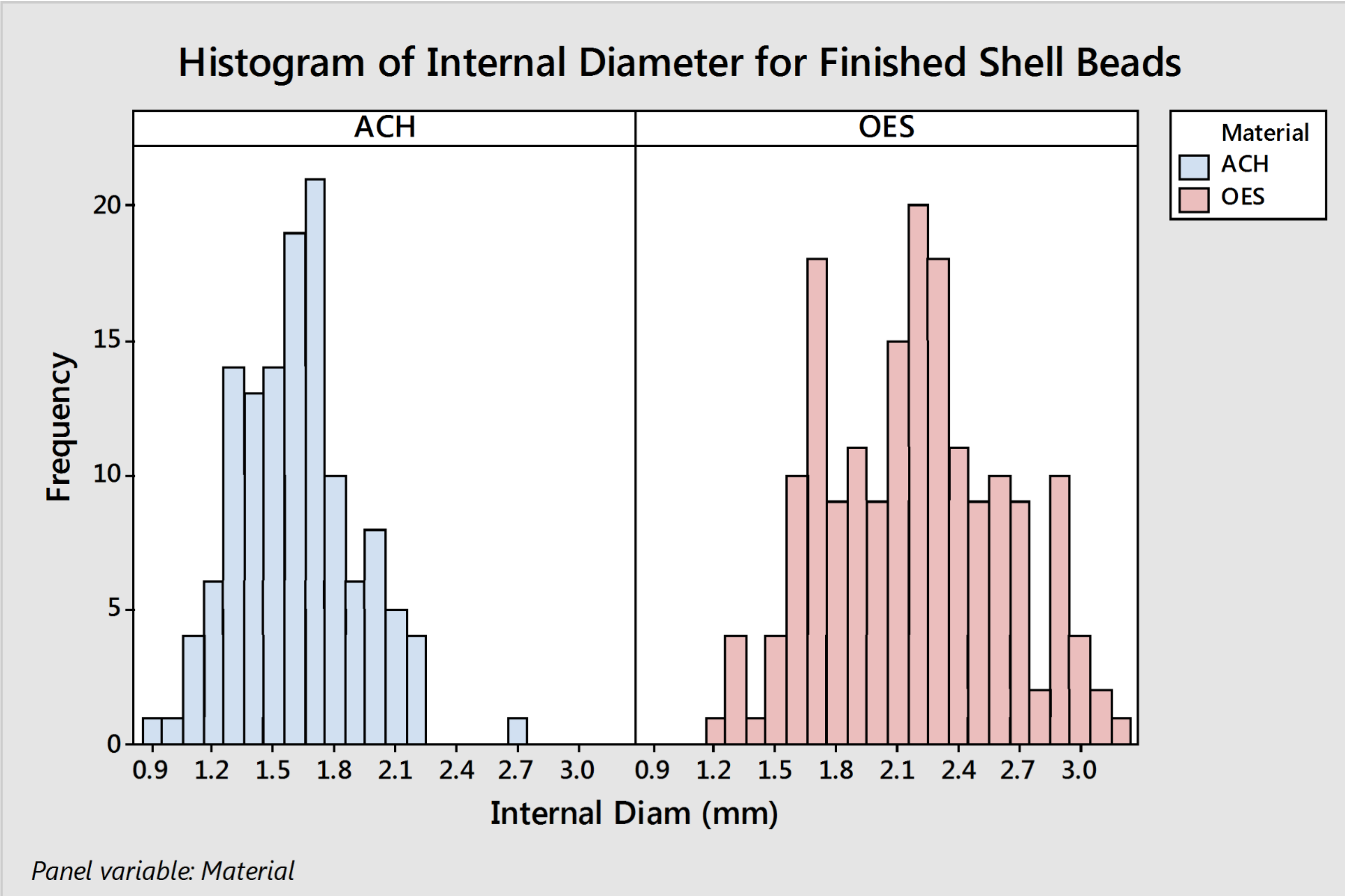

Figure 19 Internal diameters of shell beads at Thabadimasego

(Chirikure 2007) and its role in ritual and political processes (Calabrese 2000; Huffman 2001; Chirikure 2004), and comparative analyses of the spatial dimension of metal production (H. J. Greenfield and Miller 2004). For a review of general trends in the development of metal use in sub-Saharan Africa, see Childs and Herbert (2005) and Killick (2006, 2009).

Metal items overall comprise a relatively small component of most Southern African assemblages, with decorative objects (beads, bracelets, earrings, etc.) representing by far the most frequent types of metal finds (Denbow and Miller 2007). Agricultural implements such as hoes or adzes, or other tools like spears are far less common, although the comparative contexts in which these categories of metal objects have been recovered may be a useful avenue of research in the future. Metal production in archaeological contexts has been associated widely across sub-Saharan Africa with social and ritual symbolism concerning both fertility and danger (Mitchell and Whitelaw 2005; Chirikure 2004; Chirikure 2007). Given the lack of direct historical connection, it may not be productive to try to define specific associations of symbolic meaning or social function for the Early Iron Age. Yet it can still be recognized that metal production would have had spatial, social, functional and economic dimensions as well as technical aspects, such as ore sources and production techniques (Killick 2009).

Methods

The goal of analysis of the metal objects from Thabadimasego was fairly straightforward. Items were to be identified according to metal content and sorted by form, so that the assemblage could be compared in type and variety to other documented metal assemblages of the Early Iron Age. While a great degree more work can be conducted on this assemblage in the future (for example, X-ray fluorescence can identify chemical makeup, and thin-sectioning and micrography can identify smithing and smelting techniques), it is sufficient for the goals of this research project to describe and characterize the styles of metal artifacts. Doing so contributes to the overall picture of economic behavior at Thabadimasego and helps place the site in its broader cultural framework.

Two hundred and sixty metal objects from the Thabadimasego deposits were examined (Figures 20 and 21). This metal assemblage includes both ferrous and non-ferrous (presumably iron and copper, respectively) objects, and both worked items (such as beads and wire) and by-products like slag. No formal metallographic or chemical analyses were conducted on this assemblage to verify the contents or structure of the objects; a distinction between ferrous and non-ferrous was made based on macroscopic attributes like color, texture, and corrosion, as well as presence or absence of magnetism. Objects were tallied by both count and mass (in grams). High degrees of corrosion in some of the items (especially the amorphous iron fragments) as well as the friability of the slag necessitated that these items were better quantified by mass, in lump sums by lot (rather than by individual pieces). These items were too easily fragmented both in situ and during analysis for a per-object count to be meaningful. However, for the sake of comparison, counts and mass were recorded for all classes of metal objects.

The general shape and color of each object were described and the presence or absence of magnetism and corrosion were also noted. For the worked objects (beads, wire, rods/ bars), length, width and height (in millimeters) were also recorded. Consistent trends in shape recurred among both the iron and copper beads, so in order to describe their morphology adequately, additional measurements (such as thickness and gap opening) were collected for these items. These shape categories included horseshoe, c-shape, butted circle, and other types which are characterized fully in Appendix C.

Since the availability of iron and copper items in the Early Iron Age depended on different ore sources as well as a set of different production techniques (Miller 1995), taking a look at the relative proportions of each metal present in the Thabadimasego assemblage is of some interest, especially in how they compare to those of other contemporaneous sites. In general, iron was better represented than copper in terms of both mass and object counts. The total mass of copper (or at least non-ferrous) slag outnumbered iron (magnetic) slag by almost 3:1, the only instance in which copper represented a greater aggregate sum than iron. However, this observation should not be granted too much importance, since as a waste by-product, slag can vary greatly in its makeup and non-magnetic slag may full well be a by-product of iron ore reduction (Ironbridge Gorge Museums Trust 2009). The overall quantity of both ferrous and non-ferrous slag is furthermore very small in comparison to the quantities recovered at sites which are thought to have been loci of actual metal-working: the Thabadimasego slag can be measured in tens of grams, while slag mass at, e.g., Divuyu or Ndondondwane is counted in dozens or hundreds of kilograms (Miller and Killick 2004). No other corollary evidence of metal-working, such as furnace remains, was likewise recovered at Thabadimasego and so what little slag was there presents something of a mystery. For these reasons, the slag has been considered separately from the worked metal items (which identify as iron and copper, by their color and texture, much more readily).

The total quantity, either in terms of mass or count, of worked items (beads and wire/ bars fragments) is not particularly high. 76 beads and 21 pieces of wire or bar were recovered, totaling 27.5 grams and 24.3 grams respectively. Another 49 pieces (by best approximation of the highly fragmented objects) of amorphously-shaped iron, some of which may have been wire or bar prior to corrosive degradation, totaled 15.1 grams. The shape of these gives no indication of their function however (or even whether they were end products or simply by-products with high iron content).

Among the 76 beads, seven distinct bead shapes were identified. Miller (2002) and Denbow & Miller's (2007) article on the metal of Bosutswe were of great assistance in accomplishing this; these articles describe and provide illustrations for a wide range of metal tools and jewelry recovered from Bosutswe, Divuyu, Nqoma, Broederstroom, and Mapungubwe, among other places. One of the bead shapes identified in the Thabadimasego assemblage (referred to as 'cuff'-shaped in the tables) may in fact consist of wrapped-wire necklace or bracelet fragments, but without more intact versions of these objects with which to compare it remains difficult to tell. Four of the seven bead shapes were present in both the iron and copper assemblages, while the 'cuff' shape appears only in iron, and the 'flat horseshoe' and 'flat link' shapes are only present in copper. Each bead is quite small and the average

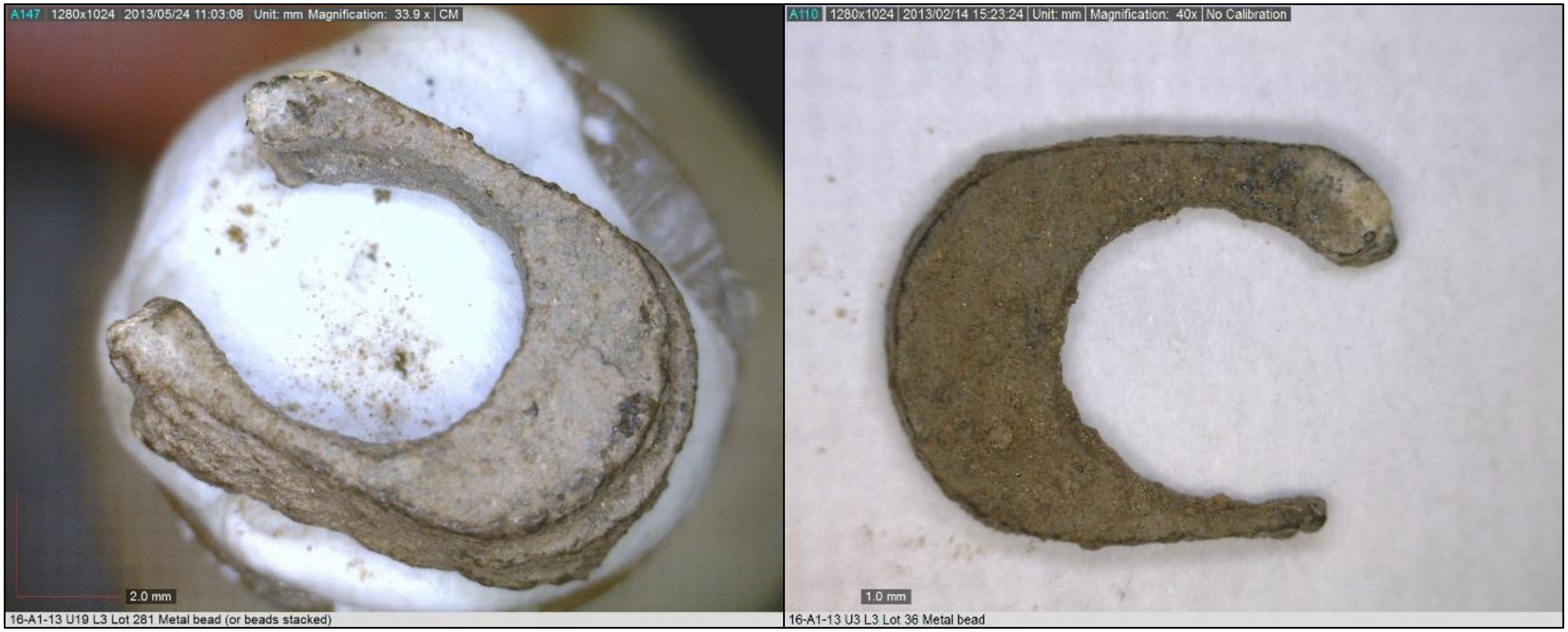

Figure 20 Copper beads from Thabadimasego

Figure 21 Copper items from Thabadimasego

mass per bead (both iron and copper) is about .35 grams. Iron beads generally outnumber copper ones, as with the rest of the metal assemblage, with a ratio of about 3:2 (for both count and mass) inclusive of all bead shapes. The wire and bar fragments present a somewhat different picture. In terms of count, iron exceeds copper by six to one. However, in aggregate mass the two metals are nearly equal. Most of the iron wire/ bar pieces are quite small (averaging about 16 mm long by 5 mm wide), while the great majority of the copper wire bulk consists of one well-preserved coil.

Results

Overall, the types of metal present at Thabadimasego - iron and copper - and their worked forms, including beads or bangle fragments, wire, and flat hammered bar fragments, are very similar in kind to other metal assemblages of the Early Iron Age, including Bosutswe and Nqoma. The flattened copper link-shaped beads (Figure 20 above) bear a striking resemblance to similar objects from Broederstroom, a site whose occupation may be as early as the fourth century AD (Miller 2002:1087). However, the copper chain from Broederstroom is of questionable provenience and ‘‘may well be intrusive from a much later occupation of the site’’ (Mason, 1986:143 in Miller 2002). The disparity in occupation dates between the two sites is therefore not of much concern.

The thicker and more rounded cuff-style beads from Thabadimasego are comparable in form to those from Bosutswe, a site whose early occupation phase was contemporaneous with Thabadimasego (Miller 2002:1088; Denbow and Miller 2007:281). Miller’s examples of this morphological form from Bosutswe include iron and copper as well as bronze and alloy beads. The Thabadimasego beads of this style were sorted as both iron and copper, but further metallurgical analysis may indicate the presence of a wider array of metal types.

The presence of minute fragments of metal slag (some of which contains ferrous material, some of which apparently does not) is difficult to explain (Figure 22). A few mere grams of slag cannot readily be explained in functional terms, especially without any further evidence of metal-working activities (like tuyere remains or a forge base) in the area. Thabadimasego appears to be unusual in this regard, and some kind of ritual purpose may be behind the presence of the slag (Gavin Whitelaw, personal communication, 2013). Given the well-documented associations between spiritual potency and metal-working for Bantu-speaking communities in Central and Southern Africa during the historic era (see, e.g., Killick 2004), this is not outside the realm of possibility. However, this issue remains better left to future research. It would be of interest to explore whether other sites as small as Thabadimasego that may have served some kind of peripheral supporting role to actual villages also include similar assemblages.

4.5 Faunal analysis

Faunal analysis comprises a critical part of the interpretation of Early Iron Age lifeways, as it may provide information on not only overall diet but herd management strategies in the case of livestock (Kinahan 1995; Denbow et al. 2008), insight into the ratio of wild to domestic animal exploitation (Atwood 2005), and in some cases even social and political organization (Huffman 2001; Badenhorst 2009). As discussed in chapter 2, domestic animals were introduced to Southern Africa by 0 AD as can be seen by the faunal remains found at several sites, including in northern Botswana at Toteng, as well as at Leopard Cave in Namibia (Robbins et al. 2005; Plerdeau et al. 2012). However, what the presence (or absence) of various species of fauna actually implies for the community exploiting them may vary depending upon the context. For example, it is highly debatable whether or not the fundamental symbolic and social importance of cattle as described in Kuper's (1982) Southern Bantu Cattle Pattern may be interpreted for Early Iron Age sites dating 1000 or more years prior to the Cattle Pattern's actual historically-documented existence among Nguni communities (Badenhorst 2010).

The relative importance of cattle specifically in an Early Iron Age economy has also been debated over the years. Huffman (2001:30) argues that cattle are under-represented in the faunal record:

> "The faunal sample therefore did not accurately reflect the number of cattle in the settlement. Moreover, if there was one cow, there had to have been at least 100 in the area in order for the

herds to reproduce (Huffman 2001). Clearly, it is not possible to determine herd size or infer cultural importance directly from faunal remains alone. Ethnographically-derived settlement models are superior for understanding cultural importance." Huffman furthermore argues for the presence of cattle in first-millennium sites based on proxy evidence like dung (Huffman 2007:8; Huffman and Schoeman 2011), and the circular arrangement of structures at villages akin to Kuper's Cattle Pattern, which Huffman claims is fundamental for understanding the ritual and social, as well as economic, significance of cattle throughout all periods of the Iron Age in Southern Africa.

M. Hall (1986) offered an early critique of the 'Bantu package' being inherently related to cattle-keeping, pointing out the absence of any cattle remains in the earliest agro-pastoral settlements of Southern Africa as well as the high ratio of marine resources found at coastal settlements for during this time. In more recent years, Badenhorst (2009) challenges the use of dung and dung-based phytoliths as proxy evidence for cattle specifically, pointing out that sheep dung in fact decomposes more quickly than that of cattle. Badenhorst (2011) has developed a 'cattle index' based on the number of individual specimens present (NISP) proportional to that of caprines in order to document the changing frequency of cattle at Iron Age sites over time, and has shown that Early Iron Age sites generally had a significantly lower ratio of cattle to caprines. However, this study does not appear to account for, nor comment on the importance of the presence or absence of, wild faunal remains.

The presence of wild fauna at Early Iron Age sites in many parts of Southern Africa may be seen as an important dietary component (Gilbert Pwiti 1996; Sadr and Plug 2001; van Zyl et al. 2013). Denbow et al. (2008:469), for example, report that upwards of 60% of the total faunal assemblage for the Zhizo horizons of the Western Precinct at Bosutswe was comprised of hunted game. Van Zyl et al. (2013), in their analysis of faunal remains from Xaro, a cluster of sites near the Okavango Delta whose occupation sequence spans the last two millennia, find a significant wild animal presence among ceramic and livestock

Figure 22 Slag fragment from Thabadimasego

remains. Included in their findings are *Achatina* and mussel shells. The authors note that both species could have been exploited as a protein resource, but also make mention of the use of *Achatina* shells in bead production (2013:56). Their conclusions overall suggest that, at least for open-air sites in the Okavango area, assemblages do not group easily into discrete forager and food-producer categories. The presence of carnivore or non-hunted animal remains (such as leopards), too, may indicate the exploitation of these animals for their fur, ivory or other luxury items produced for trade, as is the case at Schroda (Plug 2000), although these animals may have been a food source as well. On the other hand, Badenhorst (2012:266) ascribes ritual significance to smaller quantities of wild fauna.

For the Thabadimasego faunal assemblage, goals for data collection included taxon identification as well as evidence for dietary exploitation of those species (such as butchering or herd management). The entire assemblage of faunal remains was provided to Lu-Marie Fraser, a graduate student at the University of Pretoria working under the supervision of Professor Shaw Badenhorst, for species identification. Unfortunately, due to time constraints, Ms. Fraser was unable to provide a summary of evidence for butchering. However, this information will be available in her forthcoming thesis (Fraser 2015, personal communication).

Methods

Ms. Fraser kindly provided a summary of the methods she used for data collection on the faunal assemblage, which is reproduced here:

"In this section I will explain the methodology used throughout this study, starting with the manual I will utilise and then the specifics of the manual and what each aspect that can be identified regarding fauna can tell us. The manual I will follow is a manual that Driver (1991) set up for the description of vertebrate remains for the Crow Canyon Archaeological Center and which Badenhorst then adapted in 2009 (hereafter called 2009 adaption). I will apply Badenhorst's 2009 adaption to the analysis of the faunal remains from the four Iron Age sites as I found it to be the most complete manual and as mentioned before, the 1991 manual was compiled to add a degree of standardisation and a reduction in errors to zooarchaeology (Driver 1991).

"Following Badenhorst's 2009 adaption, first, specimens will be grouped into categories to describe the faunal remains. The two main categories will be identifiable and non–identifiable specimens. Refitting will be attempted where possible, on both non–identifiable specimens and identifiable specimens, where refitting was not already done, unless the specimens are too fragmented. As suggested by Driver (1991), comparative collections, published guides or keys and measurement systems will form part of the methodology. The comparative collection at the Ditsong National Museum of Natural History (Archaeozoology and Large Mammal Section) will be utilised. The measurement systems will follow Von den Driesch (1976) and Peters (1985–86), which will also serve as published and illustrated guides, along with any other guides that may need to be consulted. All relevant specimens will also be digitally photographed using scales to accurately document the specimens.

"All identifiable specimens will be described where possible by species (or family/group), part (what portion of the element is available), sex, length, measurement, and side using a code system. Fusion, breakage pattern, any modification (fashioned into an artefact or tool), taphonomy (carnivore and rodent gnaw marks, trampled, digested, cut and chop marks), burn intensity (for example black, grey, localised), pathological condition and age will be indicated where possible on both identifiable and non-identifiable specimens using a code system. These categories can help with the identification of hunting, butchering and cooking techniques. These will be explained more in detail with the recording of identifiable specimens below.

"Brain (1974:4) grouped non-identifiable specimens in categories such as 'bone flakes', 'shaft pieces', and 'miscellaneous pieces'. However, this study will only use the category 'non–identifiable'. As mentioned previously, Voigt (1983) used categories in addition to the above mentioned three, such as 'enamel', 'skull', vertebrae' and 'ribs', whereas in this study 'vertebrae', 'ribs', 'enamel' and 'cranial' fragments are part of identifiable specimens (example in Badenhorst & Plug 2004/2005:11; Badenhorst & Plug 2011:78; Driver 2005; Driver 2011:25:28) and will be documented according to size/taxon and any other identifiable characteristics where possible. Identifiable specimens' taxon and elements will then be defined."

Results

No clear pattern was evident for either type or distribution of the faunal remains according to the preliminary information gathered from the assemblage prior to sending it to Pretoria for identification. A good deal of the assemblage is highly fragmented into small pieces. Very few of the bones appeared burned and none were articulated in situ. Larger bone fragments often occurred in a context alongside ceramics or shell beads; however (as Chapter 5 discusses), small quantities of bone are also scattered fairly widely across the site and no clear pattern of distribution is apparent among them. Bone fragments were, in fact, among the most ubiquitous type of material encountered on the site (second to undecorated pottery sherds). More detailed information will be available upon Fraser's completion of her thesis. Following is the list of species present in the Thabadimasego faunal assemblage, as detailed by Fraser's preliminary report.

Table 3 List of taxa present in assemblage

Taxon	Common name	Type
Homo sapiens sapiens	Human	Human
Bos taurus	Cattle	Domesticated
cf *Bos taurus*	Cattle	
Ovis aries	Sheep	
cf *Ovis aries*	Sheep	
Ovis/Capra	Sheep/ goat	
cf *Ovis/Capra*	Sheep/ goat	
Viverridae sp. indet	Genet or civet (species indeterminate)	Wild
Loxodonta africana	African bush elephant	
Equus quagga	Zebra	
cf *Potamochoerus porcus*	Warthog	
Raphicerus campestris	Steenbok	
Aepyceros melampus	Impala	
Syncerus caffer	Cape buffalo	
Struthio camelus	Ostrich	
Achatina sp.	Land snail	
cf *Achatina* sp.	Land snail	
cf *Geochelone pardalis*	Tortoise	
Bufo/Rana	Frog or toad	
Insectivora sp. indet	Insectivore (species indeterminate)	
Carnivora medium	Carnivore	
Rodent small	Rodent	
Rodent medium	Rodent	
Lagomorpha	Hare	
Aves small	Bird	
Aves small - medium	Bird	
Aves medium	Bird	
Tortoise	Tortoise	
Reptile small	Reptile	
Sauria	Lizard	

Table 3 (cont'd)

Taxon	Common name	Type
Terrestrial gastropod	Snail	
Mollusc	Mollusc	
Bovid I	Cloven-footed, ruminant mammal	Unknown
Bovid II	Cloven-footed, ruminant mammal	
Bovid II - non domestic	Cloven-footed, ruminant mammal	
Bovid III	Cloven-footed, ruminant mammal	
Bovid III - non domestic	Cloven-footed, ruminant mammal	
Bovid III/IV	Cloven-footed, ruminant mammal	
Mammal small	Mammal	
Mammal medium	Mammal	
Mammal large	Mammal	

Table 4 Summary of NISP (Number of individual specimens) present in assemblage

Taxon	NISP observed
Domestic Bovids	36
Wild Bovids and Equids	16
Indeterminate Bov I	18
Indeterminate Bov II	229
Indeterminate Bov III	162
Indeterminate Bov II - Non Domestic	1
Indeterminate Bov III - Non Domestic	1
Indeterminate Bov III/IV	6
Indeterminate Mammals	371
Carnivores	1
Birds	7
Rodents	164
Reptile	3
Human	2
Various other small animals (lagomorph, tortoise, *Achatina* etc.)	92
Total NISP	1109

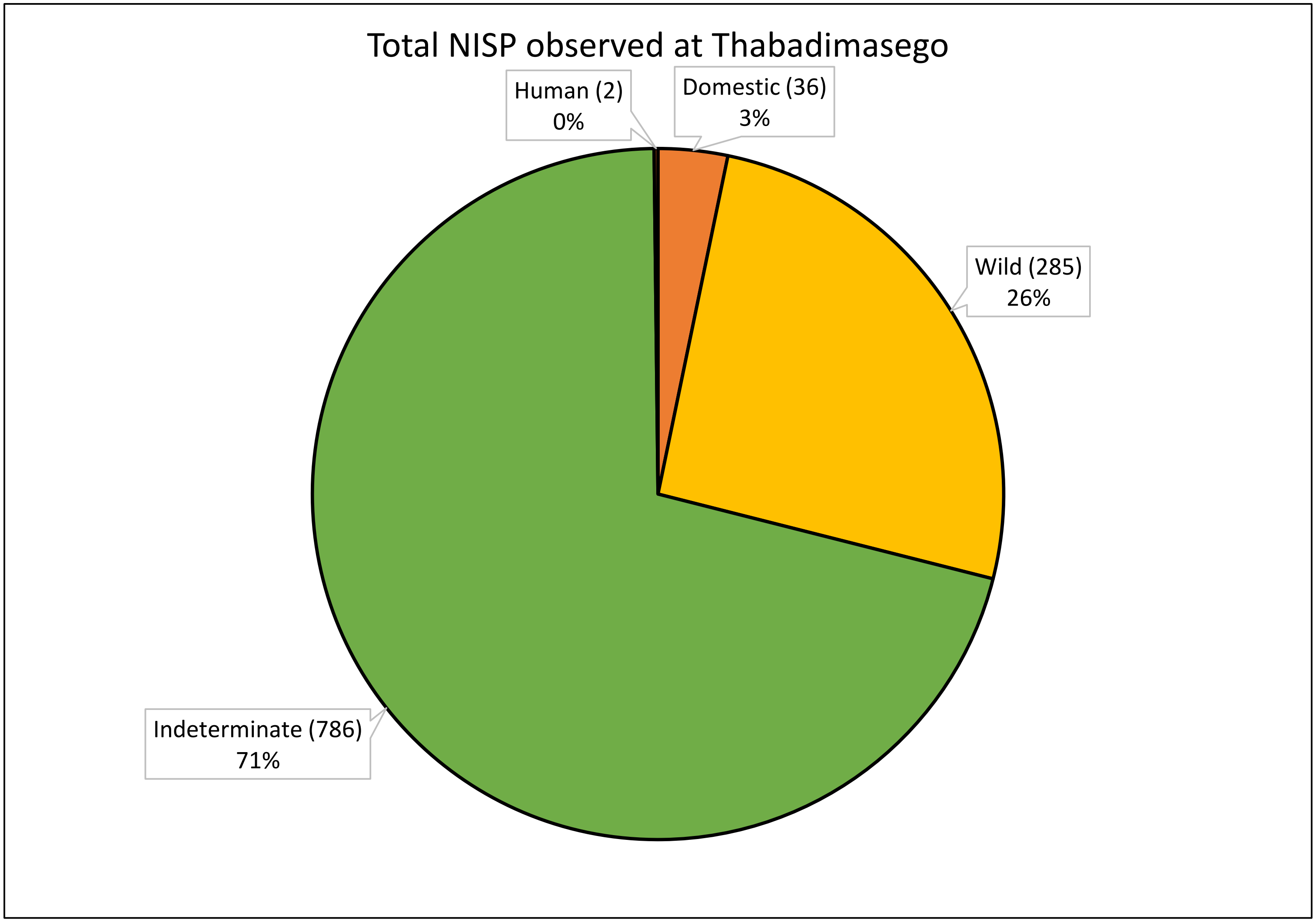

Figure 23 NISP percentages

Discussion

The presence of human remains among the faunal assemblage was a complete surprise. After further inquiry, it was made clear that the human remains were represented only by two teeth (Fraser 2014, personal communication). Apart from the human remains, little that is out of the ordinary appears in the assemblage. A combination of wild and domesticated bovids (cattle, sheep, goats, antelope) was to be expected based on reports from contemporary faunal assemblages from around Botswana and South Africa (Denbow 1999; Denbow et al. 2008; van Zyl 2013). Species diversity for wild animals is, in present day, low for South Sowa due to the extensive use of land in the area for arable farming and grazing pasture. Hundreds of kilometers of fences have been built to control cattle herd movements as well as erosion; these too have seriously affected wild herd migrations in the area (Department of Environmental Affairs and Centre for Applied Research 2010). However, the Makgadikgadi Pans overall today continues to host populations of many of the taxa enumerated in the faunal analysis, including zebra, land snails, warthogs, impala, and a wide variety of birds and rodents. Elephants, on the other hand, are more likely to be encountered further to the north near the Chobe Game Reserve.

Various taxa of small vertebrates, such as the rodents and possibly some of the birds, may be intrusive remains from post-occupation depositional processes and rodent burrows. Their presence in the assemblage should not be taken as indicative of the exploitation of these taxa for dietary purposes, although that too remains a possibility. As with van Zyl's (2013) discussion of molluscs among the assemblage at Xaro, it is also possible that *Achatina* (land snail) and other gastropods and molluscs were used as a food source in addition to the manufacture of beads out of their shells. *Achatina* in particular has been cited as a commercially farmable food for present-day communities in West Africa (Hardouin 1995).

Given the small space that Thabadimasego occupies, and given the shallowness of deposits on the site, the presence of over 1,000 individual specimens seems like a relatively large amount. As is discussed in the spatial analysis section, excavations at the site produced evidence for no more than one or two mudbrick structures. The site is therefore too small to be a village, where the accumulation of such a number of faunal remains could be expected. Unfortunately, details about the specific provenience (unit/ pit and stratum) of any particular taxa are not yet known – this too awaits Fraser's final report.

4.6 Radiometric analysis

Accelerator mass spectrometer (AMS) analysis

Out of the several charcoal samples recovered during excavations, three were chosen to submit to the NSF-Arizona AMS Laboratory at the University of Arizona. Unfortunately, the funds available for AMS dating were quite limited, so priority was given to the samples that, taken together in context, would provide the most comprehensive overview on the depositional history of the sites excavated. Two of the samples, 16-A1-13-U3-L2 and 16-A1-13-U19-L4, were chosen from central units in the main deposition area of Thabadimasego. Unit 3 Level 2 contained part of the compacted soil horizon found just below the surface on the central area of Thabadimasego's main hilltop and was also associated with a cluster of ostrich eggshell beads and faunal remains. Unit 19 Level 4 contained an expanse of collapsed mud-brick structure wall as well as one of the largest charcoal concentrations at the site. The third sample, 16-A1-12-U1-L2, was collected from the compacted soil horizon in the test unit at Site 12, which also contained a number of ceramic and bone fragments. This sample was submitted in the interest of having a comparative date from an analogous soil horizon at the Early Iron Age site nearest to Thabadimasego. Upon receipt of the uncalibrated dates, OxCal (https://c14.arch.ox.ac.uk/oxcal.html) was used to calibrate the dates using the Southern Hemisphere 13 calibration curve (Hogg et al. 2013).

Table 5 AMS Dates from Thabadimasego and Site 12

Sample	1σ	2σ	Median
16-A1-13 U3-L2 (AA101289)	860-970 AD	774-985 AD	897 AD
16-A1-13 U19-L4 (AA101290)	864-971 AD	775-985 AD	906 AD
16-A1-12 U1-L2 (AA101288)	900-1014 AD	892-1020 AD	967 AD

(Arizona sample numbers in parentheses)

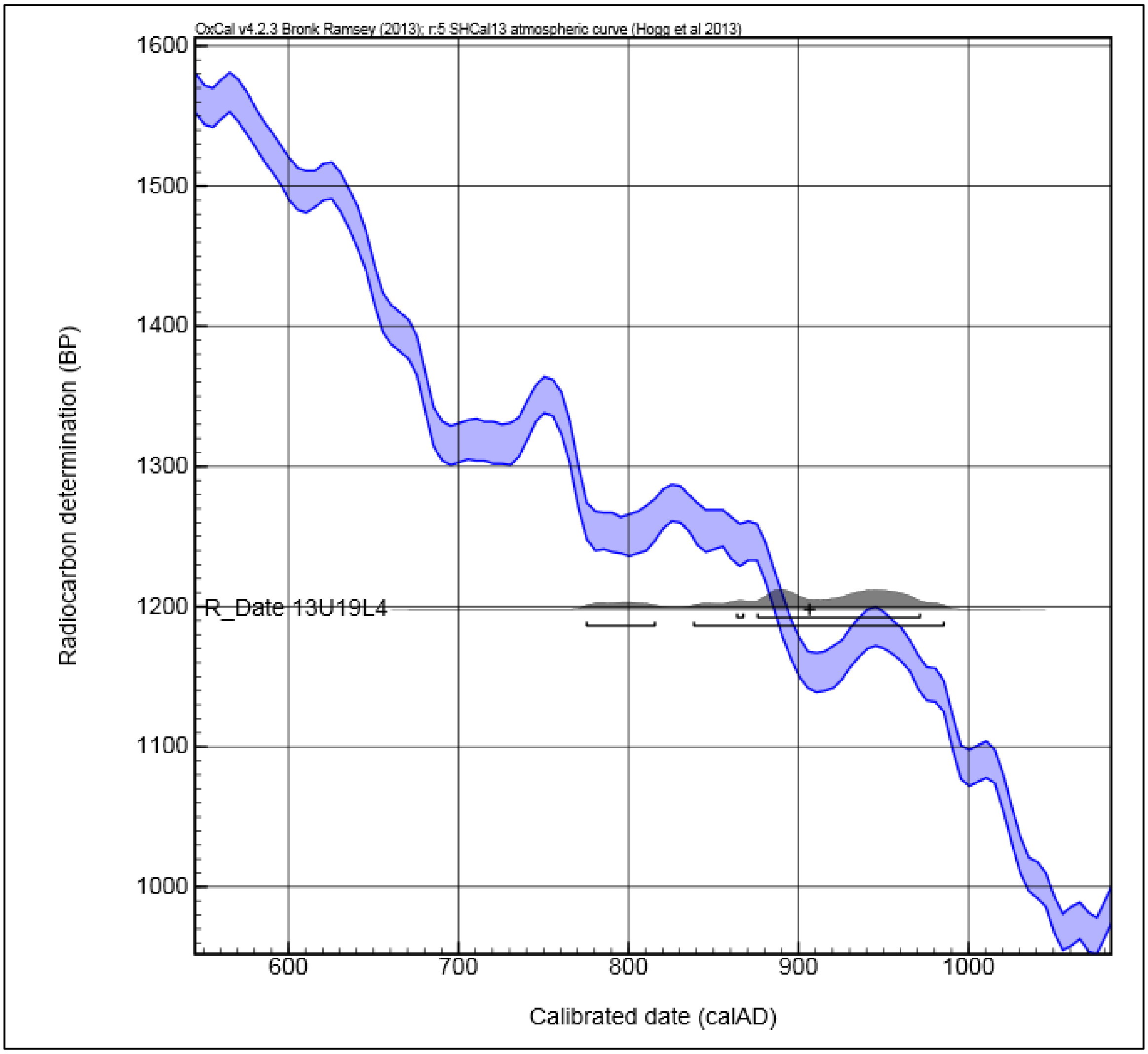

Figure 24 SHCal13 calibration curve in relation to U19-L4 charcoal sample AMS results

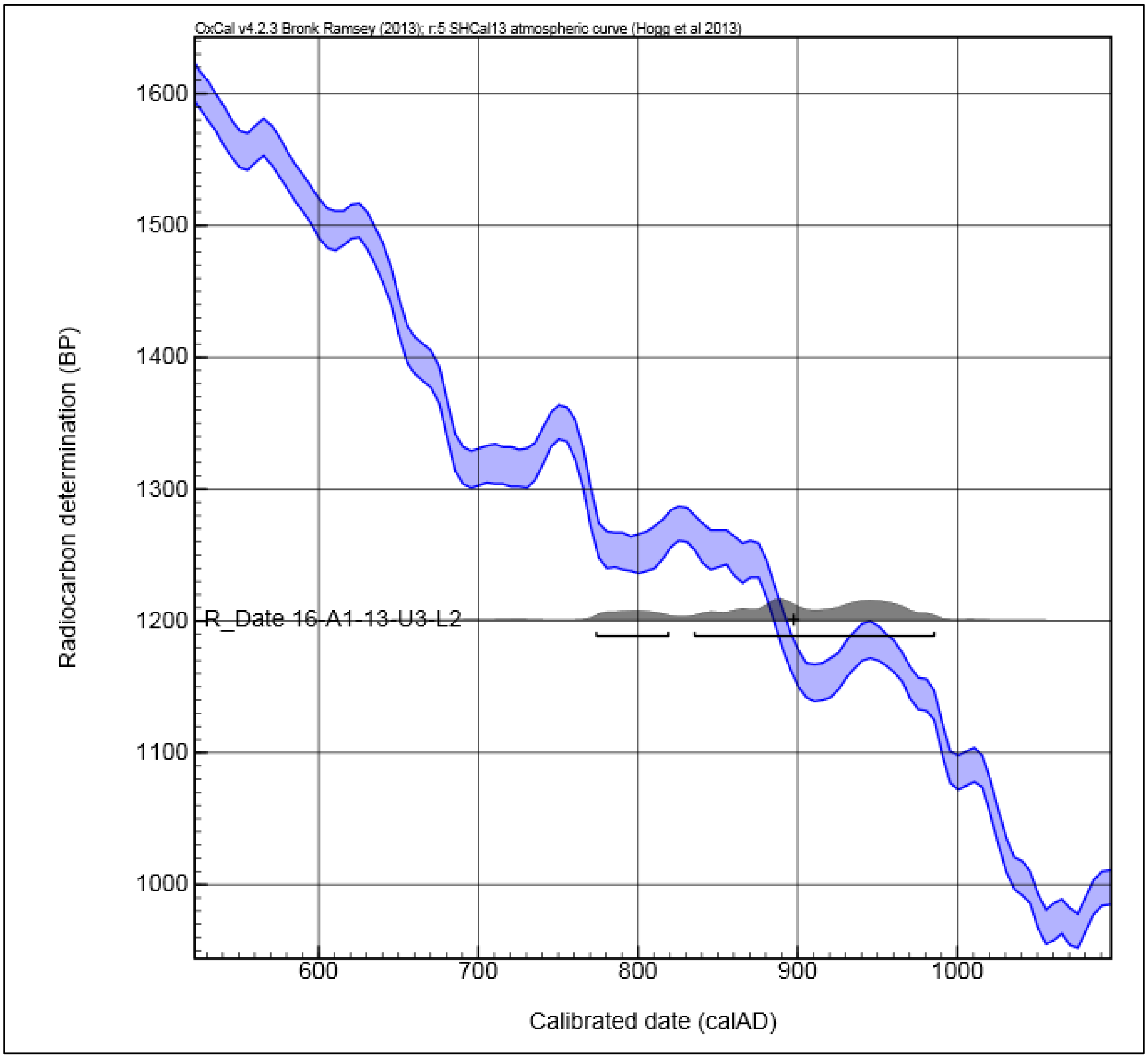

Figure 25 SHCal13 calibration curve in relation to U3-L2 charcoal sample AMS results

Optically-stimulated Luminescence (OSL) analysis

Two OSL samples were collected from two separate soil horizons at Thabadimasego, as detailed in Chapter 3. The soil horizons from which the OSL samples were taken are similar to those from which the charcoal samples used for AMS dating came from. One AMS and one OSL sample each came from the highly compacted upper soil horizon, and one of each type also came from the less-compacted horizon further down (see Figures 44 and 45, Chapter 6, for an example of this stratigraphy). The OSL samples were sent to the University of Washington Luminescence Laboratory and processed by Dr. James

Feathers(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003)(Feathers 2003). His full report, including the tables and figures mentioned below, is attached as Appendix D. The following description of the methods used in OSL analysis is cited from this report (Feathers 2014):

"Sample preparation:

"Sample material is removed from the collection container, leaving aside any portions (such as the ends of tubes) that may have been exposed to light. The latter may be used for dose rate information. From the unexposed portions, about ¼ is set aside as a voucher (material that can be used at a latter date if necessary). If separate samples for measuring moisture content have not been collected, the voucher can be used for this. For moisture the sample is simply weighed wet, and then dried for several days at 50°C before weighing again. The wet minus the dry weight divided by the dry weight gives the percent moisture by weight.

"Remaining unexposed material is separated into size fractions by sieving. If the material contains abundant silt or clay, the sample is wet sieved through a 90µm screen. Otherwise it is sieved dry. The greater than 90µm fraction is treated with HCl and H_2O_2, rinsed three times with water and dried. It is then dry sieved to retrieve the 180-212µm fraction (or any other fraction deemed appropriate). This fraction is etched for 40 minutes in HF and then rinsed with water, HCl and water again. After drying, it is passed through the 180µm screen to remove any degraded feldspar. The material caught in the screen is density separated using a lithium metatungstate solution of 2.67 specific gravity.

"Dose rate was determined by alpha counting, beta counting and flame photometry as described in the appendix [see full report for details]. Table 2 gives the relevant concentrations as determined from alpha counting (U and Th) and flame photometry (K). The beta dose rate calculated from these concentrations is compared with that measured directly by beta counting, and this is also given in Table 2. There are no significant differences that might be caused, for example, by U-Th disequilibrium in the U decay chain. Moisture content was estimated at 6 ± 3 %, which is more than the measured values of about 1%, which, however, do not reflect seasonal change. Table 3 gives the estimated dose rates, which are similar for both samples.

"Luminescence was measured on single-grain quartz using a green laser. Equivalent dose was determined as described in the appendix [see full report for details]. Table 4 gives the number of grains measured, the number rejected using the criteria given in the appendix, and the number accepted. The samples showed relatively high luminescence sensitivity for quartz. The acceptance rate for signals from which an equivalent dose could be measured averaged 13%. A high number of zero-aged grains in UW2850 suggests some contamination from the surface.

"A dose recovery test was conducted on 400 grains from both samples, of which 57 passed all the acceptance criteria. The central tendency of the derived/administered (~16 Gy) ratio, from the central age model, is 0.96 ± 0.02, which is satisfactory. The derived dose of 61% of the grains was within 1σ of the administered dose, and 84% between 2σ. The over-dispersion of the ratio distribution is 7.5%, which is a measure of intrinsic variation due to machine and sample factors and which can be taken as the minimum over-dispersion expected for a single-aged sample. A value of 10% was taken as typical for a single-age sample when evaluating age distributions.

"Table 5 gives the equivalent dose from the central age model (Galbraith and Roberts 2012) and the over-dispersion for each sample. The over-dispersion is quite high for both samples. A finite mixture model was applied to divide the sample into single-value components (see appendix). These are shown in Table 6. The samples appear quite mixed. Given the mode of deposition, it is unlikely the samples are partially bleached. The younger components probably represent downward movement of grains exposed at the surface in these shallow deposits. Also unlikely to be correct are the old components in UW2851, particularly the fifth one, which would give a late Pleistocene age. Radial graphs are shown in Figure 1. For UW2850 most values seem to cluster around the third component. This probably best represents the depositional age. For UW2851, even discounting the larger and smaller values, there is still substantial scatter. Short of any better information, the central age model, represented by the red line with a value similar to the third component, may present the best estimate, although arguments could be made for a younger age.

"Table 7 gives the ages. Using the largest component on UW2851 makes that sample about the same age as UW2850, which would suggest rapid deposition of the deposit. The older age, from the central age model, separates the layers in time and also agrees with a radiocarbon date (Daggett 2014, personal communication)"

Table 6 OSL results

Sample	Age (ka)	Error (%)	basis	Calendar (years AD)
UW2850	0.65 ± 0.04	6.9	Largest component	1370 ± 40
UW2851	1.27 ± 0.18	14.3	Central age model	740 ± 180
UW2851	0.61 ± 0.04	6.8	Largest component	1410 ± 40

Discussion

The OSL data appear to support two different sedimentary ages, one roughly consistent with a Zhizo occupation (740 AD ± 180) and one dating to the middle of the second millennium (1370-1410 ± 40). The more recent date is associated with the very compact soil which covered much of the central area of the site from about 5-15 centimeters below surface. The earlier date is associated with the soil horizon just below the compacted one, which extended about 15-25 centimeters below surface, depending on the unit. The levels excavated within this deeper horizon also produced the greatest quantities of cultural material overall. This seriation on a whole supports the site's stratigraphic integrity. A more comprehensive OSL study of the site (sampling from multiple locations on the site with a similar columnating sampling procedure) would give a more thorough picture of site formation processes. However, from these results, it is possible to suggest that the compacted upper soil horizon, as differentiated from the less-compact soil matrix below it, may be a result of taphonomic effects instead of a separate cultural horizon. There is little to no change in either color or soil makeup between horizons, and the types of cultural material from each horizon are of the same styles. In short, there is no a priori reason to believe that a second extensive prehistoric occupation occurred at Thabadimasego. However, cultural material found within the upper soil horizon and on the surface could be considered not to be in situ.

As the tables for the AMS and OSL results indicate, there is reasonable overlap between the chronological ranges provided for each radiometric type for the samples taken from the deeper soil horizon (U19-L4 and UW2851). The margin of error for the OSL date gives it a range of 560 – 920, and the 2-sigma margin for the AMS date gives it a range of 775-985. That the OSL and AMS dates for the upper soil horizon are *not* in agreement – the charcoal sample is contemporary with the earlier horizon – lends further support to the notion that this upper horizon is in some way disturbed.

4.7 Glass beads

Glass beads are a non-utilitarian good imported into sub-Saharan Africa from manufacturing sources in the Near East and South Asia since the middle of the first millennium AD (Wood et al. 2012), as part of the extensive maritime trade network that operated along Africa's eastern coast during that time (Pwiti 1991; Chami 2006). As discussed in Wood (2011), beads changed in both glass composition and appearance over the centuries, which reflects shifting patterns of trade between African communities and the various sources of glass production. The glass beads recovered from late first-millennium (Early Iron Age) and prehistoric second millennium (Middle and Late Iron Ages) contexts within Southern Africa have been organized into a typology by Wood (2005, 2011, 2012) primarily by their morphological attributes such as color, shape, diameter and opacity. This glass bead series demonstrates a robust correlation with the existing chronological sequence in Southern Africa (which is derived primarily from indigenous ceramics; both the ceramics and the beads are supported by radiocarbon), so that certain types of beads can be associated with a certain time period with reasonable confidence (Robertshaw et al. 2010).

Glass bead analysis

During excavations in 2012, approximately 40 glass beads were recovered from Thabadimasego. An additional handful of glass beads was recovered from a test unit at site 16-A1-12, located on the nearest escarpment protrusion to the west of Thabadimasego. Inclusion of glass trade beads among Early Iron Age assemblages is a well-documented phenomenon across a number of regions of Southern Africa, including coastal trading depots such as Chibuene (Wood et al. 2012); the regionally-organized settlement systems of the Shashe-Limpopo Basin and eastern Botswana (Robertshaw et al. 2010), and the village of Nqoma to the west in the Tsodilo Hills (Denbow 1999). The regions where the glass used to make the beads was produced can be determined through comparative compositional studies of glass objects from sub-Saharan Africa, the Middle East and South Asia.

In recent years a number of compositional analysis studies have been conducted on glass beads from Southern African contexts, relying for the most part on laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) to determine elemental compositions of the beads (e.g., Dussubieux, Robertshaw, and Glascock 2009; Robertshaw et al. 2010; Wood, Dussubieux, and Robertshaw 2012; Denbow, Klehm, and Dussubieux 2015). These studies have provided independent confirmation of the morphological seriation developed by Wood. For further information about LA-ICP-MS and its applications to archaeological glass, see; Gratuze, Blet-Lemarquand, and Barrandon (2001), Dussubieux et al. (2009), and Gratuze (2013a, 2013b).

A number of ancient glass compositional types that have been identified by researchers appear frequently in Southern African bead assemblages, especially ones linked to glass production in the Mesopotamian region and South Asia (for full descriptions of their typology; see Robertshaw et al. 2010 and Wood et al. 2012). In addition to the information the beads can provide about trade connections between Southern African communities and the rest of the ancient world, they also have the potential to inform understanding of social organization and economic influence within Southern African political spheres. As a non-utilitarian exchange good, the beads are interpreted as a luxury good and status item (Denbow 2002; Robertshaw et al. 2010; Wood 2011). Their presence at Early Iron Age sites, and the mechanisms by which they were redistributed between Early Iron Age communities, is therefore of considerable interest as they provide insight into the political economic dynamics of the time.

Within Southern Africa, numerous studies on the morphology and chemical content of beads have resulted in a chronological series that is unique to the subcontinent. As Wood's (2011) article discusses, over the centuries glass beads form distinct groups in terms of both chemical composition and attributes such as color, shape, diameter and opacity. These differences reflect shifting patterns of trade between African communities and glass and bead producers, as well as various Indian Ocean merchants who carry on the trade (Robertshaw et al. 2010). The glass bead series also demonstrate a robust correlation with the existing chronological sequence in Southern Africa. Identification of beads with a particular series therefore provides an independent diagnostic element for Southern African sites. For a detailed explanation of each bead series and its morphological characteristics, see Robertshaw et al (2010); Wood (2011), and Wood et al. (2012).

Wood's (2011) bead series have been shown to overlap well with the compositional types determined by Robertshaw et al. (2010) and Wood et al. (2012). Robertshaw et al. (2010) in particular compared the Southern African glass with bead assemblages from across the continent, providing an independent check on the significance of types observed within Southern Africa; this also demonstrated that the kinds of beads traded to Southern African communities were traded elsewhere. This makes LA-ICP-MS a useful (and inexpensive) tool for verifying bead types, particularly when samples are heavily corroded and many of their morphological attributes are unobservable. For earlier bead series such as Zhizo beads, devitrification and corrosion are common problems due to the glass recipe used at the time (Robertshaw et al 2010), and while in some cases devitrification is even too extensive to provide reliable elemental signatures, LA-ICP-MS techniques which use single-point sampling, as opposed to raster sampling, have been shown to be more effective at limiting the impact of corrosion on the results (Dussubieux et al. 2009).

Methods

The morphological classification of the Thabadimasego and site 12 beads was conducted by Marilee Wood, using the procedures described in Wood (2011). A total of 49 beads and one amorphous glass fragment were examined; 45 of the 50 specimens were recovered from Thabadimasego units and stratified test pits, while 5 beads were recovered from the test unit on site 16-A1-12. All beads were given a unique identifying number based on method of manufacture, shape, end treatment, diameter, length, glass diaphaneity and color (including Munsell number), and glass type. Additional information, such as glass quality and condition, were also noted. Dr. Wood's full report is included as Appendix E.

Laure Dussubieux (Field Museum Department of Anthropology) wrote the following part for a coauthored paper on the beads (which is forthcoming):

"In May 2014, the glass specimens from both site 12 and Thabadimasego were subjected to laser-ablation inductively-coupled-plasma mass spectrometry (LA-ICP-MS). The analyses were carried out at the Field Museum of Natural History in Chicago, USA, with a Bruker Inductively Coupled Plasma - Mass Spectrometer (ICP-MS) connected to a New Wave UP213 laser for direct introduction of solid samples. The analytical menu consisted of 12 oxides and 44 trace elements commonly found in archaeological glass. Two different series of standards were used to measure major, minor and trace elements. The first series of external standards are standard reference materials (SRM) manufactured by the National Institute of Standards: SRM 610 and SRM 612. Both of these standards are soda-lime-silica glass doped with trace elements in the range of 500 ppm (SRM 610) and 50 ppm (SRM 612). Certified values are available for a very limited number of elements. Concentrations from Pearce et al. (1997) are used for the other elements.The second series of standards were manufactured by Corning. Glass B and D are glasses that match compositions of ancient glass (Brill, 1999, vol. 2, p. 544). The isotope Si29 was used for internal standardization due to its relative abundance. In order to obtain absolute concentrations for the analysed elements, the concentration of the internal standard has to be known. Concentrations for major elements, including silica, are calculated assuming that the sum of their concentrations in weight percent in glass is equal to 100% (Gratuze, 1999).

"For each glass sample, the average of four measurements corrected from the blank was considered for the calculation of concentrations. A homogeneous glass composition for the beads was assumed based on the prior studies of Southern African assemblages. The detection limits range from 10 ppb to 1 ppm for most of the elements. Accuracy ranges from 5 to 10 % depending on the elements and their concentrations. A more detailed account of the performances of this technique can be found in Dussubieux et al. (2009). A total of 50 glass samples were processed (49 beads and bead fragments, and one amorphous glass fragment). Four samples were too corroded to be provide usable data. Following completion of the data collection, the reduced compositions for each sample were calculated by normalizing the seven major and minor oxides (SiO_2, Na_2O, Al_2O_3, MgO, K_2O, CaO and Fe_2O_3) to 100%. This process isolates the main components of the glasses, removes most of the compositional effects of additives, such as colorants, and permits examination of the basic glass recipe (Brill, 1999)."

Once the standardized composition ratios were determined for every sample, prior studies were referred to as comparative samples. The results of the Thabadimasego analysis were compared to figures from the Southern African assemblages in Robertshaw et al. (2010) as well as the assemblage from Chibuene, a coastal site in Mozambique (as discussed in Wood et al. 2012). Ancient glass compositions from Moretti and Hreglich (2013) were also referred to for cross-reference. The rations of the major and minor oxides were compared to these assemblages to determine the type(s) of glass (which, for this time period, are generally either plant-ash glass or mineral-soda glass). Trace element ratios were compared to determine the sub-types of plant-ash glass present.

Major and minor oxides are as follows:

- SiO_2 (Silicon dioxide; silica)
- Na_2O (Sodium oxide; soda)
- MgO (Magnesium oxide; magnesia)
- Al_2O_3 (Aluminum oxide; alumina)
- K_2O (Potassium oxide)
- CaO (Calcium oxide; lime)
- Fe_2O_3 (Ferric oxide)

Following Robertshaw et al (2010), the values for each of these oxides were subject to exploratory data analysis. The minimum, maximum, mean, and standard deviation was calculated for each oxide. Bivariate scatter plots to look for significant correlations between oxides and elements, as per Wood et al. (2012)

Results

Wood's morphological analysis had determined that, based on glass quality, bead shape and color, 42 of the beads most likely belonged to the Zhizo series. Three of these were too corroded to allow determination of color. Thirty-six are light cobalt blue (the most common color found in this series), one is yellow and two are an unusual bluish-green. The remaining six beads, 2 a light greyish cobalt blue and 4 a greyish blue-green, were tentatively assigned to the Chibuene series (Figure 26). Most of the beads are corroded to varying degrees, a condition that is often found with the Zhizo series due to the composition of the glass from which the beads are made and the conditions in which they were buried. The LA-ICP-MS analysis more or less corroborated Wood's observations. Four samples submitted for LA-ICP-MS (three of the beads and the lone glass fragment) produced Na_2O signatures well below 10% (the standard threshold for normal, uncorroded soda-lime-silica glass, per Robertshaw et al. 2010:1902). One further bead was rejected from the sample due to its very low silica content. The remaining 45 were assigned to a known subgroup based on ratios of major and minor oxides as well as trace elements. All 45 beads were determined to be made of plant-ash glass as opposed to mineral-soda glass, based on their concentrations of magnesia (MgO). MgO levels in plant ash glasses are usually above1.5%. Below this level, mineral soda (e.g. natron) is assumed to be used. In the Thabadimasego beads MgO levels are always above the 1.5%. The mean concentrations for constituent oxides fall within the ranges described for Zhizo beads by Robertshaw et al. (2010) with high magnesia and lime concentrations, and a very low concentration of alumina (see Table 7).

Table 7 Mean values of major and minor oxides from LA-ICP-MS

Bead Series	SiO_2 (μ)	Na_2O (μ)	MgO (μ)	Al_2O_3 (μ)	K_2O (μ)	CaO (μ)	Fe_2O_3 (μ)
Zhizo	69.62	13.15	4.31	3.26	3.23	5.5	0.94
K2	64.51	16.22	0.43	11.85	3.34	2.34	1.3
K2 GR	61.05	14.36	0.37	16.63	3.39	2.85	1.35
Indo-Pacific	63.08	14.75	0.59	13	3.46	2.85	2.27
Islamic	63.21	13.71	4.83	6.05	3.91	6.63	1.66
Map Oblate	61.88	13.47	5.8	7.67	3.47	6.66	1.04
Zimbabwe	60.98	15.81	4.33	6.71	3.74	6.94	1.48
Khami	61.4	18.66	1.21	9.81	2.82	3.39	2.7
Thabadimasego & Site 12	65.69%	14.67%	3.46%	3.26%	4.21%	4.68%	1.25%

In order to differentiate the Chibuene series from the Zhizo series beads, principal components analysis (PCA) was conducted for the Thabadimasego and site 12 datasets using the menu of oxides and elements which overlapped with other datasets from Southern Africa (Robertshaw et al. 2010; Wood et al. 2012) used for comparison, and excluding those known to be coloring and opacifying agents, such as cobalt. The PCA distinguished two clear groups of beads, which show strong agreement with the parameters for v-Na-Ca 1 (Zhizo) and v-Na-Ca 3 (Chibuene) beads in both the Robertshaw and Wood datasets. Based on these results, fourteen of the 45 glass beads can be placed within the Chibuene (v-Na-3) series as described in Wood et al. (2012), while the remaining 31 beads fit within the Zhizo, or v-Na-1 series (Figures 27 and 28). Of the 14 Chibuene beads, 12 were from Thabadimasego and 2 were from the neighboring site 12. The remaining beads belong to the Zhizo series (Table 8).

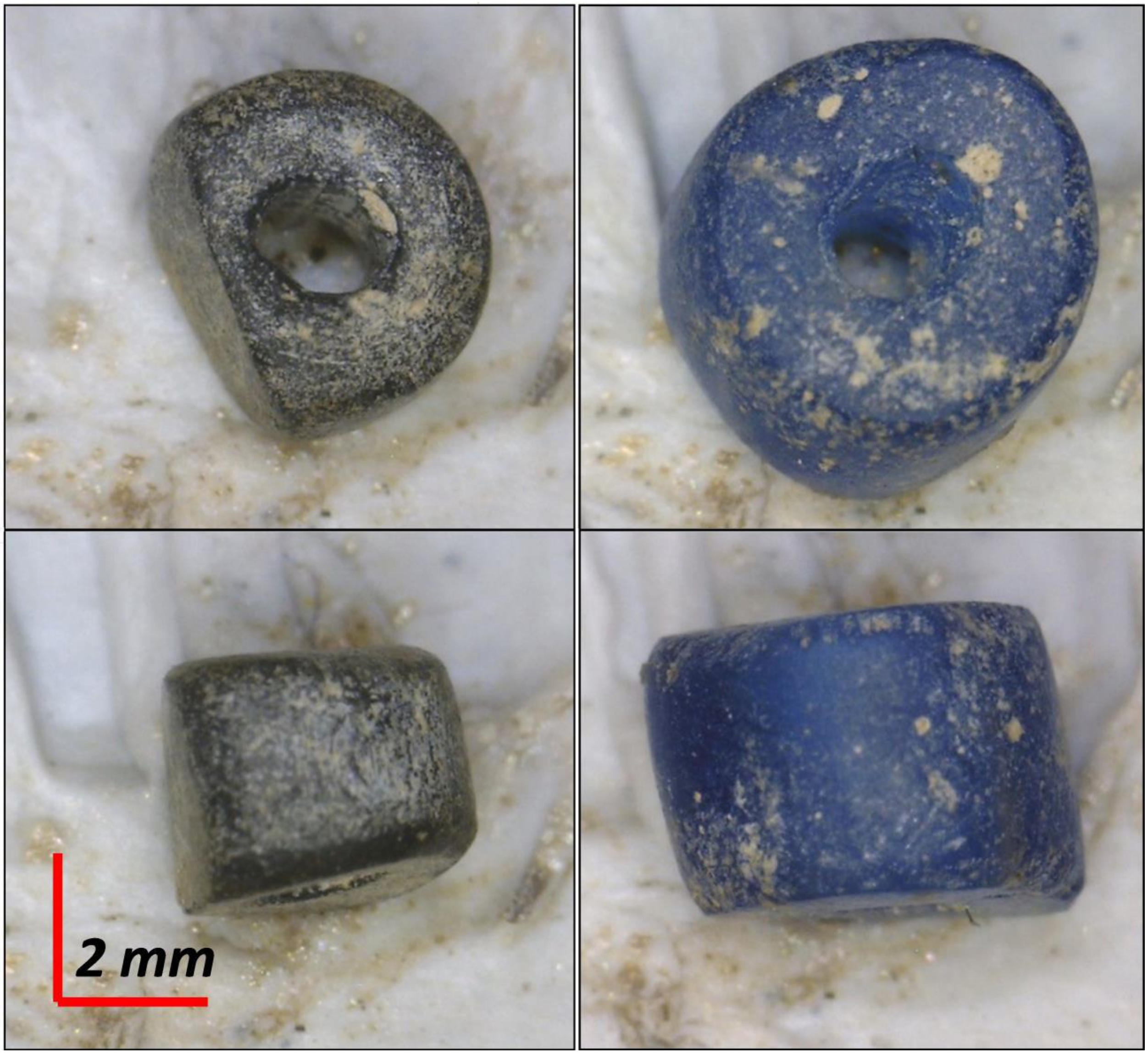

Figure 26 Chibuene (L) and Zhizo (R) glass beads

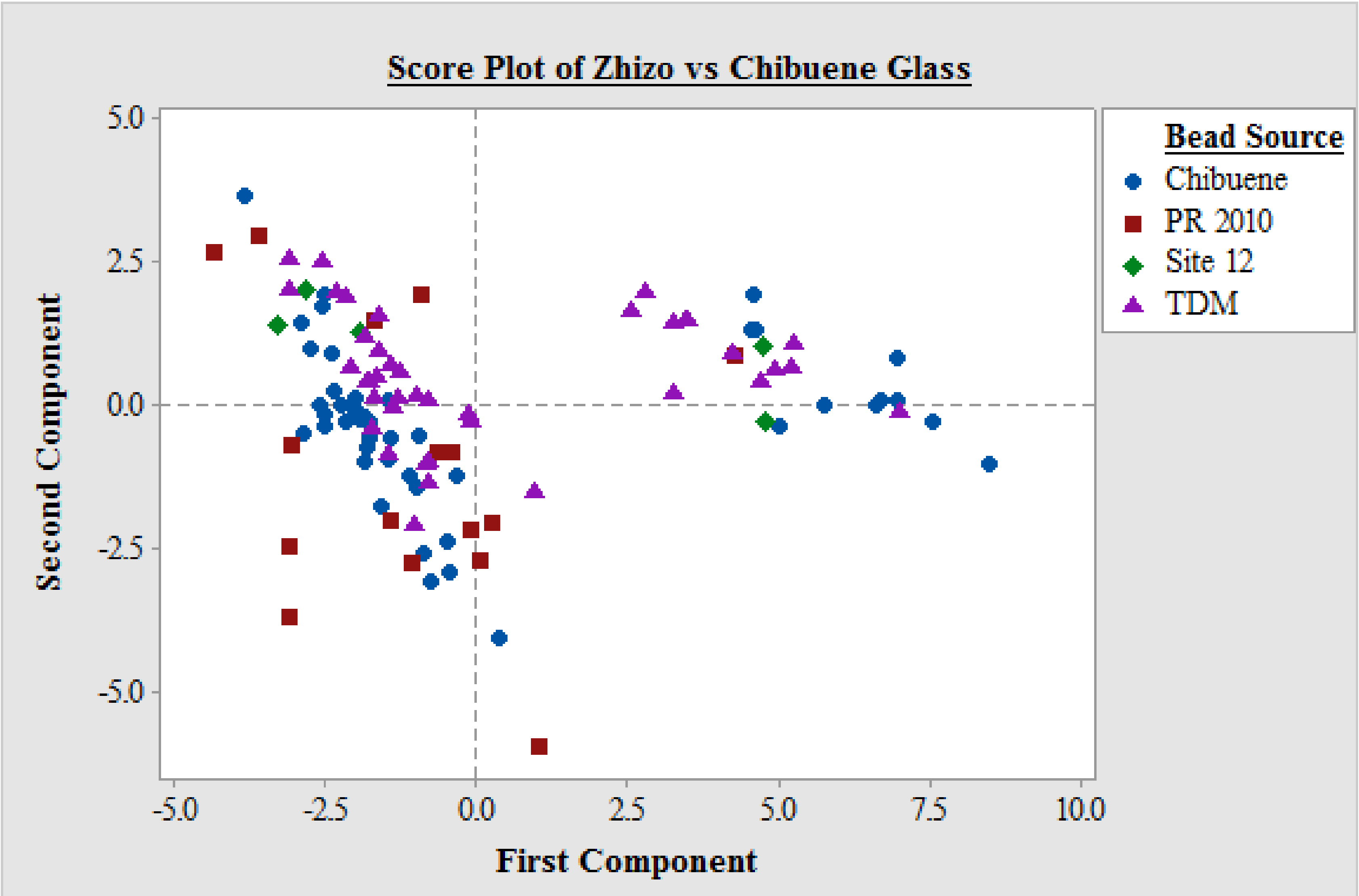

Figure 27 PCA score plot for Zhizo vs Chibuene glass types

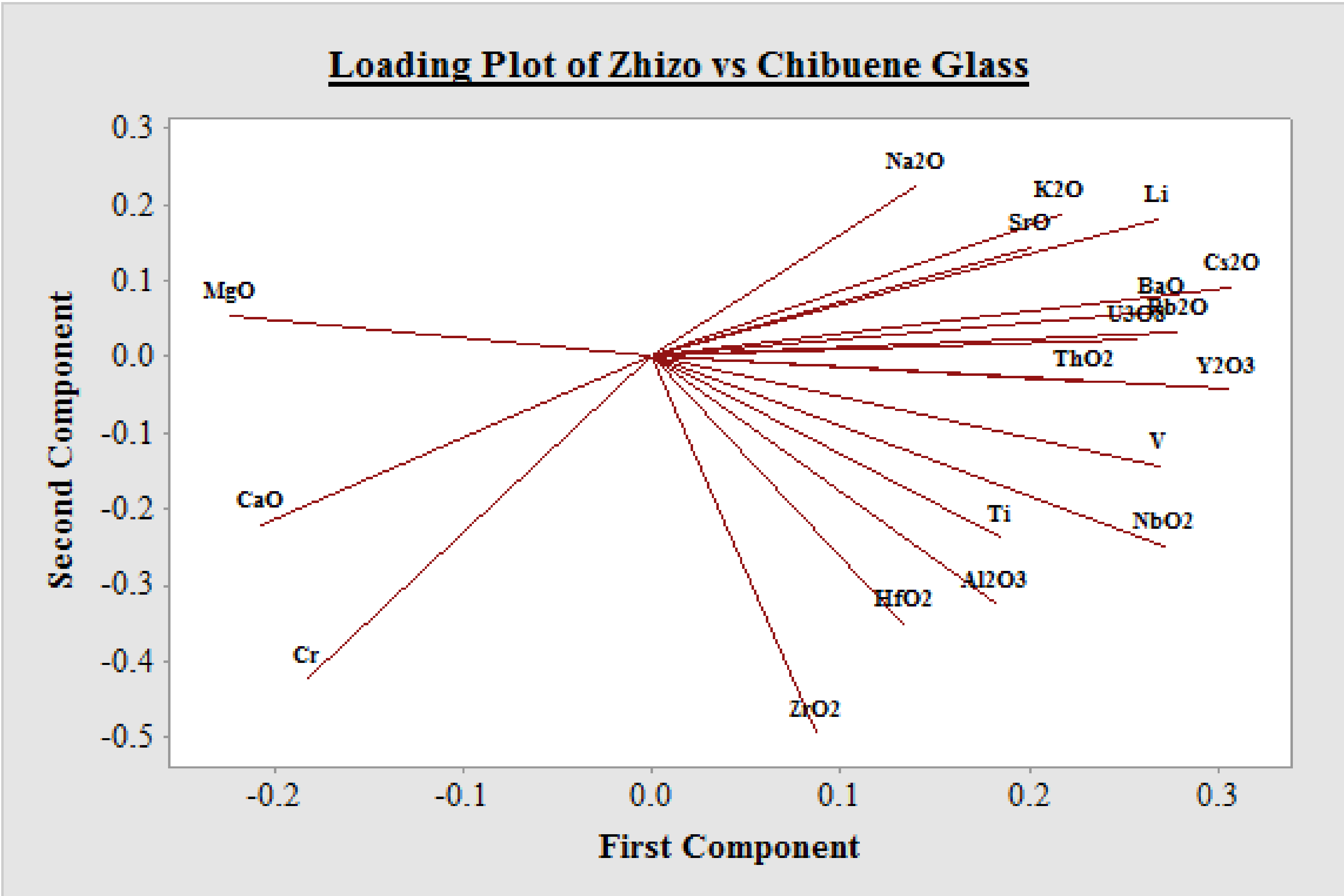

Figure 28 PCA loading plot for Zhizo vs Chibuene glass

Table 8 Series determinations for glass beads from Site 12 and Thabadimasego

Site #	Zhizo	Chibuene	Undetermined
12	Lot 373	Lot 375B	
	Lot 375A	Lot 377	
	Lot 379		
13	Lot 159	Lot 181	Lot 23
	Lot 162-3	Lot 201	Lot 36
	Lot 163	Lot 232	Lot 146
	Lot166	Lot259	Lot 232B
	Lot 172	Lot 281	Lot 224B
	Lot 205	Lot 295	
	Lot 21	Lot 328	
	Lot 222A	Lot 37C1	
	Lot 222B	Lot 37C2	
	Lot 223	Lot 37C3	
	Lot 224A	Lot 37F	
	Lot 227A	Lot 45	
	Lot 227B		
	Lot 227C		
	Lot 227D		
	Lot 229		
	Lot 259B		
	Lot 26		
	Lot 261		
	Lot 27		
	Lot 284		
	Lot 330		
	Lot 346		
	Lot 37A		
	Lot 37B		
	Lot 37D		
	Lot 37G		
	Lot 37H		

4.7 Macrobotanical identification

Positive identification of macrobotanical remains in Southern African Iron Age contexts remains problematic. Very few direct studies of macrobotanical remains in Iron Age contexts have been conducted for Southern African sites; Jonsson's (1998) thesis on plant remains at Zimbabwean hunter-gatherer and farming sites is one notable exception. A handful of other sites have had small quantities of seeds, husks or nuts identified, although it is unclear by what means the identifications were conducted; see Mitchell (2002:274).

Evidence for cultivation of plant species at Southern African sites typically comes by way of proxy indicators. The most common of these are grinding stones with grooves suited to sorghum and millet seeds (Mitchell 2002:273), mud-brick structural remains interpreted as grain bin foundations (Mitchell 2002:274; Huffman 2007:335), and ethnobotanical observations of present-day use of wild and domesticated plant species among subsistence communities in Southern Africa (Jonsson 1998; Mitchell 2002:274). An argument can also be made that communities practicing plant cultivation showed a preference for alluvial and colluvial soils near major rivers or (in earlier cases) marine coastlines (see, e.g., Maggs 1984; Pwiti 1996); however, Mitchell (2002:273) and Mitchell and Whitelaw (2005:222,223) point out that site location choices also conform with the availability of other critical resources such as iron ore or shellfish, and therefore that soil types on their own are not a reliable indicator of agricultural behaviors.

It is widely recognized in scholarly research on the transition to agriculture that proxy evidence such as grinding stones and storage facilities do not necessarily imply the existence of cultivated crops (e.g., Piperno et al. 2004; Nadel et al. 2012). In several regions of the world, the use of grinding stones for cereal preparation and construction of food storage facilities has been demonstrated to predate domestication events for plant species (Barker 2006:74-76). While current models for the appearance of agriculture in Southern Africa posit migration of communities already practicing a well-developed form of crop cultivation who carried both the technology and plant species with them, there is still substantial evidence for the continued consumption of wild plant species among food-producing communities (Maggs 1984; Denbow 1986; Jonsson 1998). It may be useful to take the perspective that, without direct evidence, crop cultivation and animal husbandry did not necessarily go hand-in-hand, even where other material indicators of the Chifumbaze cultural 'package' are present (for the classic characterization of the Chifumbaze cultural type, see Phillipson 1977). Sites representing the earliest phases of the Chifumbaze complex do not, in fact, contain many instances of preserved botanical remains at all (Huffman 2007:338), although microbotanical studies of pollen and phytoliths may change this understanding in the future.

In light of this concern, care was taken both during excavations and in post-excavation activities to watch for botanical remains. Several clusters of carbonized macrobotanical remains were in fact recovered from a number of units at Thabadimasego; the use of 1x1-mm mesh to screen excavated soil was helpful in this instance (as with other small finds such as glass beads). Additionally, soil samples were collected regularly throughout excavations, following a 'blanket sampling' strategy (Pearsall 2000:66-67) and were later processed using water flotation. Although Pearsall (2000:75) recommends collecting at least 10 liters of soil for each sample for optimal recovery of botanical and faunal remains, this quantity proved not to be feasible for this project. The small size of the features in question necessitated collection of much smaller (1-2 liters) samples, an issue also encountered by Jonsson (1998:52). Because water and drainage facilities were both very limited at the NMMAG archaeology lab, flotation was conducted at a small scale following similar lines as the manual bucket-and-scoop technique as described in Pearsall (2000:35-37). After undergoing flotation, the heavy and light fractions from each sample were dried and stored separately. The heavy fraction contents (typically larger bone fragments, small ceramic sherds and the occasional bead) were inventoried and added to the general assemblage catalog. The light fraction for each sample was weighed and included in the catalog; however no further work was done apart from packaging them for storage. The intent had been to contract with an archaeobotanical specialist to work with these samples for the purpose of taxon identification, but as was learned, the only archaeobotanist in Southern Africa currently working with Iron Age remains is presently conducting her Master's thesis research and therefore unavailable. The carbonized botanical samples recovered during excavation were photographed using a Dino-Lite digital microscope at 30-35x magnification in order that they might be identified through comparison with other images, or actual extant botanical samples.

Discussion

No formal analysis of the botanical remains could be conducted. While there are some archaeobotanists who do work with Southern African prehistoric remains, they tend to specialize in Pleistocene and early Holocene – that is, Middle and Later Stone Age – environments. Hope remains that in the future an archaeobotanist will be available to identify seeds and nuts from Iron Age contexts.

In an effort to provide some description of the botanical remains recovered at Thabadimasego, a number of archaeologists who, while not trained as archaeobotanists, have nevertheless dedicated their long careers to researching Iron Age lifeways were asked to examine the Dino-Lite photographs of the remains. While this in no way constitutes a formal determination of type, the general agreement was that the carbonized seed clusters appeared most like sorghum (*Sorghum bicolor*). Images of the Thabadimasego seeds and an example of present-day sorghum (source: user Sahaquiel9102/ Wikimedia

Figure 29 A present-day example of sorghum

Figure 30 Probable sorghum from Thabadimasego

Commons, http://commons.wikimedia.org/wiki/File:Millo_-_Sorghum_bicolor_03.jpg, accessed 2/21/2015) are included here for reference.

4.8 Discussion of results as a whole

A brief summary of the results of each type of analysis, for convenience's sake, is listed here:

Ceramics

- Most ceramics are of Zhizo type (or very similar type)
- A very few stylistic oddities
- Very little apparent refit (based on casual observation)

Shell

- Two different (but overlapping) ranges of variation for diameters *Achatina* and ostrich shell beads
- Significant difference in diameter between burnt/ unburnt for *Achatina* shell beads
- No apparent difference in diameter between burnt/ unburnt for ostrich eggshell beads
- Unworked fragments and bead blanks occur in quantities too small to associate with a bead manufacture 'workshop'

Metal

- Two types of metal present (based on outward appearance, magnetic characteristics, and comparison with other Early Iron Age assemblages); copper and iron
- Quantity of metal items overall is low relative to descriptions those from larger contemporary settlements (Nqoma, Bosutswe)
- No metal tools present; pieces of jewelry, wire and bar fragments comprise the entire assemblage
- Copper and iron beads/ bangle fragments have similar morphology to beads/ bangle fragments from a number of sites (Nqoma, Bosutswe, Broederstroom)
- Slag occurs in unusually low quantities

Faunal

- Over 1000 individual specimens counted in assemblage
- Wild bovids, domesticated bovids, other mammals and vertebrates, two human teeth
- Further work needed for clearer picture of ratios of types of bovids

Radiographic

- AMS dates indicate a median time frame of late ninth/ very early tenth century (consistent with Mosu I)
- OSL indicates two dates, one 6^{th} – 9^{th} century and one 13^{th} -14^{th} c.
- Stratigraphic context of both types of samples indicate probable disturbance in upper soil horizon
- Apart from later OSL dates, results are generally in agreement with timeframe of a Zhizo-era occupation

Glass

- Morphological and elemental analyses both indicate two facies of beads present: Chibuene and Zhizo

Botanical

- No formal analysis possible
- Preliminary designation of seed clusters as domesticated – possibly sorghum

Taken collectively, the artifact assemblage from Thabadimasego as characterized in the sections above is largely reminiscent of a late-first-millennium AD occupation whose cultural ties lie primarily to the regions east and south of the Makgadikgadi Pans. While the margins of error for radiocarbon and luminescence samples from the site provide a potential time frame of occupation as wide as the sixth through tenth centuries AD, the likely scenario for occupation falls towards the latter half of this range as indicated by the styles of pottery and metal objects predominant in the site's assemblage. This time frame is consistent with the radiocarbon dates acquired from Mosu I (Reid and Segobye 2000a) and Kaitshàa (Denbow et al. 2015). The possibility does remain that Thabadimasego was occupied earlier than the ninth century as well, particularly in light of several Chibuene-style glass beads present among the assemblage. Chibuene glass beads are relatively rare finds in Southern African sites (or at very least, are only beginning to be recognized as a separate facies) and are thought to date to the sixth and seventh centuries AD based on their initial discovery at the eponymous site in Mozambique (Wood et al. 2012). Given, however, the potential for durable luxury items such as glass beads to be curated, saved, traded, and handed down over generations, it is also possible that beads of such an early provenience only made their way to Thabadimasego long after their initial arrival in Southern Africa.

The material remains from Thabadimasego by and large provide an impression that subsistence activities typical for the Early Iron Age occurred on the site. Cattle and sheep/goats, as well as wild game animals such as zebra and steenbok populate the faunal assemblage. Carbonized seed remains, such as might be produced at a cooking fire, are found in substantial quantities along with numerous multi-gram flecks of charcoal. Decorated and undecorated pottery, much of it burned, abounds across the site, most of it in a highly fragmented state. Shell beads, present in Southern African assemblages since the Middle Stone Age, also occur frequently. Glass beads traded inland from coastal depots as well as copper and iron decorative objects occur in moderate quantities. The presence of both types of items may support the notion that occupants of Thabadimasego engaged in a network where highly valuable goods from the South Sowa area (such as, perhaps, ivory; see Reid and Segobye 2000b) were exchanged for these luxury goods.

While some of the more specific questions posed by this research project about the exploitation of certain resources (such as wild versus domesticated plants and animals) must remain unanswered until more work can be done on the assemblage, it would be easy to characterize Thabadimasego as a small, low-ranking settlement that perhaps acted as a subordinate in a Zhizo-era settlement system where a site like Kaitshàa acted as the higher-status larger village. Generally speaking, Early Iron Age sites that contain some structural remains, regardless of their overall size, seem to be characterized as some type of residential settlement (see, for example, Mitchell 2002:279-283). In the following chapters, however, the argument will be presented as to why Thabadimasego should *not* be presumed to have been a residential settlement, and why the site itself and its presence in the surrounding landscape may instead lend support towards an understanding of Early Iron Age settlement processes in more regionally variable terms.

Chapter 5 Spatial analysis

5.1 Spatial information and analysis

Spatial attributes of an archaeological site represent more than just the background of the material objects themselves. Rather, these attributes both constrain and are influenced by the activities which occurred on the site. Space is both functional and symbolic, and the manipulation or organization of space is, as such, an important component of any anthropological study (David and Kramer 2001; Branton 2009). Spatial variables and spatial attributes are too often overlooked within Southern African Iron Age research as significant components of past communities' behavioral processes, or are accepted uncritically and are not contextualized by other factors like climate, terrain or social influence; such is the case with the Central Cattle Pattern when decoupled from its direct historical connection and its original locale (Lane 1995). Badenhorst (2009), for example, points out the irregularities among features (such as hut shape and village layout) sites at which the Central Cattle Pattern has been used as an interpretive model. He suggests that placement of these features are primarily functional, not ideological, and that similar settlement layouts occur in other parts of Africa outside the Eastern Bantu/ Chifumbaze frame of reference. Regional settlement patterns are also increasingly recognized; in addition to Denbow's well-known (1984) Toutswe model for eastern Botswana, other scholars have developed local settlement sequences for the Shashe-Limpopo Valley (Meyer 2000; van Doornum 2005) and the Eastern Cape (Feely and Bell-Cross 2011).

5.2 Spatial methodology and results

Critical studies of the use of space in Iron Age contexts are beginning to tease out some of the variables which may be understood from a comparative perspective that accounts for site formation processes, variation in site function, and physical environment rather than a 'one size fits all' approach which on borrows details from a specific ethnographic analogy. In their work at Ndondondwane, for example, Greenfield and Miller (2004) and Fowler and Greenfield (2009) demonstrate by examining microstratigraphic changes as well as by sequencing shifts in metallurgical activities that the site's layout is the result of reoccupations over time, albeit within a single cultural horizon. Fowler and Greenfield (2009) relate stratigraphy to radiocarbon and ceramic sequences at Ndondondwane to document changes in site use over time. Greenfield and Miller (2004) classify metal-working residues according to type, frequency, and spatial arrangement in order to discern trends in metallurgy over time at Ndondondwane.

To address the need for a critical assessment of spatial variables within the scope of this project, the use of space was examined primarily at the site-level scale. In addition, in Chapter 6 the site will be discussed in the context of its landscape. While other spatial scales, such as the regional interaction of Zhizo-era sites, are also significant for the understanding of socioeconomic process, it was felt that the intra-site and inter-site (landscape) scales were most informative for the research questions stated in Chapter 2, particularly as the factors affecting these scales have not yet received much attention for the South Sowa area.

The overall goal for this spatial analysis is not to produce a specific model which reframes socioeconomic dynamics of Early Iron Age communities in an alternative to the Central Cattle Pattern, but rather to understand the underlying principles that dictate how space was used within the site, to the extent that this is possible using only the artifact distribution (as opposed to, for example, using ethnographic or ethnoarchaeological information as well). In other words, how are cultural materials organized at the site – are certain kinds of artifacts more likely to co-occur with other types of artifacts, or more likely to occur in one part of the site as opposed to another? Also, what other identifiable factors - taphonomic, geological, and historical - influenced the distribution of cultural material?

My future research goals include building a database that can provide a comparative perspective on the variability already observed in site organization among Early Iron Age landscapes. Attributes considered on the intra-site scale include geophysical (soil horizons, terrain, elevation, etc.); taphonomic (erosion and bioturbation), recent disturbances made by people; and behavioral (types of features, relative placement, cultural material distribution relative to non-portable features, etc.). Landscape attributes considered include the natural and cultural boundaries imposed on sites; and geophysical factors such as land formations relative to site location. This project on its own will not accomplish a full accounting of these data, but will merely lay the groundwork for it.

No a priori assumptions about artifact distribution at Thabadimasego were made prior to mapping the site (apart from the usual law of superpositioning as it relates to stratigraphic integrity). The first null hypothesis is that all cultural materials are randomly distributed across the space of the site and that no cultural factors were involved in the placement of these materials. This is highly unlikely to be a valid hypothesis (especially since some clustering was observed in the field). Therefore, a secondary null hypothesis is that none of the types of cultural materials (pottery, glass, structural remains, etc.) have any more influence than the others in the way the site is structured. In other words, no clusters of any kind of artifacts influence the clustering of any other kind of artifact. If this null hypothesis were to be supported, no conclusions can be drawn about the behaviors that influenced the site's organization, or about the socioeconomic context in which these behaviors were enacted.

It must be remembered too that non-random distributions do not automatically translate into direct evidence of a set of intentional behaviors causing the artifacts' deposition - we cannot immediately rule out clusters forming from, for example, taphonomic effects such as slopewash displacing lighter artifacts (small beads, charcoal, etc.) and leaving in place heavier ones (such as pot sherds and structural remains). Even so, mapping distributions, identifying clusters and enumerating trends in the site's patterning provides a starting point for further investigation wherein non-behavioral factors may be explained. Natural factors may have played a role in site layout at Thabadimasego. Because the edges of the hilltop are erosion-prone (particularly on the Southern side), it makes sense that structures would be built in the site's center where the soil is the most stable. Seasonal weather factors may also have played a role. For example, exposure to wind incoming from Sowa Pan could have affected location choice for structures and middens.

The spatial information collected during the 2012 excavation season was generally accurate to the arbitrary unit level (most often 5 cm below datum; occasionally 10 -cm when a unit seemed especially sterile). In mapping artifact distributions, then, it would be possible not only to represent their X and Y coordinates (northing and easting coordinates of the unit datum from the site grid), but their Z coordinate as well (depth below surface or datum). Artifact distributions could be generated for each soil horizon in this way, which could be informative as to vertical distribution and depositional processes. However, for the purposes of this project at this time, the aggregate of each pit or unit (combining all its levels/ horizons) was taken as the unit of analysis instead. This was done primarily because the working hypothesis for this project (based on uniformity of the assemblage) is that the site represents a single, fairly short-term occupation, and so all cultural materials, regardless of their present-day context, were deposited in what can be considered a single event (such as a temporary camp). As discussed in the previous chapter, the presence of artifacts in the upper horizon of soil is likely attributable to post-depositional movement caused by bioturbation and soil displacement. It will probably be of interest in the future to revisit this dataset with an eye to differentiating the vertical distribution, but that remains a problem for another time.

Spatial analysis methods

The majority of the spatial analysis was completed using the software suite ArcGIS 10.2. Among GIS software, ArcGIS is somewhat unusual in that its workflow is shared between several programs, all of which are part of the software suite. Two of these programs, ArcCatalog and ArcMap, performed the bulk of the operations for this project. ArcCatalog acts as a file and metadata manager, while ArcMap hosts the ability to edit the data stored in the files, and to create maps (which in reality are simply compilations of the types of files created in ArcCatalog and stored in a separate database).

The starting point for the spatial analysis was to convert the existing artifact inventory (stored in

Excel spreadsheets) into a table compatible with ArcGIS, and to georeference this information. This on its own was quite time consuming as it necessitated standardization and synthesis of the multiple formats by which the catalog had been compiled over the last two years (all of them were in MS Excel, but different terminology was used for the same type of artifact at different points, listed inventories in different ways, and in some cases artifacts were even classified somewhat differently at different stages. For example, while the ceramic identification in the 2012 post-excavation initially began by sorting out the burned, undecorated body sherds from the unburned, undecorated body sherds (and had additional categories for, e.g., unburned decorated rim sherds, etc.), later these two were lumped together in a single category as the distinction was not always clear and it seemed unnecessary to introduce that level of uncertainty into the dataset. A listing of each artifact category can be found in Table 9.

Before work in ArcGIS could begin, it was necessary to address the fact that, of the 218 pits and units excavated at Thabadimasego by the 2012 field team, 21 of these were 1-by-1-meter units which comprised a much larger volume than the other 197 test pits (whose surface area dimensions averaged about 40-cm-by-40-cm). For example, a 1-by-1 unit excavated to 50 cm would comprise .5 m^3 total volume, whereas a 40-by-40-cm pit excavated to 50 cm would comprise only .08 m^3 total volume. A unit and a pit, even if excavated to the same depth, would therefore each represent very disparate units of analysis. To the knowledge of the author, this is not a common practice in post-excavation spatial analysis, at least within Southern African archaeology; however, upon review of the methods employed in this chapter with Dr. Sarah Hession, a statistician with Michigan State University, it was agreed that in theory the standardization of artifact counts per unit volume would, in fact, provide a more quantitatively meaningful picture of the data.

Such a disparity in the size of each area sampled meant that counts of artifacts for pits and units were not directly comparable. However, since cultural material was generally well-dispersed throughout any given unit or pit (i.e., material did not tend to cluster in any portion of the 1-by-1, but was usually spread throughout it), this problem could be addressed fairly easily by converting each pit into a standard size. A copy of the original artifact inventory for all 218 units and pits was made where the artifact counts for each pit were ‘standardized’ to a 1-by-1-meter surface area. This was done by calculating the original surface area for each pit and dividing the count of each artifact type by the resulting fraction. For example, if pit A had dimensions of 35-by-35-cm, its surface area is 0.1225 m. If the same pit contained 150g of undecorated rim sherds, the ‘standardized’ count for its corollary 1-by-1 would be about 1225 g. While, given that at some larger scale clustering is known to occur on the site (hence the entire reason for the spatial analysis) and this correction is therefore not a perfect approximation of standard sample volumes, it was felt that using a standardized count of artifacts would address the more immediate problem of unit comparability. However, the original, non-standardized artifact counts were also retained as a separate file, so that, ultimately, spatial analysis could be performed on both and a measure of sensitivity could be gained for the standardized data.

Table 9 Artifact categories for analysis

Shell	OES beads, finished (count)
	OES beads, irregular (count)
	OES beads, ≥50% present (count)
	OES beads, <50% present (count)
	OES fragments (count)
	OES all types aggregate (count)
	ACH beads, finished (count)
	ACH beads, irregular (count)
	ACH beads, ≥50% present (count)
	ACH beads, <50% present (count)
	ACH all types aggregate (count)
	Shell all types aggregate (count)
Pottery	Pottery, all, mass (g)
	Pottery, Undec Body, mass (g)
	Pottery, Dec Body, mass (g)
	Pottery, Undec Rim, mass (g)
	Pottery, Dec Rim, mass (g)
Glass	Glass beads, count
Metal	Ferrous beads, count
	Ferrous beads, mass (g)
	Non-ferrous beads, count

Table 9 (cont'd)

	Non-ferrous beads, mass (g)
	Ferrous fragments, mass (g)
	Ferrous wire/ bar, count
	Ferrous wire/ bar, mass (g)
	Non-ferrous wire/ bar, count
	Non-ferrous wire/ bar, mass (g)
	Ferrous all, mass
	Non ferrous all, mass
	Metal all, mass
Other	Slag, mass (g)
	Dhaka, mass (g)
	Burnt seed, mass (g)
	Bone, mass (g)
	Charcoal, mass (g)

Once the data were organized, cleaned and converted into ArcGIS geodatabase tables (one each for the original and the standardized artifact counts), these were each appended to a point feature class which contain the location of each excavation unit and test pit each represented as X,Y points. The resulting files contained information (stored as attributes of the points) about the quantities of each type of artifact (glass beads, metal beads, various types of pottery, etc.) in each unit and pit in a spatially-referenced, mappable format (Figure 31). One such feature class was created for the original, unaltered data and another for the standardized data. The resulting feature classes, along with background shape files such as hill contours and site perimeter, were incorporated into an ArcMap map file for further analysis.

ArcGIS 10.2 offers a wide array of options when it comes to structuring and displaying spatial data. Each separate shapefile or feature class makes up a separate layer in an ArcMap map file (much like, in graphics editing software such as Photoshop, different elements of the image can be sorted into different layers, which can then be individually turned on or off and edited on their own). The properties of each of these layers can be changed depending on what kind of information one wishes to display in their map. In this case, the point feature class containing all 218 units and pits (and their corresponding artifact counts) first had to be used to generate subordinate shapefiles for each category of artifact, so that each of these artifact categories could be a separate layer (and therefore visualized distinctly) in the map. This is done with the following: a “select by attribute” SQL query using the syntax “[X artifact category] > 0” is applied to the point feature class to select each point containing any quantity of a given type of artifact, and the resulting selected points are exported to their own shapefile under an appropriate name. This is repeated for each artifact category. Hence, the 35 categories of artifact included as attributes for each of the 218 units and pits resulted in 35 separate shapefiles which could then be modified and displayed separately. This process was done both for the original and the standardized datasets.

Histograms

In order to get a quick overview of the distribution of each kind of artifact on the site, a series of histograms was also produced for each artifact category for both the original and standardized datasets. The histograms depict the frequency with which any given quantity of the given artifact type appears in each unit or pit. The histograms demonstrate that, for any kind of artifact, regardless of whether using the original or standardized datasets, the distribution is non-normal and skews towards zero. These histograms can be viewed in Appendix F; see Figure 32 below for an example. In general, the shapes of the distributions are very similar for standardized and original data. Possible exceptions to this include ferrous beads (mass), finished OES beads, aggregate *Achatina*, and charcoal.

There turned out to be inconsistency in the binning used for the histograms, either between artifact types or between original and standardized, because I was aiming to represent the distributions in as fine-grained a way as made sense for that artifact type, and there’s huge differences between types (and also between original and standardized, when standardization created much larger quantities than the original). It wouldn’t make sense to use 70 bins for copper wire (where there’s only 2 or 3 instances of it on the whole site), but it does for undecorated body sherds, because doing so eliminated false zeros.

OBJECTID *	Shape *	SiteID	Lot_1st	Unit	Northing	Easting	Levels	Total_depth	Length	Width_	Total_area__m_2	Positive	UniqueID	OES_beads_finished	OES_bead_irreg	OES_bead_over50	OES_bead_under50	OES_frags	OES_all
1	Point	13	21	1	48	103	1	0.2	1	1	1	Y	1	0	1	0	0	0	1
2	Point	13	22	2	65	95	3	0.3	1	1	1	Y	2	3	4	1	0	2	10
3	Point	13	26	4	81	92	4	0.6	1	1	1	Y	3	6	0	1	0	0	7
4	Point	13	24	3	102	161	5	0.3	1	1	1	Y	4	35	4	2	0	6	47
5	Point	13	37	5	101	179	4	0.4	1	1	1	Y	5	13	5	4	0	10	32
6	Point	13	147	6	111	180	7	0.4	1	1	1	Y	6	2	3	1	0	6	12
7	Point	13	159	9	111	181	7	0.3	1	1	1	Y	7	5	8	2	1	16	32
8	Point	13	166	7	80	140	5	0.3	1	1	1	Y	8	4	0	3	0	2	9
9	Point	13	176	8	80	139	5	0.2	1	1	1	Y	9	10	0	3	0	2	15
10	Point	13	189	10	100	199	8	0.3	1	1	1	Y	10	2	2	0	0	2	6
11	Point	13	206	11	111	188	4	0.3	1	1	1	Y	11	1	0	1	1	5	8
12	Point	13	214	12	71	227	4	0.2	1	1	1	Y	12	1	0	0	2	0	3
13	Point	13	222	13	100	101	3	0.2	1	1	1	Y	13	8	20	0	77	0	105
14	Point	13	227	14	99	101	4	0.3	1	1	1	Y	14	13	36	0	94	0	143
15	Point	13	236	15	108	126	6	0.3	1	1	1	Y	15	8	3	1	3	9	24
16	Point	13	248	16	88	152	5	0.3	1	1	1	Y	16	2	3	0	0	5	10
17	Point	13	259	17	78	170	4	0.3	1	1	1	Y	17	8	3	3	2	7	23
18	Point	13	268	18	90	208	4	0.2	1	1	1	Y	18	3	1	0	0	0	4
19	Point	13	275	19	103	161	6	0.3	1	1	1	Y	19	25	27	8	2	5	67
20	Point	13	291	20	97	176	5	0.3	1	1	1	Y	20	4	4	1	2	1	12
21	Point	13	345	21	-3	69	3	0.2	1	1	1	Y	21	1	1	0	0	0	2
22	Point	13	120	TTP 88	100	110	1	0.3	0.4	0.3	0.1	Y	22	1	0	0	0	0	1
23	Point	13	114	TTP 82	100	120	1	0.3	0.4	0.4	0.2	Y	23	0	0	0	0	1	1
24	Point	13	111	TTP 79	100	130	1	0.3	0.5	0.4	0.2	Y	24	0	0	0	0	0	0
25	Point	13	108	TTP 76	100	140	1	0.2	0.4	0.5	0.2	Y	25	0	0	0	0	0	0
26	Point	13	105	TTP 73	100	150	1	0.3	0.5	0.4	0.2	Y	26	1	0	0	0	0	1
27	Point	13	47	TTP 127	100	170	1	0.3	0.4	0.3	0.1	Y	27	3	0	1	0	0	4
28	Point	13	62	TTP 30	100	190	1	0.3	0.3	0.4	0.1	Y	28	0	0	0	0	0	0
29	Point	13	63	TTP 31	100	200	1	0.2	0.4	0.3	0.1	Y	29	0	0	0	0	0	0
30	Point	13	64	TTP 32	100	210	1	0.2	0.4	0.4	0.1	N	30	0	0	0	0	0	0
31	Point	13	0	TTP 123	100	220	1	0.2	0.5	0.5	0.2	N	31	0	0	0	0	0	0
32	Point	13	77	TTP 45	100	230	1	0.2	0.5	0.3	0.2	Y	32	0	0	0	0	0	0
33	Point	13	103	TTP 71	110	160	1	0.2	0.3	0.4	0.1	Y	33	1	0	1	0	0	2
34	Point	13	101	TTP 69	110	170	1	0.2	0.4	0.3	0.1	Y	34	0	0	1	0	0	1
35	Point	13	99	TTP 67	110	180	1	0.2	0.3	0.4	0.1	Y	35	2	0	1	0	0	3
36	Point	13	97	TTP 65	110	190	1	0.2	0.4	0.4	0.1	Y	36	0	0	0	0	0	0
37	Point	13	94	TTP 62	110	200	1	0.2	0.4	0.3	0.1	Y	37	0	0	0	0	0	0
38	Point	13	91	TTP 59	110	210	1	0.3	0.4	0.4	0.2	Y	38	0	0	0	0	1	1
39	Point	13	89	TTP 57	110	220	1	0.2	0.4	0.4	0.1	Y	39	1	0	0	0	0	1
40	Point	13	48	TTP 17	90	200	1	0.2	0.5	0.4	0.2	Y	40	1	0	0	0	0	1
41	Point	13	65	TTP 33	90	190	1	0.2	0.4	0.5	0.2	Y	41	0	0	0	0	0	0
42	Point	13	106	TTP 74	110	150	1	0.2	0.4	0.4	0.1	Y	42	0	0	0	0	0	0
43	Point	13	109	TTP 77	110	140	1	0.2	0.3	0.4	0.1	Y	43	0	0	0	0	0	0
44	Point	13	112	TTP 80	110	130	1	0.2	0.4	0.5	0.2	Y	44	2	0	0	0	0	2
45	Point	13	115	TTP 83	110	120	1	0.2	0.5	0.4	0.2	Y	45	0	0	0	0	1	1
46	Point	13	119	TTP 87	110	110	1	0.3	0.5	0.4	0.2	Y	46	0	0	0	0	0	0
47	Point	13	121	TTP 89	110	100	1	0.2	0.5	0.4	0.2	Y	47	0	0	0	0	0	0
48	Point	13	78	TTP 46	90	220	1	0.2	0.5	0.4	0.2	Y	48	0	0	0	0	0	0

Figure 31 Screen capture of a portion of the attribute table for the excavation units in ArcGIS

Although generally, increasing the number of bins doesn't really change the shape of the distribution, just its detail.

ArcMap displays

The display of an ArcMap shapefile for any artifact category can be modified to show something very similar. Attribute values of a given feature (in this case, quantities of artifacts per point) can be symbolized in a number of different manners in ArcMap, by varying the size, shape and color of the feature. Here, the values of the attribute in question were represented with symbols of graduated size and color, where each symbol represented a range of values (e.g., 0, 1-2, 3-5, etc.). The map then displays the locations of larger quantities of a given artifact type by showing a larger symbol, and smaller quantities with a smaller symbol, and so on (for an example, see Figure 33).

Since the goal for spatial analysis is to understand not only what material is clustering where, but how clusters of different materials may relate to one another - in an effort to look for an underlying structure to the site - then these displays can be layered and, in a sort of georeferenced multivariate scatter plot, used to compare various combinations of artifact distributions across the site (though it is not truly a scatter plot, because the X and Y axes represent the location coordinates of each point, not the values of the variables in question). Given that there are 35 different categories of artifacts, there are hundreds of potential multivariate combinations. However, certain kinds of cultural material are thought to hold more weight in the organization of any Early Iron Age site. The arrangement of mudbrick structures in particular - such as huts or grain storage bins - is the primary focus of most representations of site layout (Mitchell 2002, Huffman 2001). Burials, cattle kraals, and metal-working forges, if present, are also important. Essentially, these are the features of a site, or at least a homestead or village site, which are the 'bones' of the site, i.e., its most important and informative elements. All other material distributions are assumed to form around and in relation to these features. These features are given primacy because they represent the major cultural and economic elements of Early Iron Age subsistence patterns -

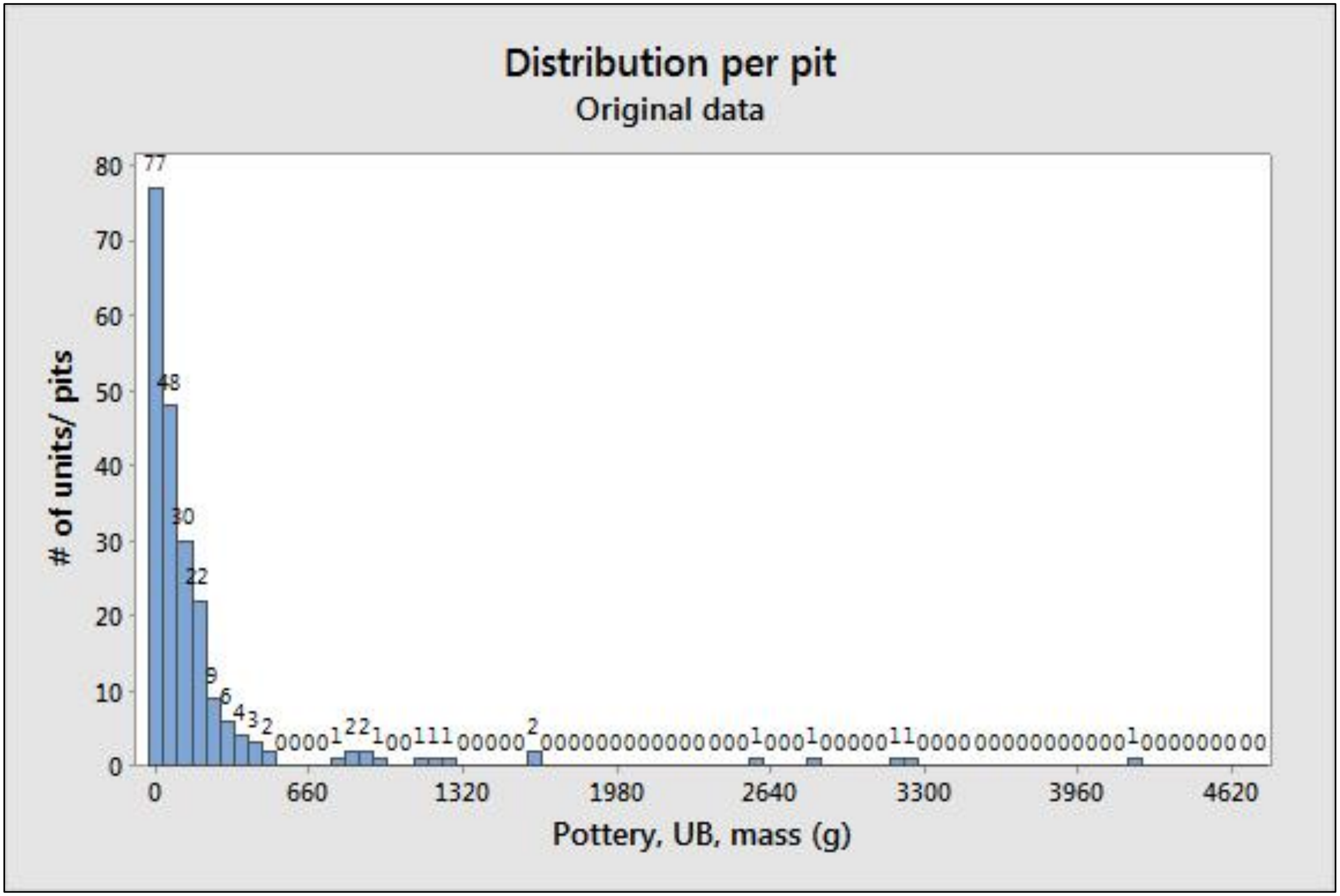

Figure 32 Example of histogram displaying frequencies of artifact counts per unit/ pit

permanent, sedentary living spaces; cattle-keeping and crop production; creation and use of metal items (which also is thought to hold significant spiritual power, hence the importance of a forge's location - see, e.g., Miller and Killick 2004). Materials in the archaeological record that indicate the remains of such features, such as stone structures, dhaka (mudbrick), and cattle dung, can therefore be given primacy when comparing the distributions of different artifact types at a site. It can be expected that these materials would contribute to the site's organization - in other words, that they would be the independent variables in terms of spatial analysis and that other artifacts would be, in essence, the dependent variable In short, what is already known about Early Iron Age socioeconomic organization provides a reason to prioritize a few variables in the search for underlying structure of a site's organization. It is already known that the extensive subsurface reconnaissance at Thabadimasego recovered no remains of a burial, forge or smelting furnace, but that stone structures, mudbrick structural remains as well as what may be ash, dung, or both are all present on the site. Figure 34 shows Thabadimasego's layout as represented solely by these elements (with the elevation contours for context as well). The "buffer" tool of ArcToolbox was used to generate polygon features representing the general areas in which ash and mudbrick are found on the site. Since ash appeared in small, dispersed clumps throughout an area several meters in diameter (as indicated by the few pits ash was found in), the original point features for ash were given a 5-meter buffer to produce the resulting polygon.

Mudbrick required somewhat different treatment. Small chunks of mudbrick (amounting to no more than a couple hundred grams) appeared in several units and pits on the site, while actual structural remains - fragments of walls or floors - only appeared in a few units in the center of the site (specifically, units 3 and 5, which are contiguous, and units 19 and 20, which are set 5 meters apart). The remains in these units added up to over 20 kilograms of mudbrick per unit. In addition, unit 16 contained about 2 kg of dhaka (mudbrick), which is still almost an order of magnitude greater than any other unit or pit. At the time of excavation, there was unfortunately not enough time to place an extended block of excavation

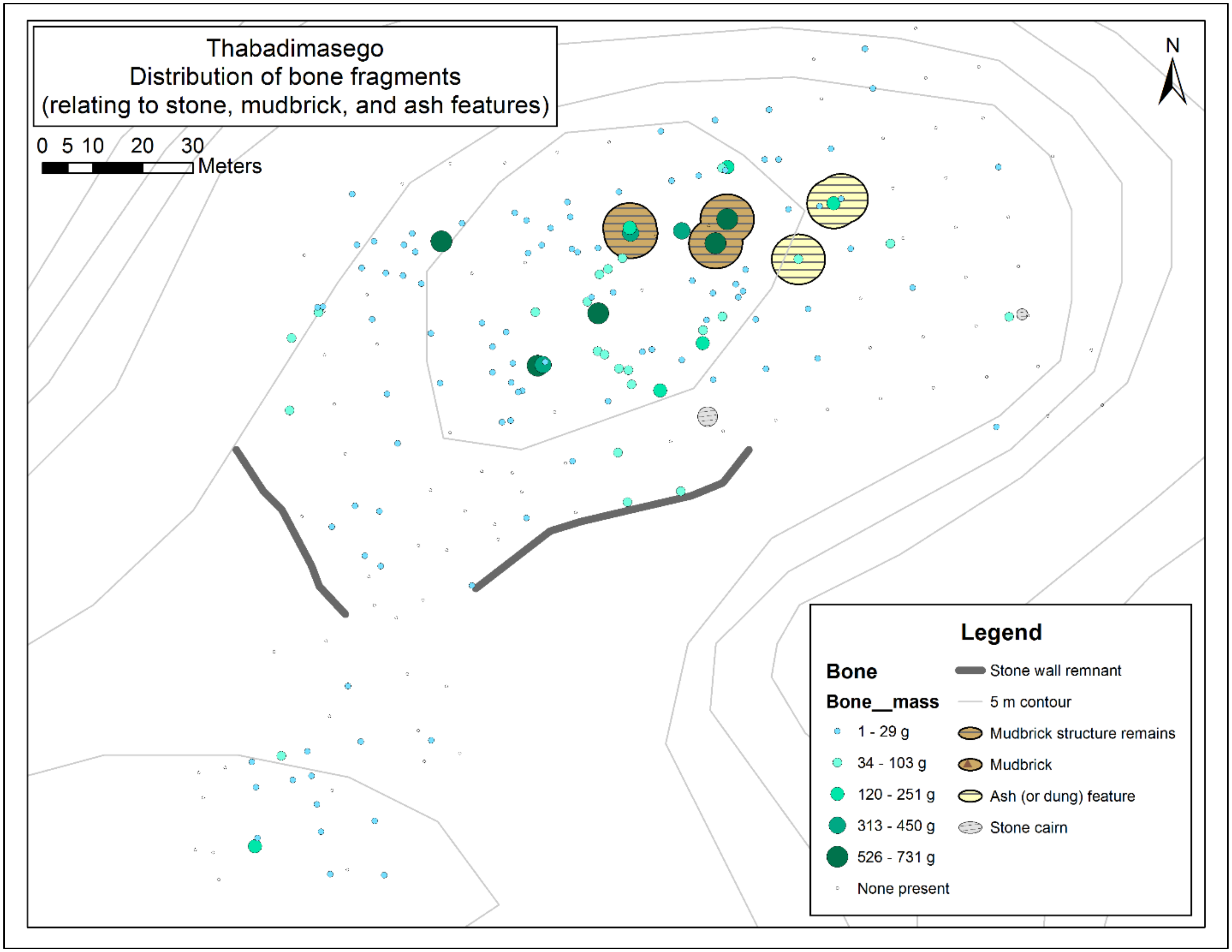

Figure 33 Value-weighted plotting of bone (by mass, per pit) at Thabadimasego

units in this central area so that the full extent and shape of the walls/ floors could be established (this would be very much of interest for future work on the site). The remains definitely do not extend more than 10 meters in any direction from the units in which they were found, as the ten-meter interval test pit survey coverage established. Therefore, as a rough estimation of the extent of the significant mudbrick features on the site, a 5-meter buffer was used for units 3, 5, 19 & 20 (5 meters being the maximum distance between any of these units), and a 1-meter buffer for the smaller feature in unit 16. The resulting polygon representations, which together with the stone structures and elevation contours comprise the 'background map' for the remaining spatial analysis. For future work - it would be informative to excavate a several-meter block of units where these wall/ floor remains were found to see if any specific structural organization can be identified, or whether it really is just a few collapsed surfaces strewn about.

However, the presence of multiple subtypes of the same material - e.g., shell beads at different stages of production, or iron items of different forms – does allow the opportunity to examine the distribution of these materials at varying levels of specificity. For example, the distribution of any and all metal present on the site may be viewed in comparison with that of, say, only copper items, or only iron beads (both of these being subtypes of the higher-order category 'all metal'). This is of interest when looking to determine the appropriate scale of analysis for materials. Are any and all metals treated the same in their placement on the site, or are copper items located differently than iron ones? Are metal beads located differently from wire or slag? That is to say, are they treated as part of the same group or as different groups? Without knowing *a priori* the significance the occupants of Thabadimasego (or any other Early Iron Age site) may have given to any one category of material as these categories are defined by the archaeologist, the use of spatial displays to examine differentiation (or lack thereof) among organization of material types can provide one window of insight into the behaviors which produced the archaeological record we now excavate.

The distribution of artifacts over the site may also be influenced by whether or not they were intentionally discarded. Intentional discard of certain types of material goods, such as broken pottery or butchered bone for example, would be liable to occur repeatedly in the same locations. Unintentional loss of other kinds of goods, such as glass, shell and metal beads lost one or two at a time from a broken necklace, would, on the other hand, be more scattered.

To some extent this appears to be true for Thabadimasego. Small decorative items like the beads tend to occur in low concentrations across large portions of the site. On its own this could say something about the occupation of the site – how long would it take for nearly 40 glass beads, for example, to accumulate through accidental discard one by one? However, the presence of the cluster of ostrich and *Achatina* shell beads near the west wall remnant, many of which are burned or broken, suggests that these items too were discarded intentionally at some point – and separately from other materials.

The stone wall itself, it should be noted, had little in the way of cultural materials directly associated with it, based on the excavation units and test pits placed adjacent to it. The chronology of stone wall development in the South Sowa area is as yet poorly understood. For Botswana's eastern hardveld, western Zimbabwe and the Shashe-Limpopo Basin, van Waarden (n.d.) associates the origins of freestanding stone walling with the appearance of the northern Leopard's Kopje culture (designated as the Mambo ceramic facies in Huffman 2007), even while she notes that sites along Sowa Pan, including Kaitshàa, have occupations which date prior to this. Unlike Kaitshàa, however, Thabadimasego has not produced evidence of a multi-phase occupation which extends into the second millennium AD (Denbow et al. 2015). There is, in other words, no reason to assume that the stone walling at Thabadimasego is associated with anything other than its Zhizo-era occupation.

There is little further that can be said about the stone wall at this time, beyond describing its physical attributes. Its current height averages about 50 centimeters tall; its width roughly two meters. This reflects the severe degree to which it has been subject to damage by livestock and human over the last millennium. Its two segments, each flanking the southwest "neck" of the site, run for about 50 meters

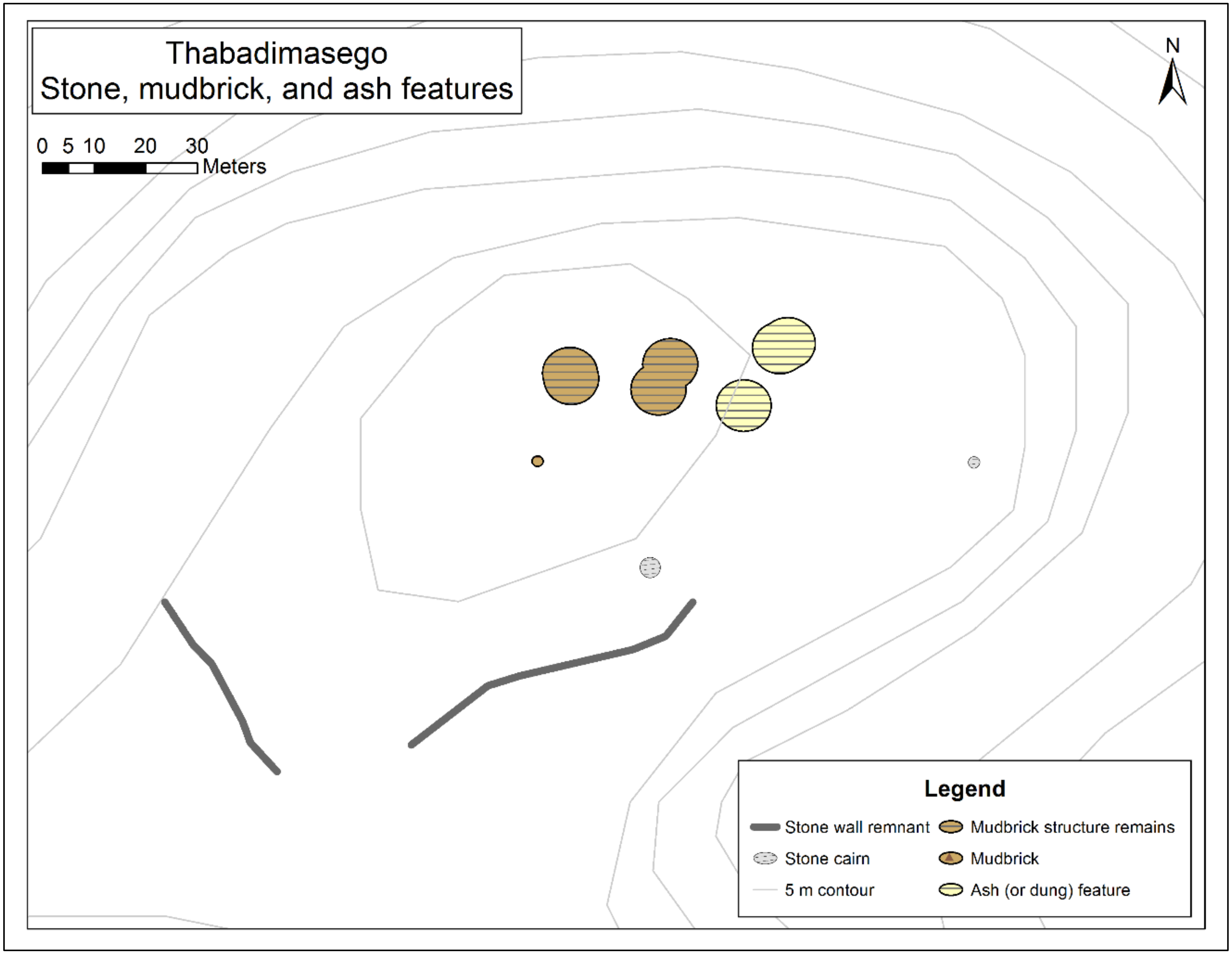

Figure 34 Stone, mudbrick and ash features at Thabadimasego

out from the opening. The wall appears to have been constructed out of local materials (probably calcrete), given that its structure gradually gives way to what looks like a natural outcrop of the same type of material further north along the hillside's western edge. The stones used to build the wall are around 30-50 cm in length and appeared uniformly weathered; they are distinctly larger, rounder, and less evenly coursed than classic Zimbabwe-type stone walls. The stone wall remains at Kaitshàa (Figure 35) are sufficiently intact to appear comparable to the P-style walling, an early form of stone wall construction that appears in the Shashe-Limpopo Basin, at Great Zimbabwe (in association with its early phases), and eastern Botswana (van Waarden 2010). The wall at Thabadimasego, on the other hand, has been destroyed too much to assess its construction style (Figure 36).

Looking beyond exploratory data analysis

The following section discusses some additional work that was conducted on the quantified spatial dataset in an attempt to understand how higher-order spatial statistical techniques operated on the data and what insights might be gained from using spatial statistics to evaluate a fine-grained data set like the one collected at Thabadimasego. In Southern Africa, the use of spatial metrics to evaluate site formation and site organization on as small a scale as has been done here is relatively uncommon (for one example, see Greenfield and van Schalkwyk 2006). The use of higher order spatial statistics, such as those discussed below, is unprecedented for Southern African Early Iron Age archaeology as far as the author is aware. As such, the proceeding discussion represents an exploration of the applicability of such methods to site-level archaeological data more so than an analysis in itself. Some of the problems and challenges related to attempting to employ spatial statistics on the dataset are discussed as well. The work discussed in this section was conducted under the tutelage of Sarah Hession, a research specialist at the Center for Statistical Training and Consulting at Michigan State University. However, any errors with either the methods or the data are mine alone.

Higher-order spatial statistics can shed additional light on the clustering of material culture in a site by highlighting not only where those clusters lie, but which clusters are in fact statistically significant (I.e. that they would not be expected to appear in a normal random distribution). Hotspot analysis is one such technique (Lawson 2010; “Hot Spot Analysis” 2015).Whereas spatial cluster analysis is a technique to measure the degree of clustering and/ or dispersion of point locations across a landscape, hotspot analysis takes measure of the degree of differences between values for a given attribute associated with the points (for example, quantities of pottery found in test pits). This technique can be used to identify locations which contain an unexpectedly high quantity of something (a hotspot) as well as an unexpectedly low quantity (a coldspot). However, a lot of assumptions about the organization of the data being subjected to these tests need to be sorted out before the results are meaningful (basically meaning that other exploratory tests need to be run first to evaluate the data, and the data need to be examined at different scales, to identify appropriate parameters). Unfortunately, completing this assessment proved to be outside the reach of this research project for the time being; what follows is a brief summary of what techniques were explored and how they may inform spatial organization of an archaeological site.

Hotspot analysis may be conducted on a dataset in ArcGIS 10.2 using the Getis-Ord Gi* function. The purpose of this function is, as described on the ESRI help files, “given a set of weighted data points, the Getis-Ord Gi* statistic identifies those clusters of points with values higher in magnitude than you might expect to find by random chance.” After selecting hotspot analysis for its ability to evaluate quantitative attributes of specific locations, a series of Global Moran’s I (tests of spatial autocorrelation) were run on the dataset prior to the hotspot analysis itself, in order to identify relevant neighborhood matrices. In essence, a neighborhood is an area, defined by a given distance, around the point of comparison where one would reasonably expect co-occurring material to have some kind of functional relationship or, in other words, to share space for some reason other than random distribution (Getis 2008). The measures of distance employed for defining neighborhood matrices were the K nearest neighbor function and the fixed distance band. The K nearest neighbor function defines a neighborhood as a user-defined given number of nearest points. If, for example, the parameters are set to look for the four closest points, then the function will include whatever four points are closest to the point in question - no matter their absolute distance from it - as the neighborhood. Conversely, the fixed distance band measure relies on an absolute radial distance around the point as the neighborhood. In other words, it includes anything within a given distance (e.g., 10 meters) of that point.

When working with prehistoric archaeological data, there sometimes is no clear-cut answer to what inherently makes sense, within the parameters of the dataset, as the outer limits of a spatial cluster. An archaeologist is an outsider attempting to make sense of remains without being aware of the choices and logic employed by the community at the time of the site's occupation. Lacking that 'insider' frame of reference, archaeologists must use what means and assumptions they can to look for structure in the data. In this case, doing so translates to playing around with a range of distances to find out how the data respond to them.

For several artifact types (bone, undecorated body sherds, ostrich eggshell, glass) the global Moran's I was run several times for a range of distances to generate a series of Moran's I indices. The Moran's I index provides an indication of the degree of spatial clustering present in the data, assuming the data is normally distributed. A positive index value indicates a tendency towards clustering, while a negative value indicates a tendency towards dispersion, with larger absolute values indicating stronger tendencies (for more information, see "Spatial Autocorrelation" 2015).The series of index values generated by inputting a variety of distances were then plotted those distance values in a scatterplot. The resulting graph presents an indicator of whether clustering in that kind of artifact drops off gradually as distance increases (as would be expected under conditions of normal distribution according to Tobler's first law), or whether any more sudden drop-offs occur (which would be a good indicator of a neighborhood boundary). The goal of this series of Global Moran's I tests was to determine appropriate neighborhood distances to plug in to the Getis-Ord Gi* function. These distances would then be tailored

Figure 35 Portion of the stone wall at Kaitshàa

Figure 36 Portion of the stone wall at Thabadimasego

to the parameters of the specific data in question, and the resulting hotspots identified would have much more meaning in the context of the site.

As mentioned before, this approach was abandoned for the time being. After running the Moran's I several times, it became apparent that the 35 different categories of artifact types employed in the spatial dataset would require a number of different neighborhood definitions, some of which were probably too small to be useful for the parameters of the data as sampled at Thabadimasego. For example, test pits were spaced at 10 meter intervals, and in some areas of the site, no additional units and pits were placed, so the minimum distance between points in those areas of the site is 10 meters. However, it is already known that charcoal, for instance, clusters on a much smaller scale than 10 meters - more like 10 centimeters. While a one-meter scale could be useful in identifying clusters of charcoal, a one-meter scale isn't applicable to areas of the site where sampling wasn't that fine-grained. Furthermore, other more ubiquitous materials such as bone and ceramic likely cluster at a much larger scale, where using a 10-meter distance as a neighborhood definition could be perfectly appropriate. In future research, it would be of considerable interest to pursue this line of inquiry. It would be of particular interest to perform a comparative study over multiple sites with a range of scales. Ultimately it was decided that, for the purposes of this research project, these issues were too much of a challenge. This is particularly the case when, as will be discussed in the following section, non-metric visual displays of material culture distribution proved sufficient for building a basic understanding of site layout at Thabadimasego.

Summary of results

Original versus standardized data

Overall, standardizing the counts of artifact types to a standard measure of volume proved to be an effective way to compensate for inconsistency in sampling procedure. While the standardized data did appear to yield smoother distributions for the most part (there are fewer large breaks between values), the ranges of values and the shape of their distributions are, for the most part, the same or similar to the original data (these may be seen in Appendix E). There are a few exceptions to this though, with dramatically overrepresented values for certain artifact types. This may point to either errors in calculations of the standardized data, or the presence of clustering at the scale of the individual pit for those particular artifact types (i.e., if locations of excavations happened to hit on a small dense area of something that wouldn't actually be equally dense if that pit were increased in size). This occurred for finished OES beads, broken OES beads, decorated rim sherds, copper beads, and iron fragments. Increases beyond the original range occurred for slag and undecorated body sherds as well, but not to the same degree - the standardized data in these cases could well be representative of what could be found in a 1-x-1-meter unit based on values that came out of other units. These findings underpin the importance of recognizing the effects of sampling procedures on results, and of getting a feel for what is 'normal' in the dataset one is working with.

The presence of unexpectedly high values for certain artifact types is, however, precisely what this analysis aimed to identify. When those artifact types that yielded unexpectedly large standardized values - finished OES beads, broken OES beads, decorated rim sherds, copper beads, and iron fragments - are isolated in ArcMap, their distribution can be seen as a series of relatively dense clusters, mostly in the western half of the site (Figure 37). When mudbrick and ash features are added back into the map display, the arrangement of the above artifact types becomes even more apparent (Figure 38). Furthermore, when additional artifact types are added to the map, those same locations tend to display higher density of those artifacts as well. This holds true whether using the original or standardized datasets (but it was easier to pick out from the standardized data thanks to the exaggerated values) (Figure 39).

Additional, albeit slightly more dispersed, concentrations of material occurred within and just adjacent to the mudbrick remains, as well as in an area several meters wide outside of the wall. More than likely, based on both the mudbrick remains and concentrations of other materials, the materials excavated at Thabadimasego represent the remains of two structures (or possibly two parts of one structure) - unit 3/5 and 19/20 respectively. Going back to the argument over what constitutes 'important' materials in terms of site organization, the mudbrick and ash clusters can be imagined as the sort of functional center of the site, and other materials understood by their placement relative to these features.

Adding yet another layer of information - the differentiation in soil matrices across the site - provides a further insight as to the site's structure. As discussed in Chapter 3, little differentiation exists overall within the site in terms of soil horizons. The great majority of soil on the site is consistently the same color, texture, and composition - a dry, light brown silty sand with a minor clay component. What does vary is the degree to which the soil is compacted in the first 10 - 15 centimeters below the surface. Figure 40 shows the variation in soil compaction within the top soil horizon across the site, while Figure 41 shows the same information but including the distribution of key cultural materials. As the Figure shows, most of the densest concentrations of cultural material fall within (in the case of the mudbrick cluster) or just adjacent to the compacted soil horizon.

Interpretation of activity areas – shell beads

As tempting as it would be to invoke the presence of the shell bead remains as evidence of a bead manufacturing workshop – i.e., for shell bead production as a sustained and high-volume activity at Thabadimasego – the spatial distribution of the shell on the site does not conclusively support this idea. Shell was certainly worked on the site, but whether or not a shell bead manufacturing "workshop" existed on the site depends to some extent on how one interprets the density of the materials in question. For instance, production of a flaked stone tool, through the process of reduction from the original cobble, often leaves behind a highly concentrated scatter of lithic debitage that becomes an easily identified feature in the archaeological record. Makers of shell beads may not have left behind such a visible footprint.

Schapera (1930), one of the earliest ethnographers of San peoples, says the following about shell

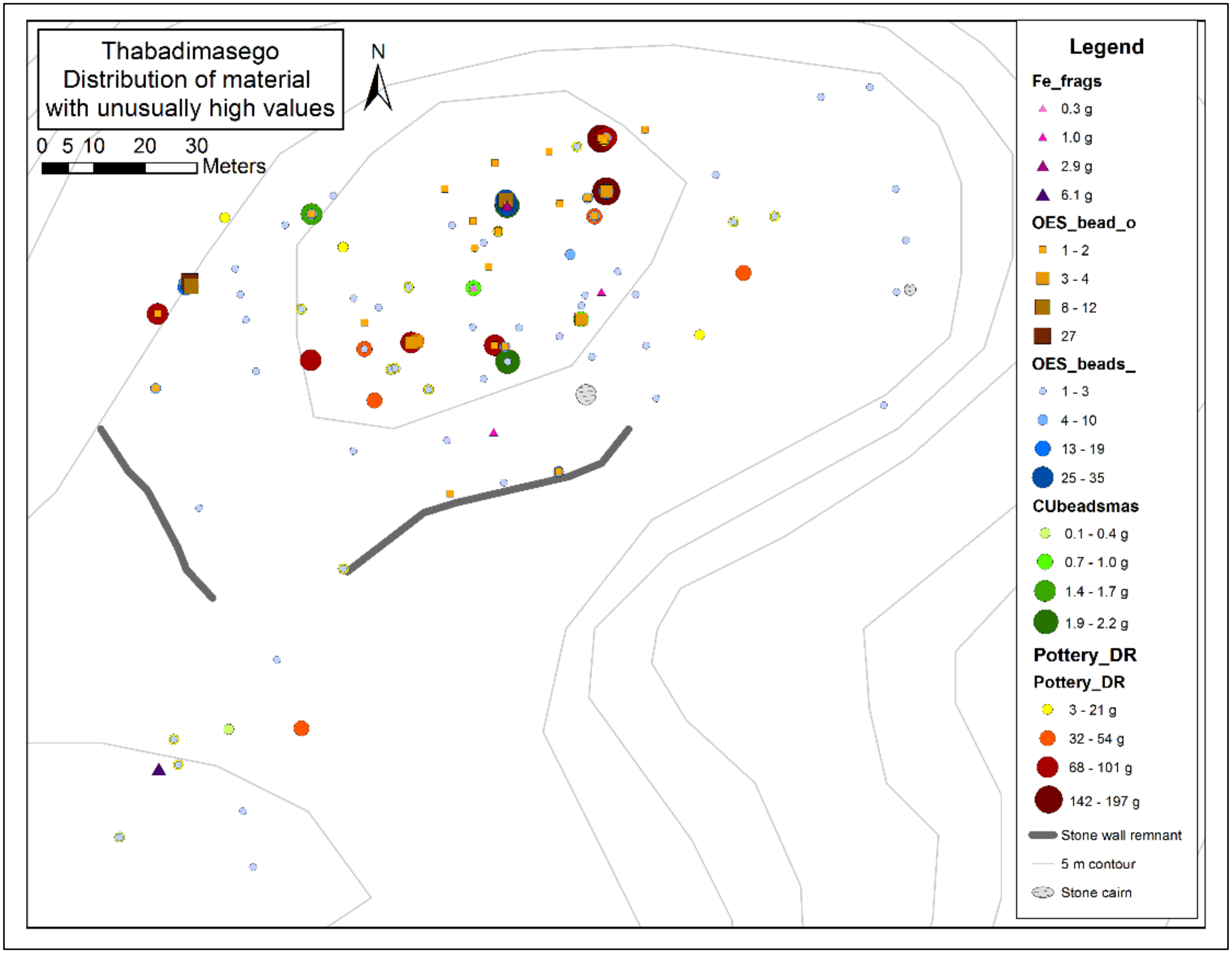

Figure 37 Materials with unusually high values

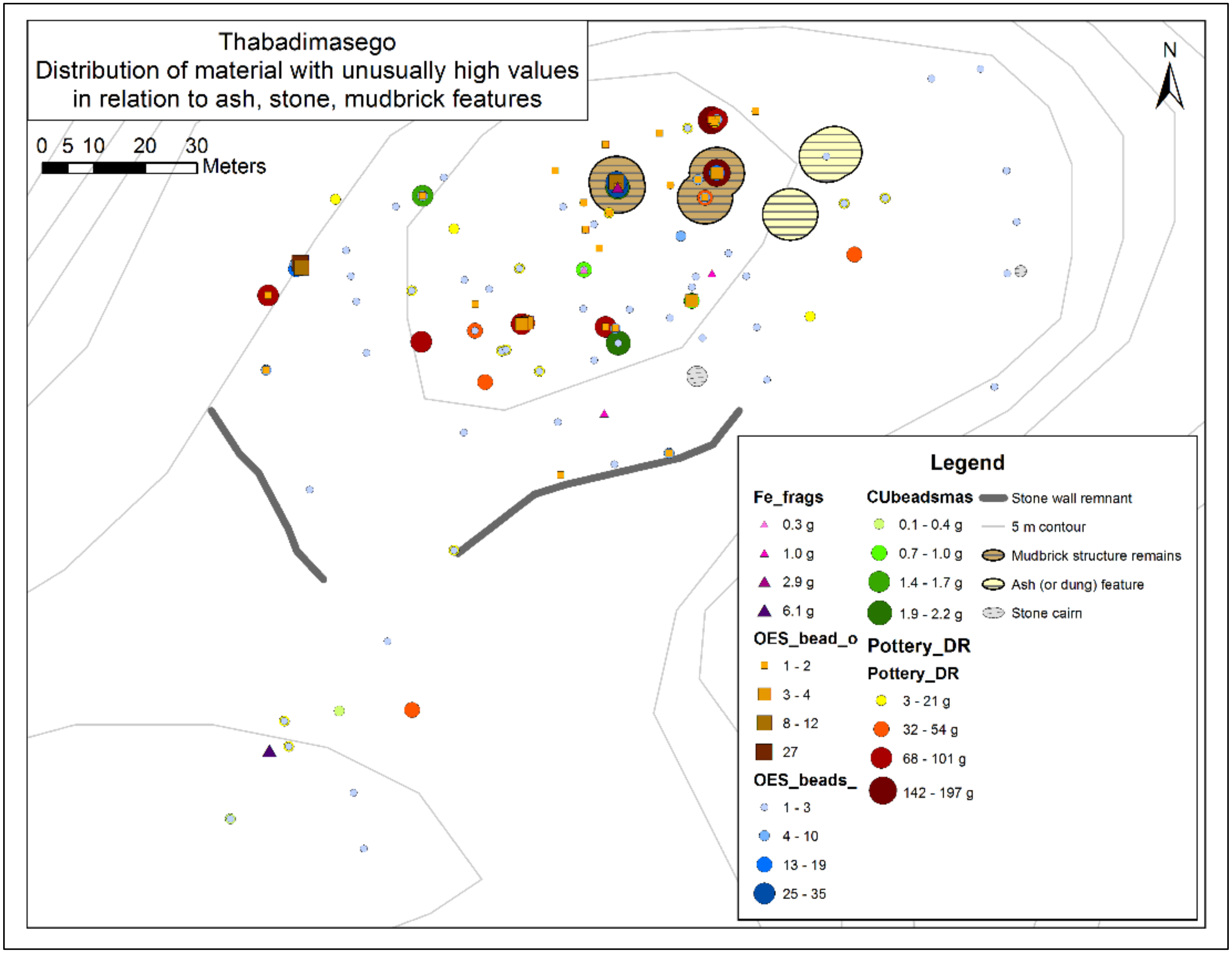

Figure 38 Materials with unusually high values plotted with ash and mudbrick features

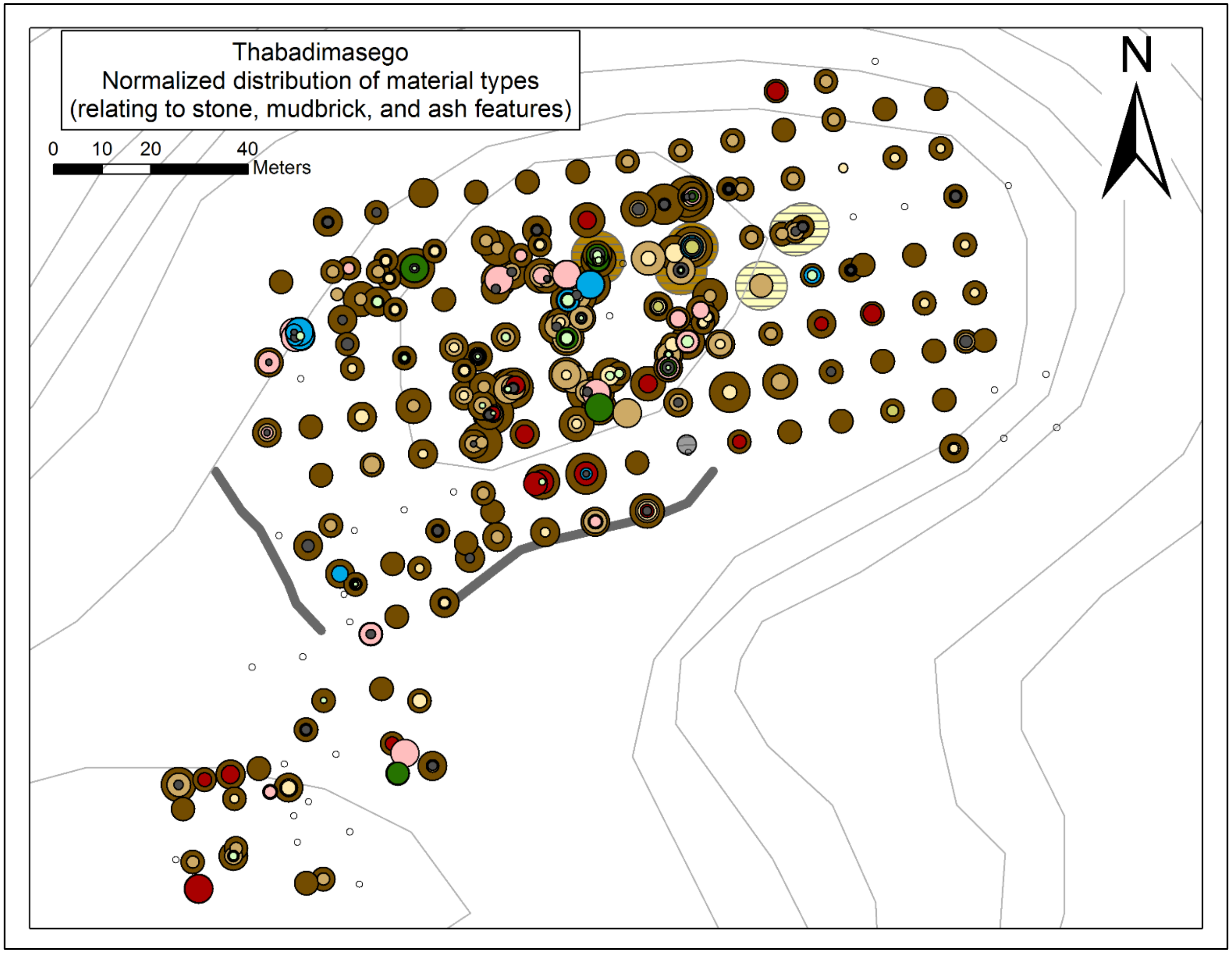

Figure 39 All material types; legend on following page

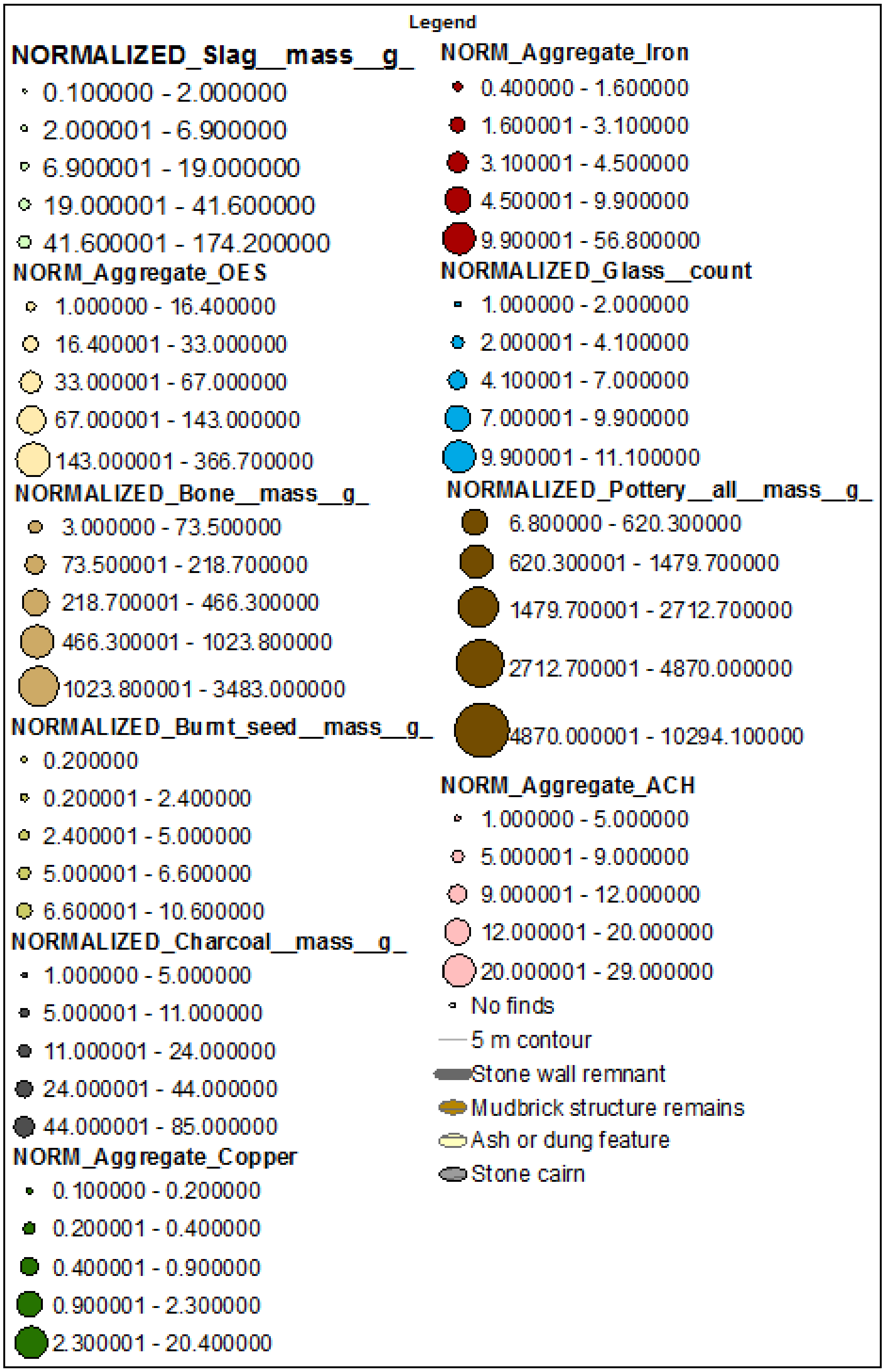

Figure 40 Legend for "all material types" density map

bead production:

"The eggshell is broken into small pieces which are softened in water and pierced with a small stone or iron borer. They are then threaded on to a strip of sinew and the rough edges chipped off with a horn. Soft bark fibre is next twisted between the beads, making the chain very taut, and the edges are finally rubbed smooth with a soft stone."

Dubroc (2010) mentions that, by way of evidence for shell bead production at Bosutswe, nearly 300 unfinished OES beads are found in the Lose (1200-1400 AD) levels in the central area of the site. He terms this a "cache", suggesting that the beads are concentrated within a relatively small area, unlike what has been observed for similar materials at Thabadimasego. Dubroc also notes the presence of grooved "smoothing stones," akin to those of Schapera's description, in the same strata on the western part of the site. One broken grooved stone was recovered from Thabadimasego (Figure 42), but it is not of the softer calcrete native to the escarpment, and therefore was imported from another location. Sadr and Fauvelle-Aymar (2006) summarize the way that groove shapes and depths found at sites across sub-Saharan Africa may indicate a very wide range of different uses (grinding particular grains or pigments, and sharpening bone and stone tools, among others); therefore it seems hasty to assume that the grooved stone fragment at Thabadimasego is associated with the site's shell bead fragments.

Site layout

Overall, it would be entirely possible to interpret the layout as a concentric semi-circular ring extending west from the mudbrick cluster with the ash feature sitting in 'front' of it. The majority of material clusters not associated with mudbrick appear to occupy the western half of the site in a loosely defined zone arcing from the western wall remnant to just north of the Southern wall remnant. Numerous low-density artifact scatters occur among and outside of this area as well; this could be interpreted as the 'background' debris accumulated across the site over the course of its occupation.

Alternatively, the argument can also be made that no overarching structure exists to the site apart from the fact that material generally concentrates in its center (this effect can also be argued to be taphonomic, which will be discussed further in the next chapter). Some of the material clusters primarily

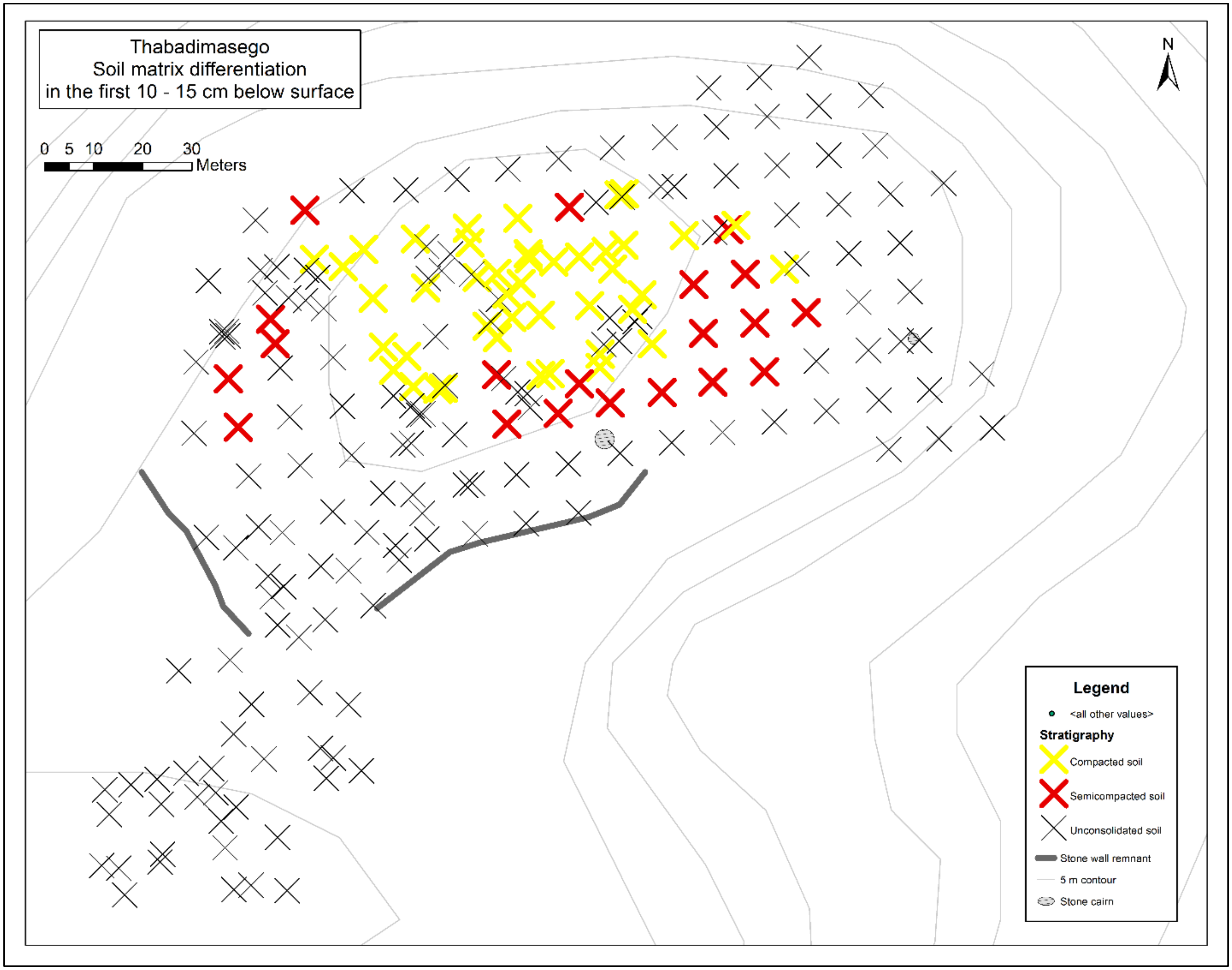

Figure 41 Variation in soil compaction

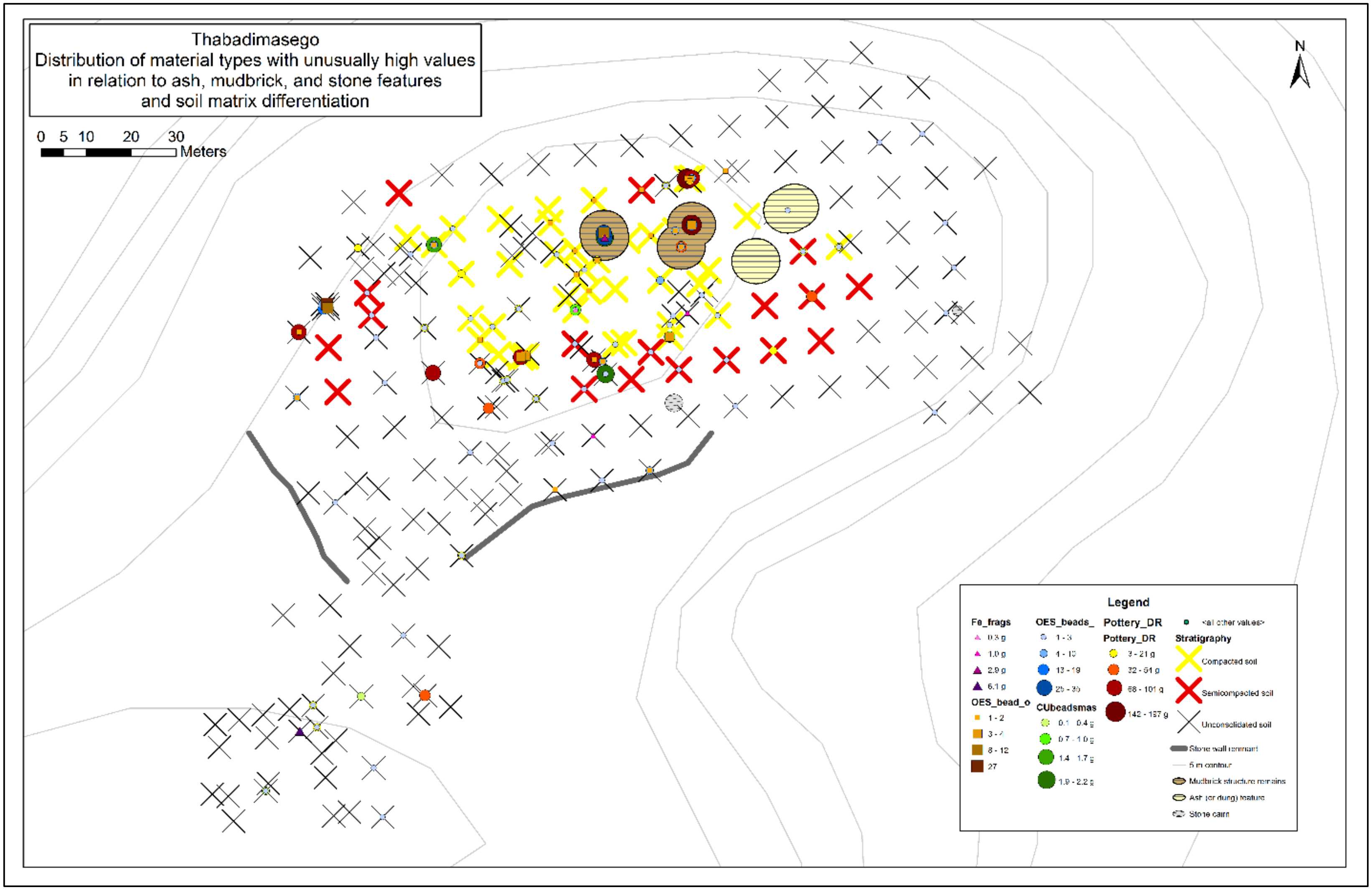

Figure 42 Variation in soil compaction with distribution of key cultural materials

feature one or two artifact types - the shell bead cluster near the west wall, for example, and the two pottery concentrations on the north and south edges of the central area. Without extended quantitative analysis, and especially without additional data collected at a similar resolution from other Early Iron Age sites, the placement of material clusters themselves can easily be construed as randomly placed middens within a given 'neighborhood' (the central area of the site).

In the end, either interpretation is ultimately an arbitrary imposition of perceived structure, and a prioritization of some categories of information over others. The data can support either argument and, perhaps both interpretations should stand as competing hypotheses until further data is collected. Additional excavations at Thabadimasego - particularly in the central area where the mudbrick features lie - as well as new excavations at neighboring sites may change the picture substantially. Likewise, whether these interpretations can be substantiated by independent statistical assessment is a mystery that will have to wait for another time (and maybe a more comprehensive dataset).

The following chapter will delve into these matters as they speak to archaeological understandings of space and form beyond the immediate boundaries of this one site. Much can be said in the way of methodological comparisons between fieldwork at Thabadimasego and at other Early Iron Age sites, as well as of the interpretive ramifications different methodologies produce.

Figure 43 Fragment of grooved stone found on Thabadimasego's surface

Chapter 6 Conclusions

In order to approach a synthetic understanding of the analytical results, it seems appropriate to return to the research questions posed in Chapter 1. What can the results of analysis discussed in Chapters 4 and 5 offer in terms of understanding diachronic variability in South Sowa, of the use of space both within walled sites and further abroad on the landscape, and of the forager-farmer relationship in the South Sowa area? This chapter will address each of these issues in turn.

6.1 Site level: Use of space and diachronic variability

Site-level analysis

To recap very briefly the conclusions drawn in the previous two chapters, Thabadimasego is a small hilltop site which was at one point walled off from the rest of the escarpment, although the spread of cultural material extends beyond the wall onto the escarpment. As previously mentioned, the site contains a good diversity of material, from glass and shell beads to copper and iron jewelry to extensive bone and ceramic scatters. Small amounts of fragile material such as carbonized seeds, red ochre, and slag were also recovered. One or two structures were located in the center of the site. No forges or burials were observed (it is possible that the two stone cairns located on the site could contain burials, but as the cairns were left undisturbed for the sake of their preservation, this remains unknown).

As discussed in chapters 4 and 5, the collective body of evidence recovered from Thabadimasego points to a single and likely short-term (i.e. single generation or less) occupation of the site. The stratigraphy observed on the hilltop was fairly simple. In the center of the hill, a compacted horizon of light brown loamy sand overlay an uncompacted horizon of the same soil type, which gave way to large calcrete cobbles and eventually solid bedrock. Elsewhere (including on the adjoining escarpment), the soil was uncompacted from the surface down to bedrock. Most cultural material occurred in the uncompacted layer, including in the center of the site. Very few features (hearths or ash pits, for example) were visible in the soil matrix and there did not appear to be any evidence of this type of feature overlaying one another. Radiometric samples likewise point to a single date (around 850-900 AD) for the deposits in the uncompacted horizon, while the compacted horizon in the center of the site may be somewhat younger.

Cultural material also does not exhibit any clear differences among the soil horizons, apart from increasing in density below the compacted horizon in the center of the site (although it is possible that a formal spatial analysis incorporating depth below surface as a variable could produce more specific insights on this). Worked materials, such as pottery, glass, and metal, whose styles and methods of production could indicate a difference in time period or population (or both), likewise maintain consistency throughout the depths of the deposits at Thabadimasego. This is true even for the glass beads - Zhizo and Chibuene beads, which are made from chemically distinct glass recipes and date to different periods, are both found at varying depths on the site. This, in fact, adds to the suggestion that the older Chibuene beads may have been curated and handed down over generations since their original point of entry onto the African continent.

In other words, the organization of the site does not follow any known model for Early Iron Age village layouts, and given the fairly small area occupied by the site as well as its small quantity of structures, it does not follow that Thabadimasego was in fact a long-term residential occupation. This should be clear when comparing a map of Thabadimasego's surface features with those mapped at Bosutswe by Denbow et al. (2008:460). While dozens of grain bin foundations, stone clusters, and remnants of stone walls are visible on Bosutswe's surface (see Denbow et al. 2008 for a map), only a handful of these are present at Thabadimasego. Bosutswe also hosts a number of vitrified dung exposures, the likes of which only form under conditions of long-term, continuous accumulation. Stratigraphic profiles of both sites likewise demonstrate a similar difference in complexity: whereas multiple overlapping mudbrick (dhaka/ daga) floors and ash deposits are evident in the Central Precinct excavation profile from Bosutswe (Denbow et al. 2008:46), such features were rare finds at Thabadimasego, did not overlap at all, and only occurred in one soil horizon.

The same is true when comparing Thabadimasego with other contemporary sites around Southern Africa. Ndondondwane, an 8th-century single-occupation site in South Africa's Thukela Valley, is arguably the most similar to Thabadimasego in terms of site size and occupation length (although their environmental settings differ considerably, as detailed in the table below). Ndondondwane is half the size of Thabadimasego, yet includes a substantially greater degree of complexity in its features. Greenfield and van Schalkwyk (2006) see the site's layout as two zones, central and peripheral, which include among its features several middens, a charcoal preparation area, and a burial. The sites whose locations make them the most comparable to Thabadimasego - Mosu I and Kaitshàa, both located on the escarpment edges of the Sowa area - do not unfortunately have sufficient published data on their layout to characterize them accurately.

Thabadimasego clearly does not follow the Central Cattle Pattern; its few structures do not circle a kraal and its cultural material distribution gives no indication of any gendered or class-based divisions of the use of the site's space. It also does not conform to the site layouts described by Denbow (1984) for any class of the Toutswe system, which in fact are quite similar to the CCP. Apart from these two, no other intra-site spatial model has been developed for Botswana to which the site's layout could be compared. There do seem to be discrete concentrations of cultural material, as with Ndondondwane, but these by and large appear to be middens of discarded materials instead of activity areas per se. Thabadimasego also contains no known burials (and given how shallow its sedimentary deposits are, is unlikely to contain any at all), and no apparent kraal around which its very few structures might sit. Overall Thabadimasego appears considerably less complex than many multi-generation village sites of its time. It may instead be characterized as a 'snapshot' site - one occupied for a brief period of time that depicts a way of life for a very specific time and place. Given its anomalous, low-complexity features, it should also be characterized as something other than a long-term residential site.

If Thabadimasego does not fit the Central Cattle Pattern spatially, it follows that the site cannot

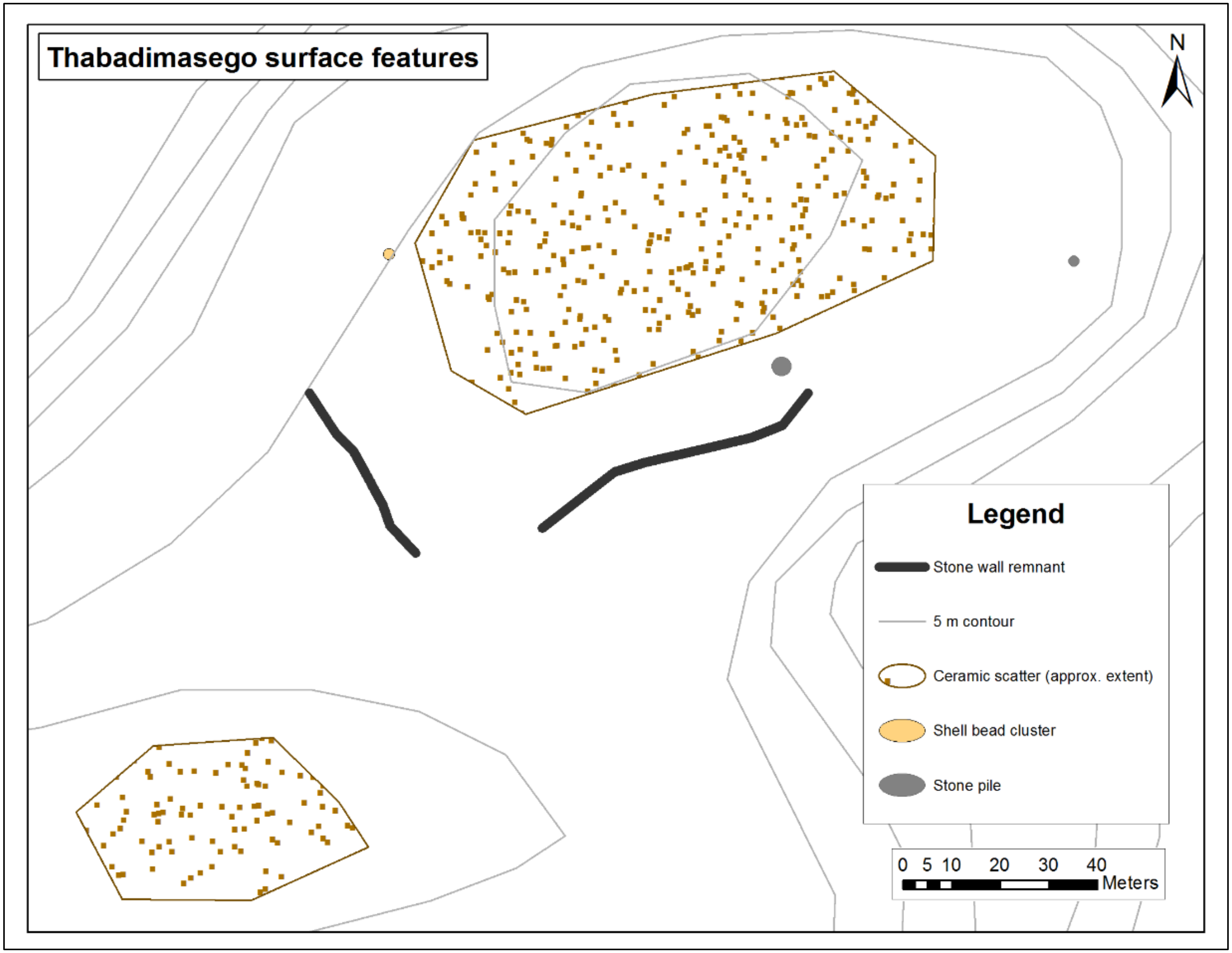

Figure 44 Thabadimasego surface features

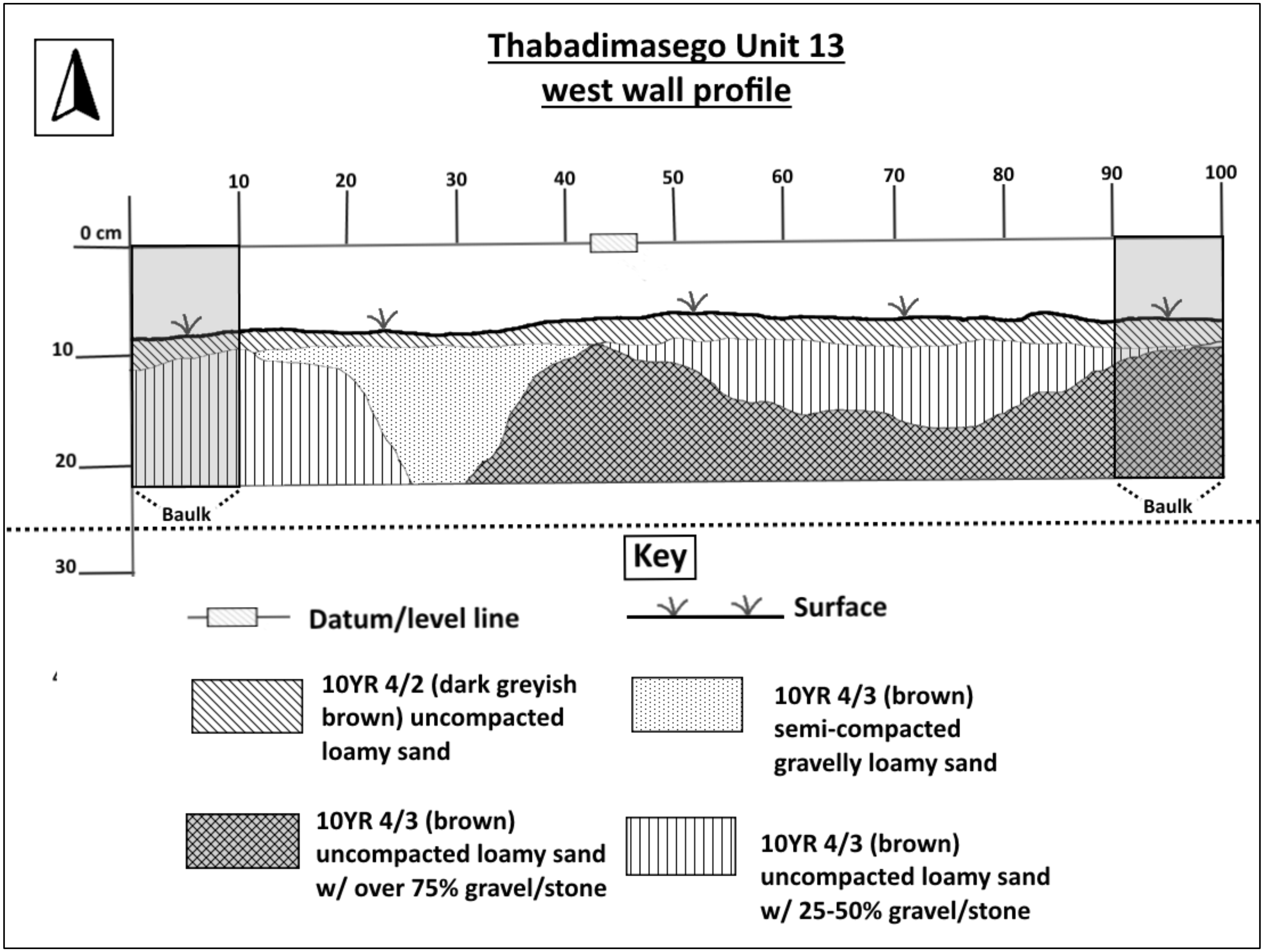

Figure 45 Unit 13 west wall profile

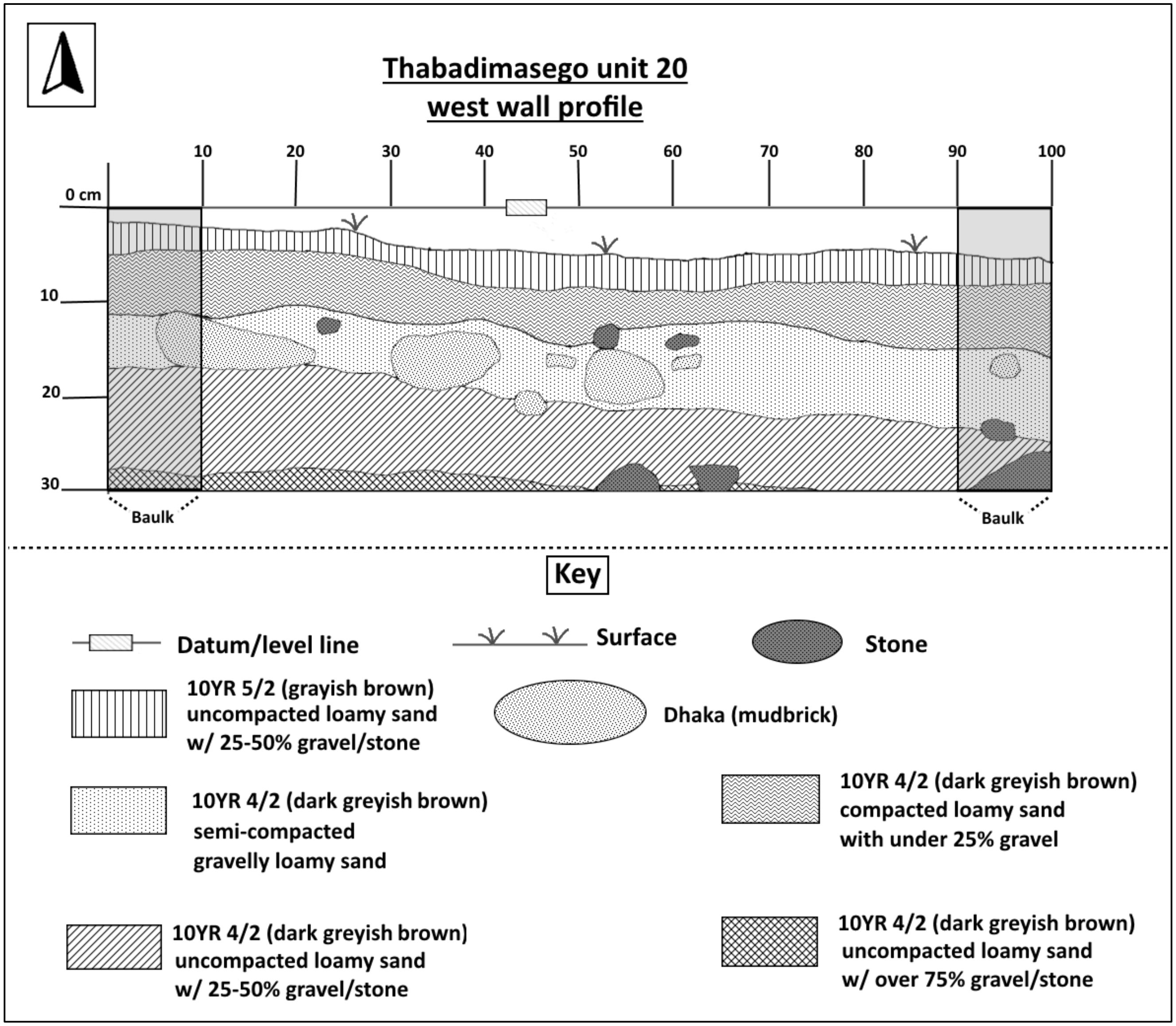

Figure 46 Unit 20 west wall profile

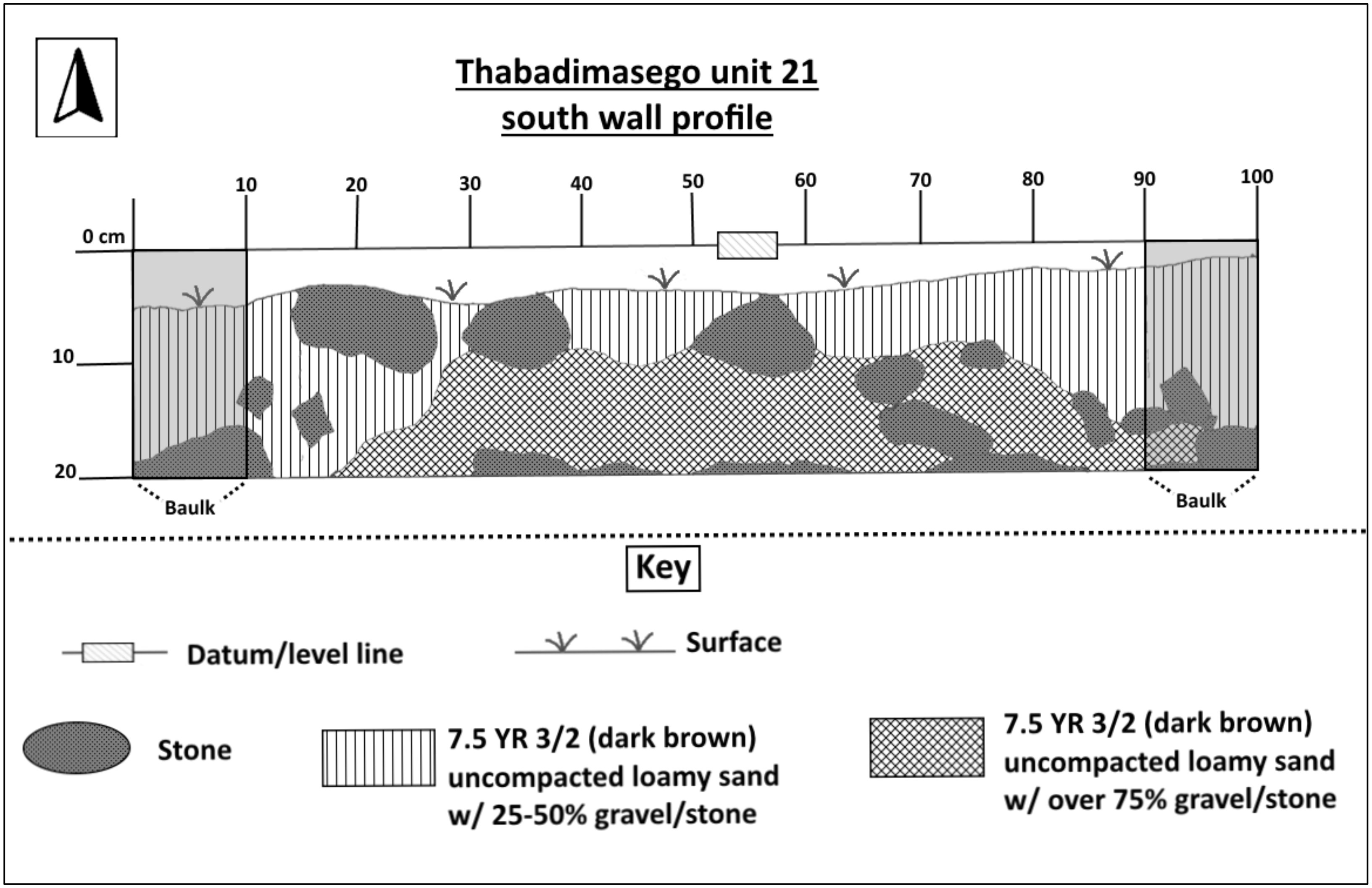

Figure 47 Unit 21 west wall profile

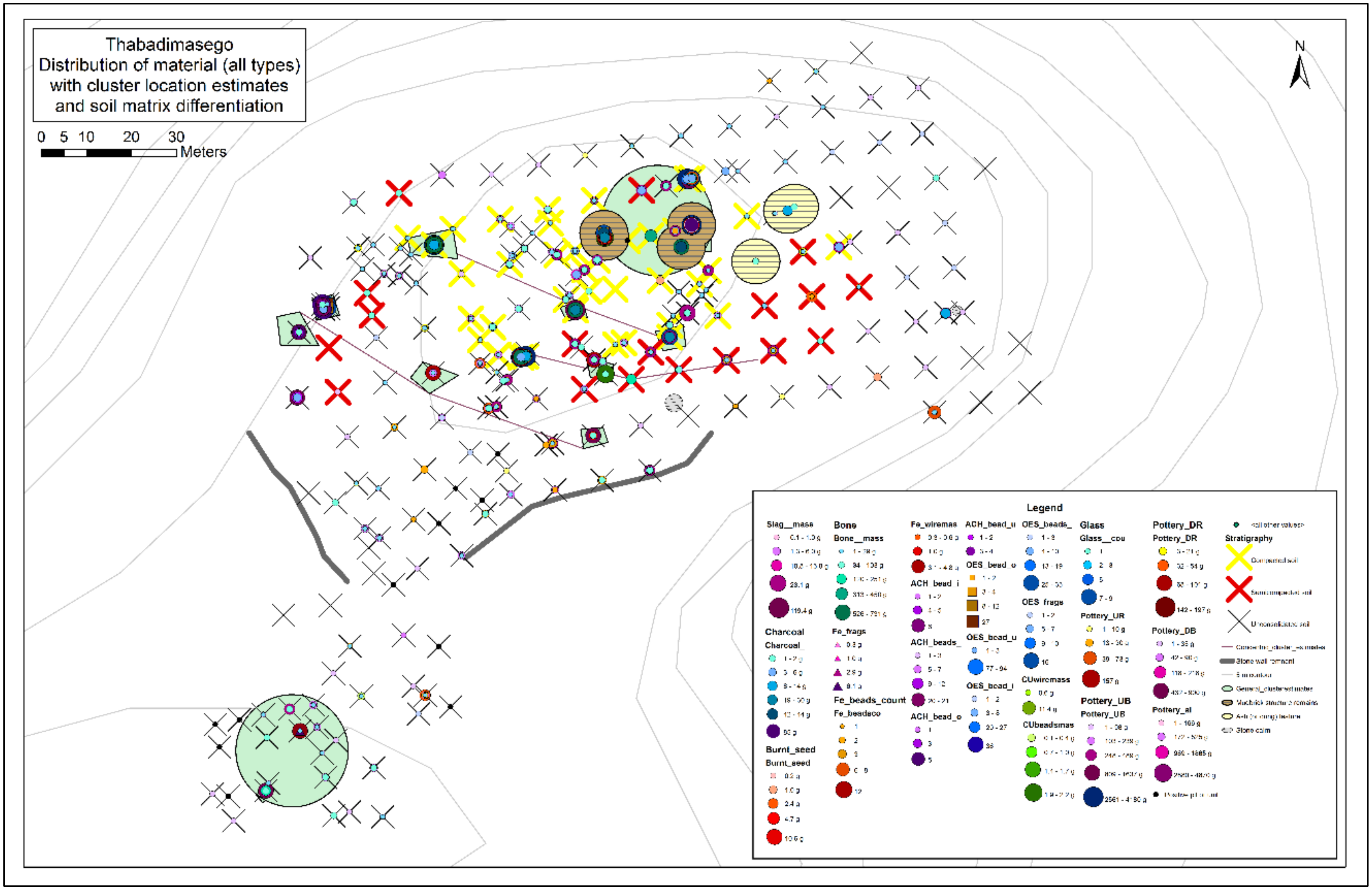

Figure 48 Cluster location estimates at Thabadimasego

Table 10 Comparison of selected Early Iron Age sites

Site name	Site area (m^2)	Site area (hectares)	Time period for site	Features observed on site	Site organization	Components	Location	Environment	Sources
Thabadimasego	12000	1.2	9th-10th c	Small ceramic and shell bead middens, structures, stone walls, ash or dung	Central structures, peripheral middens	Single-phase occupation (Zhizo)	South Sowa (Botswana)	Mosu Escarpment/ Sowa Pan	GPS tracklog, 2012
Kaitshàa	124340	12.4	7th-10th c	Glass bead cache, stone wall (other unknown); six small mounds	unknown	Multi-phase occupation (Zhizo; Leopard's Kopje)	South Sowa (Botswana)	Escarpment/ Sowa Pan	GPS tracklog, 2012; Denbow et al. In press
Mosu I	24000	2.4	10th c	Ash, dung, ivory bangle cache	unknown	Likely single-phase	South Sowa (Botswana)	Mosu Escarpment/ Sowa Pan	Reid and Segobye 2000a, b
Bosutswe	32000	3.2	8th - 18th c	Over 200 stone features, inc. grain bin foundations, stone granary platforms, and 7 semi-circular stone walls on the top of the hill; additional	2 precincts: central and western	Multi-phase occupation (Zhizo; Toutswe)	Eastern Kalahari (Botswana)	hardveld, hilltop	Denbow et al. 2008 (estimate from site map)

Table 10 (cont'd)

Site name	Site area (m^2)	Site area (hectares)	Time period for site	Features observed on site	Site organization	Components	Location	Environment	Sources
				grain bins and other stone features at the base of the hill					
Schroda	150000	15	900 - 1000 AD	clay figurines; houses encircling a large cattle enclosure	Central Cattle Pattern	Multi-phase occupation (Zhizo; LK/Leokwe)	Shashe-Limpopo Valley (South Africa)	plateau in valley	van Schalkwyk and Hanisch 2002; Calabrese 2007
Ndondondwane	5000	0.5	750 AD	Infant burial, charcoal prep, midden, domestic household complexes	2 zones: central and peripheral	Single-phase occupation (Ndondondwane)	Thukela Valley (South Africa)	river valley	Greenfield and van Schalkwyk 2006; Fowler and Greenfield 2009

be expected to conform to the social expectations laid out by this model. Instead, some limited conclusions about social processes at the site may be drawn from the specifics of its material record. Activities conducted at Thabadimasego clearly included some subsistence activities, such as processing of animal remains and cooking, and likely included small-scale shell bead manufacture as well. Hunting and herding both contributed to the diet of the site's occupants, but which prevailed (in terms of biomass) is not yet clear, and which was considered more *valuable* is even less clear. There is no reason as yet to assume that cattle were especially important for occupants of Thabadimasego, as compared to any other protein source. There is reason, given the demonstrated importance of cattle elsewhere and at later dates, to keep an eye out for things that would point to cattle being important, but assuming it *a priori* puts the cart before the horse in terms of interpreting data. Likewise, there is not sufficient evidence that livestock were actually kept on the site. The one expanse of residue that may be ash or dung is, quite frankly, very small, and does not constitute its own horizon; the material occurs in small chunks rather than an expansive patch. Because of this, it is more likely to be discarded ash than dung. Overall, in fact, there is not sufficient evidence that people actually established a permanent residence at the site. There are so few structures (possibly only one), and little in the way to suggest storage and hearth areas as might be expected from the layouts at Ndondondwane and Bosutswe.

Evidence for behavior other than subsistence activities is, however, present at Thabadimasego. Clearly, the site's occupants had connections to other communities both in the South Sowa area and further abroad. They decorated their ceramics in a style shared with other sites of the region, and they acquired metal and glass decorative objects through exchange networks. In addition, other evidence for non-economic activities is present at Thabadimasego. The tiny fragments of slag and red ochre present on the site are not explainable by any known economic practice for the time period within Southern Africa, although the possibility exists that the slag fragments are the result of on-site small-scale iron tool repair; such a pattern exists for copper items in Mesoamerica (H. Pollard, pers. comm. 2015). A ritual purpose for these items has also been suggested (G. Whitelaw, personal communication), but it is not clear what that purpose would be. Little is known about ritual practices during the first millennium AD for this part of Botswana in the first place. Undoubtedly, these oddities will become explained in time with further research both in South Sowa and elsewhere in the country.

A comment on the site-level methodology

The intensity of the sampling strategy employed (as described in Chapter 3) is, to my knowledge, unusual among archaeological investigations within Southern Africa. However, the use of a gridded approach incorporating both surface and sub-surface sampling was, for this project, inspired by the cultural resource management (CRM) data collection techniques I became familiar with during work with CRM firms in the Midwestern United States. Placing small test pits at regular intervals over a substantial area, even in an area where cultural material is already known to exist, is a technique commonly used in CRM both to identify features within a site as well as define the boundaries of the site. At Thabadimasego, a site whose extent was already roughly defined by the scatter of pottery sherds clearly visible on its surface, demonstrated the utility of this technique inasmuch as it successfully located several 'hotspots' within the site, allowed for the development of an overall site layout model, and furthermore demonstrated the continued extent of the site onto the escarpment beyond the stonewalled hilltop. In addition, the documentation of stratigraphic profiles in the test pits, at hundreds of points across the site, provided substantial information by which to make informed interpretations regarding site formation processes.

It should be noted, however, that such an intensive sampling strategy was successful in part thanks to the shallow deposits at Thabadimasego. Conducting a comprehensive gridded test pit survey over the entire site would have proven much more difficult if the soil deposits were substantially deeper, especially given how rocky the soil matrix was (as this disallowed the possibility of employing a soil augur for testing). Even so, this technique is entirely adaptable to a wide variety of circumstances. The coverage may be modified to an interval larger than 10 meters, for example, or additional data collection techniques such as magnetometry and ground-penetrating radar may be employed in the service of generating a site-wide layout model. Given the importance placed in Southern African Iron Age archaeology on site organization and spatial layouts, it must be said that comprehensive survey techniques, while time-consuming, are invaluable methods of collecting data that will help resolve some of the most pressing theoretical issues that the discipline faces today.

6.2 Intra-site scale: comparing with other sites and engaging with explanatory frameworks

Thabadimasego on its own cannot, unfortunately, provide much if any insight into change over time in economic practices or material consumption in the South Sowa area. As a 'snapshot' of one brief period in the late first millennium AD, the site is very valuable, but it cannot say much about change over time or larger-scale variation. By way of comparison, Site 16-A1-12 sits on the next closest escarpment hilltop to the west of Thabadimasego and was also surveyed during the 2012 fieldwork season. This site's surface is dense with flaked stone and what (on casual inspection) appears to be multiple facies of pottery. While the single excavation unit placed on Site 16-A1-12 bore witness to a very similar stratigraphic record as Thabadimasego (Figure 48), future work at this site may provide valuable information pertinent to interpreting the settlement history at South Sowa, particularly for shallow deposits containing multiple occupations. It remains a certainty as well that area excavations at numerous sites throughout the escarpment will need to occur before its Early Iron Age settlement history is understood well enough to characterize in detail. Thabadimasego and Kaitshàa, for example, present some interesting comparisons and contrasts - in particular the differences in their size and depth of deposits. However, it remains to be seen how other Early Iron Age sites will compare in terms of lengths of occupation, ranges of cultural material and structures, and how these individual depositional records speak to one another.

Accordingly, this section takes a step back from the layout of the site itself in order to consider how site-level analysis informs an understanding of the broader context of the South Sowa

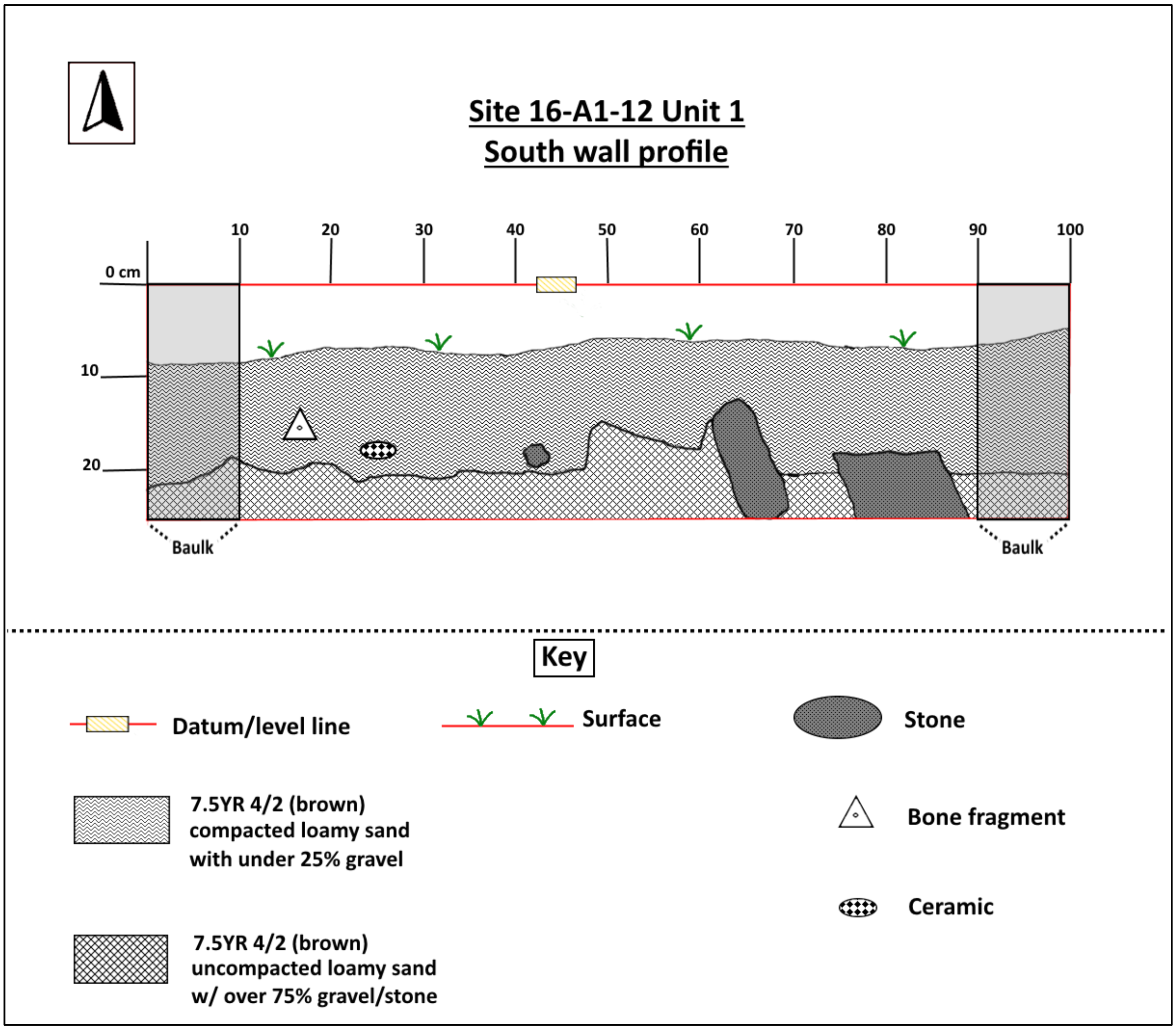

Figure 49 Site 12 unit profile

landscape.

Any archaeological site is best understood in the context of its local physical environment, surrounding site record, and the known settlement/ use history of the area. No site makes sense without knowing something about the terrain, climate, natural resources, and social history of the place it occupies. What constitutes the local environment for any given settlement, however, depends in part on how the settlers of that site perceive and use the space around them. For example, a hunter-gatherer whose range of mobility may extend dozens of kilometers in the normal course of a day may define "local" in a way very differently from a farmer who spends the majority of his time on or near a homestead and the surrounding fields, or from transhumant pastoralists, whose concerns include access to water sources, grazing pasture, and protection of herds from predators.

We cannot be certain how occupants of the South Sowa landscape in the late first millennium AD viewed the area or what they considered local, long-distance, or otherwise. What can be measured, however, is the location of currently known archaeological sites in relation to one another and an estimation of their function, in context of the settlement pattern and physical environment. Furthermore, much has already been written about Early Iron Age settlement patterns for Southern Africa and about typical activity patterns for agro-pastoral communities in general. In the present-day Mosu area, people typically spend their time in one of three places: the village itself, their cattle posts, or their farm fields. They will also head out to the bush to collect firewood, raw clay, mophane worms, and other economically important resources on a regular basis. This system of land use is fairly typical for rural Botswana (Silitshena and McLeod 1998). People tend to move around from one of these places to another fairly frequently; walking several kilometers in a day to get from place to place is nothing unusual. Likewise, herds of goats and cattle will cover several kilometers over the course of their grazing, since herds range more or less freely in Mosu (as, again, in much of Botswana), even given the presence of leopards in the area. The space that the Mosu community occupies therefore ranges far beyond the boundaries of the village itself. It can be assumed that an Early Iron Age community would be no different in this regard.

The archaeological literature has addressed this point to some extent already. As has been discussed in Chapters 1 and 2, Huffman's (1986, 2001) Central Cattle Pattern provides a model for the layout of individual villages, while Denbow's (1982, 1984, 1986) Toutswe settlement pattern for eastern Botswana offers one example of a hierarchical system of villages participating in an integrated socioeconomic network. In this model, smaller, subordinate settlements situated in lowlands near water and arable land serve as providers of resources to larger, dominant elite hilltop sites. The larger settlements in turn maintained economic and social stability through regulation of herding strategies as well as prestige goods. The villages in this system occupied a shared landscape across which each settlement utilized a different but interrelated set of resources. In other words, the Toutswe region would have comprised an integrated and self-contained socioeconomic entity not only because the settlements in that area existed in the same physical environment, and shared the same language and subsistence practices, but also because of their mutual interdependence. These communities presumably acted within the same set of rules about who uses what, who makes and who consumes what.

The Mosu area can be thought of in similar terms, albeit on a smaller scale. The site files at the Botswana National Museum indicate that over a dozen Zhizo-era sites exist within 35 kilometers (although most of them are much closer than that) of Mosu village, most of which lie on or near the edge of the escarpment. Most of these sites have been identified as Zhizo only via a small sample of material collected from their surfaces, and a great deal of additional work will be needed to verify both the chronology of each site as well as their respective extents. Another couple of dozen sites containing either an unidentified Iron Age component or a mix of Early/ Later Iron Age components (again, as indicated by small-scale surface collection) also exist in the same area. Nothing definitive can be said as yet as to the nature of Early Iron Age settlement in the Mosu area - whether multiple self-sufficient villages co-existed, or a hierarchical settlement pattern was in play wherein one or two large elite villages extended control over numerous smaller satellite residential areas, or otherwise. But the argument can still be made, given the density of contemporaneous sites in the area, that this locale did in fact comprise some sort of integrated settlement system. Consistencies in radiocarbon date ranges as well as material finds (Zhizo glass trade beads in particular) among the three sites so far excavated in the area further support this premise (Reid and Segobye 2000a, b). The forthcoming publications by Denbow et al. (2015) featuring results of excavations at Kaitshàa will no doubt prove highly informative towards these issues.

Although the material scatter documented on the escarpment outside the walls of Thabadimasego could be construed as a separate archaeological site (and it in fact is listed as a separate one in the national register), it doesn't really make sense to see it as its own site. Instead this scatter is better explained as a continuation of the hilltop occupation for the following reasons: there is no evidence of structures or activity areas per se, just fairly low-density scatters of material (and also because the two co-occur so closely together on the escarpment. The survey conducted in 2012 south of the edge of the escarpment as well as along the bluff edges, supports the observations made by Samuel (1999) and Main (2008) that Iron Age sites cluster along the escarpment edges. Of course, further survey work could always provide a different perspective, but for now it stands as a reasonable, evidence-based assessment of site distribution in the area.

It is important to bring attention to the fact that the observations made in this chapter, and indeed the questions that gave rise to this research, build upon a number of other bodies of research. In particular, Denbow's (1982, 1984) formulation of the settlement system around Toutswemogala, and especially the data-driven approach taken in his work, were foundational for the research conducted here (even more so than I knew at the time I proposed this research). Specifically, Denbow's (1982, 1984) publications address organization at both the site scale and the landscape/ regional scale. Whereas his focus is placed more on the regional scale (most of his fieldwork at the time was aerial and foot survey), in this case the focus flips and takes a closer look at the site level (much like Denbow 2002, 2008 has done since for Bosutswe). Denbow (1984) also calls for a multivariate approach for evaluating sites (as opposed to, for example, focusing only on establishing ceramic chronologies). He also points out the need for interpreting changes in the Toutswe region and elsewhere within a "wider, dynamic framework of interaction, exchanges and interdependence", as well as working towards "better definition of activities at each level" in the future (1984:37). These statements parallel (as well as precede) the discussion made in previous chapters of this dissertation. The concerns raised over 30 years ago by Denbow continue to be valid, especially as the frontiers of archaeological knowledge base expand to incorporate heretofore understudied areas like South Sowa. There is a continued need to examine critically the assumptions that underpin archaeological interpretations of a social as well as economic nature; there is also a continued need to specify and account for context - not only the immediate physical context of a site but its broader regional connections and environmental constraints.

Even so, the Toutswe model cannot be applied directly for the South Sowa area. With the few sites for which a substantial body of evidence exists, a range of sizes is observable (Kaitshàa is big, Thabadimasego is quite small, etc; see Table 6-1); however, the sites are almost all situated on escarpment edges or on isolated hilltops. In other words, there does not appear to be the differentiation in location choice in South Sowa between small, potentially subordinate sites and larger villages as has been observed in the Toutswe region. Neither is there, at least for Thabadimasego, a site layout indicative of a residence with a kraal, therefore this begs the question of whether the South Sowa settlement system incorporated non-residential, special-purpose sites (similar to Binford's 1980 logistic mobility model for foragers, wherein certain locations on the landscape are utilized as either cache points or vantage points for hunting). The function of these sites is not yet established; they may have been temporary camps, procuration sites, or otherwise. Other possibilities include that they functioned as lookout sites, were temporary seasonal camps, or even splinter groups forming new villages. It seems clear, however, that Thabadimasego may have fit in to the South Sowa settlement scheme as one of these outpost or specialist sites. Considerably more fieldwork will need to be conducted in the area before a comprehensive idea can be had of either site-level organization practices or of settlement dynamics on a landscape scale, and further analysis may indicate that a new model of settlement will be warranted.

6.3 Forager-farmer interaction

Because Thabadimasego provides a short-term, ‘snapshot’ of the community that contributed to the site, it is hard-pressed as a body of evidence to provide information about change over time in either material culture or social dynamics for the South Sowa area. As a snapshot though, it offers some insight to interpreting overlapping culture-history ‘types’ such as the shell beads and faunal assemblage.

Interpretations of interaction between foraging and farming communities in Early Iron Age Southern Africa often rest upon the assumptions that 1) users and makers of non-luxury/ non-exotic goods are from the same community (Huffman 2001); and 2) that specific socioeconomic traditions, passed down through generations as learned adaptations, are exclusive to specific communities (Smith 1990, 1998). For many (though not all) researchers in Southern African archaeology, interaction between the three 'classic' socioeconomic groupings of the later Holocene - that is, hunter-gatherers, herders, and farmers - is measured in the archaeological record by the presence of one type of material culture set - e.g. pottery and sheep bones - in a context usually associated with another type - e.g., rock shelters (e.g., Denbow and Wilmsen 1990; Smith and Lee 1997; Smith 2001; Denbow 2002; Sadr 2002). Processes of interaction are usually typified as assimilation, displacement, coexistence/ symbiosis and/ or trade, or more than one of these over a period of centuries. The presence of iron tools in rock shelters or other typical hunter-gatherer sites is usually interpreted to mean trade between farmers and foragers, or assimilation of foragers into a farming economy, depending on the proportion of Iron Age material present (e.g., Denbow 2002). On the other hand, the presence of stone tools or ostrich eggshell beads in walled farmer settlements is generally interpreted as either evidence of trade or the presence of hunter-gatherer residents in the farming village (Smith 2001; Sadr 2005; Mitchell et al. 2008). In other words, similar kinds of assemblages are interpreted differently depending on the geographical location in which they are found; group identity and ethnicity are assumed to be strongly tied to settlement locations as well as cultural material traditions. Acquisition of new technology and cultural practices is generally assumed to occur passively within hunter-gatherer communities only; the assumption is implicit that agency in, and control over, change belonged solely to farmers. For example, the presence of ceramics, iron or livestock in hunter-gatherer sites is often taken to represent the passive incorporation of new traditions of knowledge into hunter-gatherer communities (e.g., Sadr 2002). Underlying these distinctions is the supposition that some technology and subsistence activities, such as ceramic production or reliance on animal products, are easily learned and diffused, while others, e.g. livestock herding or lithic tool production (see Smith 1990, 1998), are both the product of specialists and products restricted within certain sociocultural and cultural/ethnic boundaries. In other words, although material exchange may flow both ways, the acquisition of new skills and knowledge is generally assumed to flow one way. Clearly, some assumptions about agency and power underpin this view.

The roles of agency and choice in hunter-gatherer behavior are discussed in some case studies. For example, Thorp (2000) details the cooperative exchange relationship maintained by hunter-gatherer communities in South Africa's Caledon Valley with nearby farmers over the course of several centuries. Likewise, Mitchell et al. (2008) demonstrate that hunter-gatherers adopted cattle- and sheep-herding during the Early Iron Age in Lesotho. In general, though, agricultural communities are positioned as superior in both social and political power; they are both larger and stronger entities with whom peripheral hunter-gatherer communities must deal with (or be dealt with). Even these models rest upon problematic assumptions, however. As Hammond-Tooke (2000) writes, classifications of material culture in terms of supposed ethnic affiliations is "analytically vague." If materials associated with Later Stone Age and Iron Age "packages" batched consistently into separate sites during the Early Iron Age - that is to say, if they grouped in discrete and non-overlapping assemblages - there would be little reason to question the social identity associated with the artifacts. However, this is not the case. As several researchers working in different parts of the Kalahari have established, hunter-gatherer communities over the last 1500 years have adopted technology and acquired goods from herding and farming communities, but the reasons for doing so and the actual course by which these transferences occurred differed greatly in each case. At Cho/ana, Namibia, for example, Smith and Lee (1997) examine a long sequence of hunter-gatherer occupations, recording the presence of pastoralist ceramics and beads dating to the late first millennium AD. They argue that these items were acquired through trade for *hxaro* exchange, that evidence for sustained direct contact with outside food-producing groups did not occur in the area (contra

Denbow and Wilmsen 1986), and that evidence for socioeconomic transformations does not appear in the archaeological record until the late nineteenth and twentieth centuries. Oral histories recorded from some of the area's older living occupants support this. Sadr's (2005) evaluation of three Later Holocene assemblages from rock shelters in south-eastern Botswana suggest that assimilation did occur in each case after contact with farmers, but that the way each happened was very different. Archaeology from deep in the Kalahari suggests that hunting and gathering remained a way of life till recently, but by the 1960s, it was no longer the sole source of subsistence as previously claimed (Smith and Lee 1997; Brooks 2002). Smith (2001) also compares case studies from the Middle and Late Iron Ages in northeastern Namibia and southeastern Botswana. He found that San of Namibia were in contact with Kavango farmers during the Late Iron Age, but only to a limited extent for trading purposes, while, according to changes in the material culture record, San in rock shelters around Gaborone were gradually encapsulated by the farming economy. Even open-air sites (as opposed to rockshelters) do not sort easily; van Zyl et al. (2013:54) write how "open-air sites in the Okavango area cannot be grouped into convenient categories such as farmer, pastoral or hunter-gatherer" (*cf.* Sadr, 1997). This appears to be true for the South Sowa area too; even though certain aspects of the sites and their assemblages - namely, the pottery and the metal - bear strong connections to a larger Early Iron Age system, this may not actually indicate a specific form of socioeconomic organization.

There are, unfortunately, far fewer studies which evaluate changes in Iron Age assemblages in reference to the adoption of hunter-gatherer technology or socioeconomic behaviors. By and large, these focus on the acquisition of San ritual practices, not of material technology or economic behavior, by Bantu-speaking farming communities. Van der Ryst, Lombard, and Biemond (2004) write that appropriation of San ideology and ritual practices by farming communities was relatively common during the Later Iron Age. Hammond-Tooke's (1998, 1999) work on historic Nguni communities corroborates this, and suggests further that ideological borrowing was very specific, at least in the case of the Nguni. Certain practices such as trance dancing were adopted and recontextualized for particular Nguni rituals; San ideology was not adopted wholesale (Hammond-Tooke 1998:14). Physical spaces with cosmological significance were likewise appropriated from their original San creators by Bantu-speakers in the Middle and Later Iron Ages, in south-eastern Botswana as well as north-eastern South Africa (S. Hall and Smith 2000; van der Ryst et al. 2004). In these cases, even though knowledge moved from hunter-gatherer to food-producer populations (unlike what is suggested by the studies of hunter-gatherer sites discussed above), it would appear that the power dynamic is no different, such that farming communities still maintain the controlling share of transactional power by co-opting San knowledge and places.

The overall impression one is left with is of a subtle but uncomfortable tension between the evidence as excavated, and the manner in which it is framed and interpreted (for example see Wilmsen, Dubow, and Sharp 1994; Wilmsen 2002, 2009). Evidence clearly shows that behavior and material culture differ over time as well as by region - particularly among hunter-gatherers living near herders and farmers, but also among the food-producing societies. Because of this, a number of scholars (Hall 1984; Lane 1995; Denbow 1999; Sadr 2008) have questioned the utility of characterizing assemblages in terms of socioeconomic identity, much less ethnicity. At the same time, for lack of another well-developed frame of reference, archaeologists working in the Southern African Early Iron Age feel pressed to rely on those selfsame culture-historical tropes to build our arguments anyway. Theory alone, it is clear, will not be capable of resolving this tension, nor of clarifying specific regional chronologies. These issues must be addressed on both epistemological and methodological levels.

The assemblage from Thabadimasego provides an opportunity to parse out some of these issues. As has been clearly demonstrated in this research, Thabadimasego is an open-air, stone-walled site located on a hilltop (a common choice of terrain for Iron Age sites in eastern Botswana). This single-occupation site contains materials classically associated with iron-tool-using agropastoralists (metal and glass jewelry; domesticated animal remains; Zhizo pottery; permanent structures – although not as many structures as expected on a typical village site) as well as some material classically associated with stone-tool-using hunter-gatherers (ostrich eggshell beads; wild animal remains). Wild animals are, in fact, a common component of Early Iron Age faunal assemblages as well, while shell beads (both ostrich and *Achatina*) are likewise frequently reported in Iron Age deposits, but often factored out of behavioral interpretations of those sites.

Like Bosutswe (Dubroc 2010), Thabadimasego contains evidence that both *Achatina* and ostrich eggshell beads were not only used but also produced on-site. Hundreds of shell beads and unworked fragments, in various conditions and stages of production, were recovered at Thabadimasego. The shell beads also comprised one of the few clearly clustered midden areas on the site, and as such cannot be ignored in an interpretation of the site's function. The ostrich eggshell beads range in size from what previous studies (including Tapela 2001 and Dubroc 2010) considered 'small' and 'large,' while the *Achatina* beads tend to cluster along the smaller end of the size spectrum. All sizes of beads are found concurrently in the deposits; there is no stratigraphic differentiation by size. The shell bead assemblage does not therefore fit the hypothesis originally proposed by Jacobsen (1987) that smaller beads were produced by hunter-gatherers and larger ones by food-producing communities. The tradition of shell bead production, of course, reaches back tens of thousands of years before the arrival of Bantus-speaking 'Iron Age' populations in Southern Africa. Although the bead production tradition has furthermore been associated in ethnography with San-speaking communities in Namibia, Botswana, and South Africa (Lee 1979; Tanaka 1980), there needs to be a consideration that these beads were both made and used on a regular basis by people who farmed and used metal. It does not make sense to infer the presence of a completely different group of 'outsiders' adding to the site's deposits simply on the basis that their hunter-gatherer ancestors made these beads too. It makes a lot more sense to infer that whoever occupied Thabadimasego, regardless of what language they spoke or what ethnic or social affiliation they identified as, was capable of learning that set of skills.

Likewise, hunting as well as herding contributed to the faunal assemblage at Thabadimasego, and presumably the diet of the site's occupants as well. The presence of wild game in proportions of up to 60% is, of course, already documented for several sites occupied during the Early Iron Age in Botswana, including Bosutswe, Divuyu, Nqoma, and Xaro (Denbow 1999; van Zyl 2013). The number of individual specimens (NISP) identified at Thabadimasego totaled 1109 (see Figure 23 in Chapter 4). However, it is too early to make a conclusive assessment of the proportions of game to stock at Thabadimasego. Fraser's (2014) identification of the faunal assemblage, while ongoing at the time of writing, has indicated that the great majority of the assemblage - 71%, or 786 NISP - consists of indeterminate mammals. Of these, only slightly more than half (n = 415) could be identified as bovids, meaning that while they were likely consumed for meat, it is still unclear what kind of animals these remains represent. Of the individual specimens that could be identified more precisely, wild animal remains (n = 285) - including game animals as well as birds, reptiles, rodents, and carnivores - greatly outnumbered domestic stock (n= 36) by a factor of almost eight to one. However, of these wild fauna, only 18 were identified as large game (i.e. bovids and equids). Over half (n = 164) were rodents and quite possibly intrusive to the deposits. 92 specimens were identified as small animals (such as hares and tortoises), one as a carnivore, and seven as birds of indeterminate species. The small animals, birds and even the carnivore may have also been food sources for the people of Thabadimasego, but without further information it is too early to tell, and too early to make direct comparisons with faunal assemblages from other Early Iron Age sites. It remains to be seen how the ratios of wild to domestic, and food to non-food, fauna species may change if a greater number of specimens can be assigned specific taxa. All that can be said with any confidence at this juncture is that people at Thabadimasego hunted, herded, and probably set traps and snares as well. Although paleoenvironmental reconstructions for the South Sowa area (particularly for the Holocene) are not yet robust, it may be assumed – based on the taxonomic similarity between faunal remains recovered from Thabadimasego and those species known to populate the Makgadkikgadi Pans during the wet season –

that South Sowa would have been an attractive hunting ground in the first millennium AD when the pan was filled with water. However, based on the growing number of sites for the first millennium AD in Botswana whose assemblages indicate exploitation of an admixture of wild and domestic food species, it does stand to reason that the evidence does not support the framework of the Early Iron Age (at least for Botswana) as a predominantly farming, and particularly cattle-centric, time period. At the very least, the food sources for Early Iron Age should be taken on a site-by-site, or perhaps region-by-region, basis.

To return to the issue of inferring identity from material remains, the faunal assemblage in particular raises the question of whether or not the practice of distinguishing hunter-gatherers from herder-farmers is even a fruitful exercise for the study of Early Iron Age Botswana at this point, at least for the South Sowa area where knowledge of the archaeological record is so incomplete. This is particularly true given the absolute paucity of formal analyses for Early Iron Age botanical assemblages; there is simply too little extant data to be able to make comprehensive inferences about agricultural/ plant consumption practices in general for this time period. There is little doubt that cultural and economic traditions of totally different origins, derived from separate ancestral populations, contributed to the system of settlement and patterns of behavior collectively termed the Early Iron Age. There is also compelling genetic evidence (e.g. Mitchell 2010; Schuster et al. 2010) that, in some cases, these populations and the communities they formed remained distinct up to a point. At the same time, hunting, herding, and farming all contributed to the diet of people at Thabadimasego as well as at other Early Iron Age sites. It appears as if a range of subsistence practices were in use in Botswana for the first 1000 years AD, and clear distinctions between ancestrally San and ancestrally Bantu populations cannot be made on the basis of their subsistence alone, even for open-air sites that include pottery (van Zyl et al. 2013). That pottery deriving from Bantu traditions (Urewe or Kalundu) is found in rockshelters alongside flaked stone tools (for an example, see Sadr 2002) for this same time period further underscores that boundaries of material usage were permeable. For example, Robbins (Personal communication, 2015) has found Divuyu potsherds and flaked stone artifacts underneath of a mine tailing at Tsodilo Hills.

The assemblage from Thabadimasego bolsters the growing evidence for a range of region-based diversity in economic practice and social organization during the Early Iron Age in Southern Africa. As stated above, there is no a priori reason to assume that, for example, ostrich eggshell beads recovered from a deposit dating to about 900 AD were created by people who identified as hunter-gatherers both socially and economically. Instead, there is good cause to consider who the makers and users were on a case-by-case basis taking the specific contexts of the finds into consideration, rather than generalizing from broad theoretical assumptions developed out of ethnographic studies. It would be more productive to generate a series of regional case studies focused on characterizing the full complement of a site's features and what those features indicate about behavior - much like Schiffer (1995) and Schiffer et al. (2001) famously argue, and as Denbow (1982, 1984) likewise demonstrates for the landscape around Toutswemogala in east-central Botswana. As opposed to depending on models that prioritize normative socioeconomic identity, allowing the excavated evidence to both set the foundation for -and provide feedback to - dynamic theoretical models will develop a stronger understanding of the range of variability present among Early Iron Age societies.

The above discussion should in no way be taken as a suggestion to start with a blank slate, however. The existence of those normative models based on a culture-historical framework, against which the Thabadimasego assemblage may be compared, make it possible in the first place to recommend a modified approach. As is the case with any discipline, archaeology is the process of contributing to a continuous feedback loop of data and interpretation. As Denbow (1984) stated, there must exist a continuing interchange of information from the local scale to the regional to theoretical level and back again, and again.

6.4 Conclusion – thoughts on identity and theoretical praxis

Processes and behavior cannot be directly observed in the archaeological record; they cannot be excavated or recorded. Instead, researchers must make theory-based (but also, one hopes, data-informed) bridging arguments about the behavior that created the material record (Binford 1978). We must always be clear about the differences between data and interpretation; too often interpretations are later construed as immovable facts or data in themselves. This leads to a weakening of our understanding of Southern African prehistory overall. The material record is raw, unprocessed data; the social and behavioral models, on the other hand, are highly processed interpretations and are therefore several steps removed from the archaeological record itself. We must always return to the extant data when we evaluate models in light of new data. We cannot rely solely on published interpretations as our basis for evaluating new data - we need to understand how the data compare directly, or as directly as is possible in any given circumstance. We have to, in short, be painstaking in setting forth just what our data consist of, and on what scale or scales they were measured, as well as what biases or shortcomings may have contributed to the creation of the dataset as it exists.

At Thabadimasego, despite similarities in styles of material culture - particularly ceramics and metal - there really is not much to suggest that a specific set of non-subsistence-based social behaviors in general can be inferred. There is evidence, via the stylistic similarities of certain materials as well as the exotic trade goods, that connections existed; however, there is no real evidence as to what those connections actually meant to the people who participated in them. Furthermore, absolutely zero indication exists of gendered behavior on this site (excluding any arbitrarily-imposed 19th- or 20th-century gender roles, as with the CCP). Likewise, there is also absolutely zero indication of ethnic affiliation, other than obvious geographic ties to other Zhizo settlements. The pottery only indicates a stylistic affiliation, however, not an ethnic affiliation. Pottery-making is a learnable skill, and arguably one that can be transferred without special equipment or generations of specialist training. Raw clay is fairly easily acquired - given the demonstrated mobility of historical San communities (Kelly 1995; Thacker 2006), it can be assumed that even clay sources prized for their purity could be attained by any community with sufficient mobility - and no special tools are necessary for pottery manufacture. This begs the question, why is it that archaeologists continue to assume that finding pottery of a certain style on a site is a definite indicator of actual genetic/ ethnic affiliation? It would bolster the Southern African research paradigm to question the assumption that, for the Early Iron Age at least, pottery styles were restricted to language/family groups (and therefore not transferred to other socioeconomic groups). In fact, when it comes to the question of group identity, we should ask ourselves why we care so much about establishing socioeconomic identities for material assemblages in the EIA when there are much more interesting questions to pursue (such as what other regional subsistence patterns are there, and what other types of information can we get from something as common as pottery) that in time could also help us answer the question of identity in much more detail.

In the end, there is no hard positive evidence that rigid social boundaries, or discrete groups of actors, existed during the Early Iron Age. By the same light, there is also no hard positive evidence for a fluid, free-for-all melting pot. What we do appear to have evidence for, in fact, is a range of variation in combinations of material culture and economic practice. We ought to, however, let go of the presumption that we know which particular, clearly-defined, ancestral ethnic group was responsible for these practices. We should start at the point of understanding the full range of variation of material culture and subsistence practices and trade.

As has been said in previous chapters, a much more thorough understanding of settlement processes in South Sowa area is needed. Information about the diversity of sites present as well as secure dates for them needs to be collected before further social inferences can be made with confidence. Based on the evidence at Thabadimasego and the other contemporary sites discussed above, it is also apparent for the need to frame Early Iron Age socioeconomic processes in terms of flexibility and variation. Denbow (1982, 1984) laid out a foundation for this framework, but continued fieldwork and multivariate analysis is needed to fill in the specifics for sites as well as regions of Southern Africa. Additionally, ongoing synthesis of case studies (for example, Mitchell 2004; Mitchell and Whitelaw 2005) will be necessary to provide feedback as to how well any model fits the data. Taking a "big data" approach to Southern African Iron Age archaeology, by building comparative datasets and bridging arguments, will help to address many of the issues currently facing the discipline. Building a comparative, synthesized body of evidence for Early Iron Age (not to mention Later Iron Age) socioeconomic practices across multiple countries and for several centuries is a monumental task that will almost certainly never end, but is also needed. It will be increasingly important in the future to have collaborative research partnerships in order to accomplish this goal (especially as Batswana are being trained as archaeologists in growing numbers). We need to work together, and we need to be open to multiple interpretations. The past may now be static, but our understanding of it is not. It is important to recognize that while the past can no longer be changed, our understanding of it does continue to evolve. Archaeologists should not be too attached to any one explanatory model, and instead adopt what best fits the data in question. Just as Early Iron Age communities did for their economic practices, adapting our interpretive practices will shape our work to best fit the landscape of scholarly knowledge.

Further considerations

This final section addresses a number of issues encountered during the research and analysis for this project. This section also raises potential future avenues of inquiry. It is my hope that this work will pave the way for continued research on the past settlement history of the South Sowa area. Issues encountered during research included sampling bias and analytical limitations. Coverage of the site by survey and excavation was fairly extensive, so it stands to reason that the majority of sub-surface features were identified. Because the initial survey covered all areas of the site equally, the overall distributional density for subsurface material should be an accurate representation of the site's total material. Still, it remains possible that for the spatial analysis, both the regularity of the test pit coverage as well as the interval used (10 meters) could have introduced sampling bias that presents challenges to some statistical techniques. Hotspot analysis, as discussed in Chapter 5, was discontinued for a number of reasons. One of these reasons was that 10 meters is the minimum distance between locations in some parts of the site and many artifact clusters would have been much smaller than that. Furthermore, the gridded coverage could possibly make things look more structured than they really are, although it's hard to know this for sure without further testing.

As is briefly mentioned in Chapter 4, some materials recovered from Thabadimasego were inventoried but not subject to additional analysis. This for the most part included any lithic material. So few flaked lithics were found - perhaps five in all - and they were not identifiable as products of intentional flaking, at least not without seeking out another comparable assemblage from an Early Iron Age site (if such an assemblage even exists). There were also a number of water-rolled pebbles collected during excavations which definitely were not born of the parent rock (calcrete) on the site. Some ideas about what they might be (transports from nearby sand beds, or ostrich gullet stones) were raised in discussion with other archaeologists working at the Botswana National Museum at the time (Staurset 2013, personal communication). Without having anything solid to go on, this too was left for future consideration. Finally, the botanical remains, while discussed in the analysis in Chapter 4, still deserve a much more comprehensive evaluation by a specialist at some point.

The research reported on here raises several future lines of inquiry worth pursuing in the future. Unsurprisingly, at the top of the list is continued survey and excavation at other sites in the South Sowa area. Building an understanding of the area's settlement history will take time but will fill in a gap in the archaeological record of Botswana. In particular, evaluation of other small, low-complexity sites which may parallel Thabadimasego will be of interest, as these sites may also be of interest for other regions where hierarchical settlement patterns exist. It would also be informative to conduct fine-grained spatial evaluations, similar to what has been done for this project, for other Early Iron Age sites in eastern Botswana. The methods used here ought to be replicated not only to build comparable datasets, but to evaluate the resilience of the methodology itself. It would be of particular interest to collect spatial data for a site whose chronology is already well-documented so that I can see how accurately what I did in this project represents the depositional history of a site.

There is also more research potential for Thabadimasego itself. Numerous charcoal samples were collected from the site but not submitted for AMS dating. Submitting these for analysis would flesh out the radiocarbon record of the site. Continuing to work out the wrinkles of the higher-order spatial analysis is likely a task that will be pursued in the near future. Eventually, the spatial analysis will take into account vertical depositional data as well - that is, material distributions by soil horizons and depth. Although the rationale for aggregating the materials from each unit and pit was presented in Chapter 5, it would be really interesting to go back and evaluate those observations quantitatively. That could leave open the possibility of focusing solely on what might be construed the "in situ" materials from the bottom horizon and the site layout might look different. Also, developing a user-friendly way to visually model quantified depositional distributions could be very useful to archaeology as a whole.

Finally, it needs to be said that the most important future work of all is continuing collaboration with other scholars, both specialists and field researchers alike. The field of Southern African Iron Age archaeology is, thankfully, ripe with people who are interested in testing models and building bodies of evidence, many of whom are just beginning their careers. Putting together our collective lines of inquiry will result in a robust and exciting research framework for decades to come.

APPENDICES

APPENDIX A

MISCELLANEOUS TABLES

Table 11 Pit and Unit Summary

Unit	Northing	Easting	# Levels	Total depth (m)	Length (m)	Width (m)	Total area (m^2)	Positive
1	48.00	103.00	1.00	0.23	1.00	1.00	1.00	Y
2	65.00	95.00	3.00	0.25	1.00	1.00	1.00	Y
3	102.00	161.00	5.00	0.29	1.00	1.00	1.00	Y
4	81.00	92.00	4.00	0.57	1.00	1.00	1.00	Y
5	101.00	179.00	4.00	0.35	1.00	1.00	1.00	Y
6	111.00	180.00	7.00	0.37	1.00	1.00	1.00	Y
7	80.00	140.00	5.00	0.26	1.00	1.00	1.00	Y
8	80.00	139.00	5.00	0.24	1.00	1.00	1.00	Y
9	111.00	181.00	7.00	0.34	1.00	1.00	1.00	Y
10	100.00	199.00	8.00	0.33	1.00	1.00	1.00	Y
11	111.00	188.00	4.00	0.32	1.00	1.00	1.00	Y
12	71.00	227.00	4.00	0.21	1.00	1.00	1.00	Y
13	100.00	101.00	3.00	0.20	1.00	1.00	1.00	Y
14	99.00	101.00	4.00	0.25	1.00	1.00	1.00	Y
15	108.00	126.00	6.00	0.30	1.00	1.00	1.00	Y
16	88.00	152.00	5.00	0.29	1.00	1.00	1.00	Y
17	78.00	170.00	4.00	0.25	1.00	1.00	1.00	Y
18	90.00	208.00	4.00	0.18	1.00	1.00	1.00	Y
19	103.00	161.00	6.00	0.32	1.00	1.00	1.00	Y
20	97.00	176.00	5.00	0.26	1.00	1.00	1.00	Y
21	-3.00	69.00	3.00	0.19	1.00	1.00	1.00	Y
PTTP 1	10.00	71.00	1.00	0.20	0.40	0.40	0.16	Y
PTTP 2	18.00	82.00	1.00	0.18	0.38	0.30	0.11	Y
PTTP 3	18.00	72.00	1.00	0.15	0.39	0.37	0.14	Y
PTTP 4	13.00	82.00	1.00	0.17	0.35	0.35	0.12	Y
PTTP 5	23.00	82.00	1.00	0.21	0.34	0.39	0.13	Y
PTTP 6	16.00	85.00	1.00	0.11	0.38	0.42	0.16	Y
PTTP 7	23.00	92.00	1.00	0.11	0.39	0.34	0.13	Y
PTTP 8	8.00	82.00	1.00	0.13	0.38	0.30	0.11	Y
PTTP 9	-2.00	92.00	1.00	0.15	0.30	0.28	0.08	Y
PTTP 10	8.00	92.00	1.00	0.21	0.38	0.42	0.16	Y
PTTP 11	23.00	102.00	1.00	0.14	0.42	0.34	0.14	Y
PTTP 12	0.00	82.00	1.00	0.11	0.40	0.36	0.14	Y
PTTP 13	0.00	85.00	1.00	0.15	0.32	0.27	0.09	Y
PTTP 14	20.00	104.00	1.00	0.19	0.40	0.40	0.16	Y
PTTP 15	33.00	102.00	1.00	0.12	0.30	0.37	0.11	Y
PTTP 16	17.00	102.00	1.00	0.15	0.37	0.40	0.15	Y
PTTP 17	17.00	109.00	1.00	0.12	0.37	0.33	0.12	N
PTTP 18	30.00	109.00	1.00	0.12	0.24	0.28	0.07	N
PTTP 19	43.00	102.00	1.00	0.11	0.30	0.40	0.12	N
PTTP 20	33.00	92.00	1.00	0.16	0.32	0.30	0.10	Y
PTTP 21	28.00	87.00	1.00	0.19	0.29	0.32	0.09	Y

Table 11 (cont'd)

PTTP 22	33.00	77.00	1.00	0.21	0.33	0.42	0.14	Y
PTTP 23	23.00	72.00	1.00	0.21	0.45	0.33	0.15	Y
PTTP 24	18.00	78.00	1.00	0.15	0.29	0.37	0.11	Y
PTTP 25	18.00	72.00	1.00	0.26	0.25	0.30	0.08	Y
PTTP 26	23.00	67.00	1.00	0.22	0.30	0.42	0.13	N
PTTP 27	18.00	67.00	1.00	0.19	0.30	0.40	0.12	N
PTTP 28	13.00	67.00	1.00	0.10	0.32	0.33	0.11	N
PTTP 29	8.00	67.00	1.00	0.14	0.27	0.32	0.09	N
PTTP 30	3.00	67.00	1.00	0.16	0.36	0.36	0.13	Y
STTP 1	105.00	110.00	2.00	0.12	0.20	0.25	0.05	Y
STTP 2	110.00	113.00	2.00	0.11	0.33	0.38	0.13	Y
STTP 3	103.00	114.00	2.00	0.13	0.33	0.37	0.12	Y
STTP 4	102.00	117.00	3.00	0.16	0.33	0.35	0.12	Y
STTP 5	108.00	118.00	2.00	0.13	0.38	0.41	0.16	Y
STTP 6	106.00	120.00	3.00	0.18	0.38	0.34	0.13	Y
STTP 7	87.00	134.00	3.00	0.18	0.40	0.37	0.15	Y
STTP 8	85.00	131.00	3.00	0.17	0.30	0.31	0.09	Y
STTP 9	81.00	134.00	3.00	0.16	0.31	0.40	0.12	Y
STTP 10	77.00	133.00	2.00	0.16	0.30	0.33	0.10	Y
STTP 11	75.00	134.00	3.00	0.20	0.34	0.40	0.14	Y
STTP 12	75.00	135.00	3.00	0.17	0.36	0.39	0.14	Y
STTP 13	70.00	132.00	3.00	0.15	0.33	0.37	0.12	Y
STTP 14	72.00	155.00	2.00	0.20	0.30	0.36	0.11	Y
STTP 15	75.00	155.00	2.00	0.25	0.32	0.43	0.14	Y
STTP 16	76.00	153.00	2.00	0.20	0.29	0.37	0.11	Y
STTP 17	79.00	151.00	3.00	0.23	0.38	0.30	0.11	Y
STTP 18	78.00	158.00	3.00	0.25	0.22	0.26	0.06	Y
STTP 19	78.00	160.00	3.00	0.22	0.33	0.35	0.12	Y
STTP 20	82.00	171.00	2.00	0.13	0.30	0.35	0.11	Y
STTP 21	82.00	174.00	3.00	0.23	0.34	0.39	0.13	Y
STTP 22	85.00	178.00	2.00	0.15	0.37	0.27	0.10	Y
STTP 23	86.00	179.00	2.00	0.25	0.32	0.36	0.12	Y
STTP 24	87.00	173.00	2.00	0.16	0.36	0.25	0.09	Y
STTP 25	88.00	178.00	3.00	0.25	0.35	0.24	0.08	Y
STTP 26	91.00	155.00	3.00	0.21	0.33	0.37	0.12	Y
STTP 27	95.00	153.00	3.00	0.26	0.36	0.28	0.10	Y
STTP 28	96.00	155.00	3.00	0.22	0.28	0.38	0.11	Y
STTP 29	97.00	158.00	3.00	0.26	0.28	0.33	0.09	Y
STTP 30	91.00	151.00	2.00	0.23	0.39	0.30	0.12	Y
STTP 31	100.00	154.00	3.00	0.23	0.35	0.27	0.09	Y
STTP 32	101.00	149.00	3.00	0.15	0.37	0.27	0.10	Y
STTP 33	102.00	141.00	3.00	0.26	0.26	0.35	0.09	Y
STTP 34	103.00	144.00	2.00	0.23	0.29	0.40	0.12	Y
STTP 35	106.00	146.00	2.00	0.16	0.34	0.36	0.12	Y

Table 11 (cont'd)

STTP 36	108.00	142.00	2.00	0.17	0.34	0.28	0.10	Y
STTP 37	107.00	150.00	3.00	0.11	0.28	0.38	0.11	Y
STTP 38	110.00	175.00	3.00	0.23	0.36	0.30	0.11	Y
STTP 39	99.00	196.00	2.00	0.22	0.22	0.33	0.07	Y
TTP 1	55.00	95.00	1.00	0.20	0.50	0.50	0.25	Y
TTP 2	57.00	104.00	1.00	0.19	0.45	0.45	0.20	Y
TTP 3	59.00	114.00	1.00	0.26	0.45	0.45	0.20	Y
TTP 4	62.00	124.00	1.00	0.16	0.45	0.45	0.20	Y
TTP 5	46.00	100.00	1.00	0.20	0.50	0.50	0.25	N
TTP 6	49.00	110.00	1.00	0.26	0.45	0.45	0.20	Y
TTP 7	54.00	120.00	1.00	0.70	0.45	0.45	0.20	N
TTP 8	60.00	130.00	1.00	0.20	0.45	0.45	0.20	N
TTP 9	39.00	108.00	1.00	0.16	0.50	0.50	0.25	Y
TTP 10	47.00	115.00	1.00	0.13	0.30	0.30	0.09	N
TTP 11	51.00	124.00	1.00	0.09	0.50	0.50	0.25	N
TTP 12	56.00	132.00	1.00	0.20	0.50	0.50	0.25	Y
TTP 13	40.00	117.00	1.00	0.30	0.45	0.45	0.20	Y
TTP 14	47.00	124.00	1.00	0.24	0.45	0.45	0.20	Y
TTP 15	51.00	132.00	1.00	0.12	0.45	0.45	0.20	Y
TTP 16	60.00	142.00	1.00	0.12	0.45	0.45	0.20	Y
TTP 17	90.00	200.00	1.00	0.21	0.46	0.38	0.17	Y
TTP 18	70.00	180.00	1.00	0.22	0.35	0.40	0.14	Y
TTP 19	70.00	160.00	1.00	0.29	0.33	0.37	0.12	Y
TTP 20	50.00	160.00	1.00	0.29	0.48	0.36	0.17	Y
TTP 21	70.00	170.00	1.00	0.29	0.37	0.40	0.15	Y
TTP 22	90.00	170.00	1.00	0.20	0.50	0.40	0.20	Y
TTP 23	90.00	180.00	1.00	0.23	0.40	0.37	0.15	Y
TTP 24	75.00	165.00	1.00	0.38	0.45	0.30	0.14	Y
TTP 25	80.00	170.00	1.00	0.29	0.40	0.42	0.17	Y
TTP 26	80.00	180.00	1.00	0.31	0.34	0.31	0.11	Y
TTP 27	60.00	160.00	1.00	0.24	0.44	0.40	0.18	Y
TTP 28	60.00	170.00	1.00	0.23	0.37	0.42	0.16	N
TTP 29	60.00	180.00	1.00	0.12	0.44	0.42	0.18	Y
TTP 30	100.00	190.00	1.00	0.26	0.32	0.40	0.13	Y
TTP 31	100.00	200.00	1.00	0.24	0.43	0.34	0.15	Y
TTP 32	100.00	210.00	1.00	0.19	0.38	0.36	0.14	N
TTP 33	90.00	190.00	1.00	0.22	0.36	0.46	0.17	Y
TTP 34	90.00	210.00	1.00	0.12	0.43	0.40	0.17	Y
TTP 35	80.00	190.00	1.00	0.21	0.41	0.47	0.19	Y
TTP 36	80.00	200.00	1.00	0.17	0.40	0.40	0.16	Y
TTP 37	80.00	210.00	1.00	0.29	0.35	0.40	0.14	Y
TTP 38	70.00	190.00	1.00	0.23	0.41	0.41	0.17	Y
TTP 39	70.00	200.00	1.00	0.23	0.39	0.37	0.14	Y
TTP 40	70.00	210.00	1.00	0.17	0.35	0.32	0.11	Y

Table 11 (cont'd)

TTP 41	60.00	190.00	1.00	0.16	0.39	0.38	0.15	Y
TTP 42	60.00	200.00	1.00	0.19	0.46	0.40	0.18	Y
TTP 43	60.00	210.00	1.00	0.15	0.38	0.40	0.15	Y
TTP 44	90.00	160.00	1.00	0.28	0.32	0.27	0.09	N
TTP 45	100.00	230.00	1.00	0.19	0.48	0.34	0.16	Y
TTP 46	90.00	220.00	1.00	0.21	0.50	0.41	0.21	Y
TTP 47	90.00	230.00	1.00	0.08	0.48	0.43	0.21	Y
TTP 48	80.00	220.00	1.00	0.11	0.49	0.41	0.20	Y
TTP 49	70.00	220.00	1.00	0.15	0.34	0.36	0.12	Y
TTP 50	60.00	220.00	1.00	0.21	0.33	0.50	0.17	Y
TTP 51	80.00	230.00	1.00	0.10	0.43	0.39	0.17	Y
TTP 52	50.00	220.00	1.00	0.30	0.61	0.41	0.25	Y
TTP 53	70.00	230.00	1.00	0.15	0.43	0.35	0.15	Y
TTP 54	60.00	230.00	1.00	0.20	0.41	0.40	0.16	N
TTP 55	110.00	229.00	1.00	0.18	0.50	0.40	0.20	Y
TTP 56	120.00	230.00	1.00	0.21	0.37	0.40	0.15	Y
TTP 57	110.00	220.00	1.00	0.16	0.35	0.38	0.13	Y
TTP 58	120.00	220.00	1.00	0.20	0.34	0.38	0.13	Y
TTP 59	110.00	210.00	1.00	0.29	0.44	0.36	0.16	Y
TTP 60	120.00	210.00	1.00	0.15	0.46	0.41	0.19	Y
TTP 61	128.00	210.00	1.00	0.19	0.38	0.41	0.16	Y
TTP 62	110.00	200.00	1.00	0.20	0.40	0.30	0.12	Y
TTP 63	120.00	200.00	1.00	0.22	0.40	0.35	0.14	Y
TTP 64	128.00	200.00	1.00	0.20	0.35	0.32	0.11	Y
TTP 65	110.00	190.00	1.00	0.19	0.38	0.37	0.14	Y
TTP 66	120.00	190.00	1.00	0.21	0.40	0.35	0.14	Y
TTP 67	110.00	180.00	1.00	0.22	0.34	0.39	0.13	Y
TTP 68	120.00	180.00	1.00	0.19	0.39	0.34	0.13	Y
TTP 69	110.00	170.00	1.00	0.15	0.39	0.32	0.12	Y
TTP 70	120.00	170.00	1.00	0.18	0.44	0.42	0.18	Y
TTP 71	110.00	160.00	1.00	0.23	0.31	0.37	0.11	Y
TTP 72	120.00	160.00	1.00	0.29	0.47	0.38	0.18	Y
TTP 73	100.00	150.00	1.00	0.28	0.52	0.41	0.21	Y
TTP 74	110.00	150.00	1.00	0.21	0.35	0.37	0.13	Y
TTP 75	120.00	150.00	1.00	0.22	0.43	0.45	0.19	Y
TTP 76	100.00	140.00	1.00	0.23	0.39	0.45	0.18	Y
TTP 77	110.00	140.00	1.00	0.24	0.34	0.44	0.15	Y
TTP 78	120.00	140.00	1.00	0.12	0.43	0.36	0.15	Y
TTP 79	100.00	130.00	1.00	0.25	0.46	0.40	0.18	Y
TTP 80	110.00	130.00	1.00	0.24	0.40	0.50	0.20	Y
TTP 81	122.00	130.00	1.00	0.16	0.43	0.40	0.17	Y
TTP 82	100.00	120.00	1.00	0.31	0.39	0.40	0.16	Y
TTP 83	110.00	120.00	1.00	0.24	0.45	0.40	0.18	Y
TTP 84	120.00	120.00	1.00	0.14	0.40	0.39	0.16	Y

Table 11 (cont'd)

TTP 85	120.00	111.00	1.00	0.27	0.34	0.35	0.12	Y
TTP 86	95.00	110.00	1.00	0.36	0.40	0.38	0.15	Y
TTP 87	110.00	110.00	1.00	0.26	0.48	0.41	0.20	Y
TTP 88	100.00	110.00	1.00	0.27	0.37	0.33	0.12	Y
TTP 89	110.00	100.00	1.00	0.18	0.46	0.44	0.20	Y
TTP 90	80.00	100.00	1.00	0.23	0.40	0.51	0.20	Y
TTP 91	70.00	100.00	1.00	0.18	0.45	0.36	0.16	Y
TTP 92	60.00	100.00	1.00	0.28	0.37	0.45	0.17	Y
TTP 93	50.00	100.00	1.00	0.22	0.45	0.35	0.16	Y
TTP 94	90.00	150.00	1.00	0.27	0.41	0.36	0.15	Y
TTP 95	80.00	150.00	1.00	0.21	0.39	0.39	0.15	Y
TTP 96	70.00	150.00	1.00	0.24	0.46	0.33	0.15	Y
TTP 97	60.00	150.00	1.00	0.18	0.55	0.44	0.24	Y
TTP 98	50.00	150.00	1.00	0.22	0.35	0.44	0.15	Y
TTP 99	50.00	140.00	1.00	0.10	0.33	0.43	0.14	Y
TTP 100	60.00	140.00	1.00	0.17	0.38	0.40	0.15	Y
TTP 101	70.00	140.00	1.00	0.17	0.36	0.34	0.12	Y
TTP 102	80.00	140.00	1.00	0.13	0.39	0.34	0.13	Y
TTP 103	90.00	140.00	1.00	0.19	0.46	0.45	0.21	Y
TTP 104	90.00	130.00	1.00	0.23	0.39	0.35	0.14	Y
TTP 105	80.00	130.00	1.00	0.25	0.32	0.46	0.15	Y
TTP 106	70.00	130.00	1.00	0.30	0.45	0.45	0.20	Y
TTP 107	90.00	120.00	1.00	0.19	0.40	0.36	0.14	Y
TTP 108	80.00	120.00	1.00	0.21	0.38	0.32	0.12	Y
TTP 109	70.00	120.00	1.00	0.13	0.36	0.38	0.14	Y
TTP 110	90.00	110.00	1.00	0.20	0.40	0.40	0.16	Y
TTP 111	80.00	110.00	1.00	0.15	0.33	0.32	0.11	Y
TTP 112	70.00	110.00	1.00	0.22	0.34	0.40	0.14	Y
TTP 113	98.50	101.50	1.00	0.16	0.30	0.30	0.09	Y
TTP 114	99.50	101.50	1.00	0.18	0.30	0.30	0.09	Y
TTP 115	35.00	80.00	1.00	0.16	0.30	0.28	0.08	N
TTP 116	35.00	90.00	1.00	0.11	0.28	0.29	0.08	N
TTP 117	40.00	100.00	1.00	0.08	0.42	0.44	0.18	N
TTP 118	50.00	230.00	1.00	0.11	0.39	0.36	0.14	N
TTP 119	50.00	240.00	1.00	0.22	0.37	0.32	0.12	N
TTP 120	60.00	91.00	1.00	0.18	0.40	0.34	0.14	N
TTP 121	61.00	240.00	1.00	0.14	0.46	0.40	0.18	N
TTP 122	90.00	100.00	1.00	0.14	0.41	0.35	0.14	N
TTP 123	100.00	220.00	1.00	0.17	0.53	0.47	0.25	N
TTP 124	100.00	240.00	1.00	0.09	0.39	0.33	0.13	N
TTP 125	130.00	220.00	1.00	0.22	0.41	0.40	0.16	N
TTP 126	100.00	175.00	1.00	0.37	0.40	0.30	0.12	Y
TTP 127	100.00	170.00	1.00	0.33	0.38	0.34	0.13	Y
TTP 128	100.00	165.00	1.00	0.24	0.35	0.25	0.09	Y

Table 12 Flotation inventory

Lot	Unit	Level	Location/ matrix	Orig. vol. (nearest 100 ml)	Flot. sample vol. (to 100 ml)	Mass (g)	Notes
30	3	2	Feature 1	5000	1000	1300	
145	5	4	NW ¼	1100	1000	1269	
150	6	3	SE ¼	1100	1000	1302	
151	6	4		1000	1000	1395	
153	6	14-28 cm		2300	1000	1354	
155	6	28-34 cm	Feature 2	500	500	858	578 g ceramics withheld from sample and not inc. in flot volume; bagged separate
157	6	24-34 cm	Feature 2	600	600	964	
164	7	4	SW ¼	700	700	1117	325 g ceramics withheld from sample and not inc. in flot volume; bagged separate
169	8	3	Feature 3	700	700	1091	
171	8	4	S ½	900	900	1298	
178	9	2	Along W wall	1100	1000	1298	
186	9	6	SW ¼	600	600	918	
197	10	5		450	450	518	Small 1L pitcher is in 50 ml increments
198	10	5	Semi-packed soil	600	600	663	
200	10	6	Center of unit, cluster of ash/ dhaka	500	500	566	
208	11	2	SE ¼	600	600	888	
218	12	3	W ½	200	200	305	
221	13	1	N ½	700	700	1090	
225	13	2	W ½	1000	1000	1474	
225	13	3	W ½	900	900	1358	
228	14	1	N ½	2000	1000	1274	
230	14	2	NW ¼	500	500	701	1st sample to use 1 mm sieve
232	14	3	NW ¼	2400	1000	1332	
233	14	4	SW ¼ only	800	800	1016	The outer bag also contained the general level bag which has same lot #
234	15	3	NW ¼, hard-packed soil	900	900	1174	

Table 12 (cont'd)

242	15	4	NE ¼, Semi-packed soil	600	600	945	
243	15	4	SW ¼,	350	350	440	
251	16	2		1000	1000	1183	
253	16	3	NE ¼	900	900	1106	
263	17	3	SE ¼, Hard-packed soil	800	800	937	
264	17	3	SE ¼, Semi-packed soil	700	700	903	
269	18	2	NW ¼	600	600	804	
271	18	3	NE ¼	1500	1000	1479	
280	19	3	SE ¼, Hard-packed soil	2000	1000	1335	
285	19	4	E ½	600	600	894	
287	19	5	NW ¼	1000	1000	1331	
288	19	4	Burnt soil/ stone surface	2500	1000	1498	
292	20	1	NW ¼, Hard-packed soil	700	700	957	
294	20	2	NW ¼, Hard-packed soil	500	500	736	
296	20	3	NW ¼, Semi-packed soil	1000	1000	1333	
297	20	2&3	N ½ gravel concentrate	800	800	1031	S ½ gravel in sep. bag inside outer bag, not processed in flot sample
299	20	4	SE ¼	800	800	1100	
347	21	2	NE ¼	400	400	641	
349	N40 E99-100	0-8 cmbs	opening in wall, towards N portion of wall	1500	1000	1583	
374	1-12	2	SW ¼, Hard-packed soil	2400	2000	2765	
376	1-12	3	SW ¼	1500	1000	1404	
378	1-12	4	NW ¼	1800	1000	1376	
392	1-33	2	SE ¼	2300	1000	1488	
394	1-33	3	SE ¼	1500	1000	1454	
397	1-33	4	SE ¼	1600	1000	1508	
398	1-33	5	SE ¼, Semi-packed soil	900	900	1295	
399	1-33	5	SW ¼, Loose-packed soil	1500	1000	1267	
402	1-33	6	SE ¼	1300	1000	1351	

Table 12 (cont'd)

403	1-33	6	E ½, Compact ashy matrix	1200	1000	1308	200 ml of compact ashy chunks withheld from flot
405	1-33	7	SE ¼	1700	1000	1335	
162-1	7	11-18 cm	Feature 3, NW ¼	2000	1000	1486	
162-3	7	13-20	Feature 3, SE ¼	2900	1000	1672	

Table 13 Ceramic facies determinations

Lot	Unit #	Level #	Sherd type	Impression type	Motif	Paint/ burnish	Layout	Facies	Notes
22	2	1	DB	CS	single line	N/A	Unknown	Probable Zhizo	
22	2	1	DB	LI	3-4 banded LI	N/A	Unknown	Probable Zhizo	
22	2	1	DB	LI	3-4 banded LI	N/A	Unknown	Probable Zhizo	one incision is possibly punctate
22	2	1	DB	CS & LI	diagonal banded LI between two rows of CS	N/A	Unknown	Probable Zhizo	
22	2	1	DB	LI	single line	red paint	Unknown	Probable Zhizo	
23	2	2	DB	CS & LI	two rows of angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
23	2	2	DB	CS & LI	two rows of angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
23	2	2	DB	CS & LI	single row angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
23	2	2	DB	CS	angled lines of CS bounded by horizontal CS	N/A	Unknown	Probable Zhizo	
25	2	3	DB	LI	multiple bands	N/A	Unknown	Probable Zhizo	
25	2	3	DB	CS & LI	two rows of angled LI bounded by CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

25	2	3	DB	wide CS	single row wide CS; angled LI	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS	single row CS	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS & LI	single row angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS & LI	single row angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS & LI	two rows angled LI separated by row of CS	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS & LI	2 rows of: horiz CS row above wide-spaced angled LI	N/A	Unknown	Probable Zhizo	
26	4	1	DB	CS & LI	1 row of: horiz CS row above wide-spaced angled LI	N/A	Unknown	Probable Zhizo	
27	3	2	DB	CS	one line on neck, one line on shoulder	N/A	neck and shoulder	zhizo	
29	4	2	DB	triangular punctate	alternate large + small triangular punctate, 1 row	faint red paint	Unknown	? Ziwa	
29	4	2	DB	CS	2 rows of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

29	4	2	DB	CS & LI	2 rows of: horiz CS row above angled LI band	N/A	Unknown	Probable Zhizo	
29	4	2	DB	CS & LI	1 row of: horiz CS row above angled LI band	N/A	Unknown	Probable Zhizo	
29	4	2	DB	CS & LI	angled band LI + single row CS	N/A	Unknown	Probable Zhizo	
33	4	3	DB	CS	2 widely spaced obliquely angled CS rows	N/A	Unknown	Probable Zhizo	
33	4	3	DB	CS & LI	three rows angled LI separated by row of CS	N/A	Unknown	Zhizo	
33	4	3	DB	CS & LI	three rows angled LI separated by row of CS	N/A	Unknown	Zhizo	
34	3	3	DB	LI	multiple banded LI	N/A	Unknown	Probable Zhizo	
36	3	3	DB	vertical short curved incisions	single row	N/A	Unknown	Probable Zhizo	
36	3	3	DB	CS & LI	multiple diagonal LI bordered by linear CS	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS	Single row of CS	N/A	neck	Probable Zhizo	
37	5	1	DB	CS	Single row of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

37	5	1	DB	CS	Single row of CS	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS	two rows CS	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS	v-shaped CS line	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS	two CS lines at oblique angles	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS & LI	three rows angled LI separated by row of CS	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS & LI	angled LI band bounded by CS rows	N/A	Unknown	Probable Zhizo	
37	5	1	DB	CS & LI	two rows of angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
37	5	1	DB	LI	single band of fine LI	N/A	Unknown	Probable Zhizo	
43	5	2	DB	CS & LI	two rows of angled LI bounded by CS	N/A	Unknown	Probable Zhizo	
45	5	3	DB	CS & LI	Single CS row above LI band	N/A	Unknown	Probable Zhizo	
45	5	3	DB	LI	single band of LI	N/A	Unknown	Probable Zhizo	
146	5	4	DB	CS & LI	three rows angled LI separated by row of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

147	6	1	DB	LI	single band LI	N/A	Unknown	Probable Zhizo	
148	6	2	DB	LI	single band LI	N/A	Unknown	Probable Zhizo	
148	6	2	DB	LI	single band LI	N/A	Unknown	Probable Zhizo	
149	6	3	DB	dashed LI	single row dashed LI	N/A	Unknown	Probable Zhizo	
150	6	3	DB	LI	single LI	N/A	Unknown	unknown	
151	6	4	DB	CS	Single row of CS	N/A	Unknown	Probable Zhizo	
151	6	4	DB	CS & LI	Single CS row above LI band	N/A	Unknown	Probable Zhizo	
159	7	1	DB	CS & LI	single row CS above angled LI band	N/A	unknown	Probable Zhizo	
160	7	2	DB	LI	single band	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS	two lines	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS & LI	one line CS, multiple angled LI	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS & LI	two lines CS bordering band of angled LI	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS	single line	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS & LI	single line CS with band of LI	N/A	Unknown	Probable Zhizo	
160	7	2	DB	CS	three lines of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

160	7	2	DB	CS & LI	one line CS, multiple angled LI	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS & LI	three lines of CS with band of LI	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS & LI	single line of CS with band of LI	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS	three lines of CS	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS & LI	single line of CS with two oblique bands of LI	N/A	Unknown	Probable Zhizo	
161	7	3	DB	CS & LI	two lines of CS wit band of LI	N/A	Unknown	Probable Zhizo	
161	7	3	DB	LI	three lines of LI	N/A	Unknown	Probable Zhizo	
163	7	4	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
163	7	4	DB	CS & LI	one line of CS multiple angled LI	N/A	Unknown	Probable Zhizo	
163	7	4	DB	CS & LI	one line CS, surrounded by multiple angled LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

163	7	4	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
163	7	4	DB	LI	single linear incision	N/A	Unknown	Probable Zhizo	
163	7	4	DB	CS & LI	single line CS with band of LI	N/A	Unknown	Probable Zhizo	
163	7	4	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
165	7	5	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
166	8	1	DB	CS	single line CS	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS	single line	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS & LI	single line CS with band of LI	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS	three lines at oblique angles	N/A	Unknown	Probable Zhizo	
167	8	2	DB	LI	single line	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS	single line CS	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS & LI	two lines CS bordering band of angled LI	N/A	Unknown	Probable Zhizo	
167	8	2	DB	LI	multiple LI in angled band	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS	single line CS	N/A	Unknown	Probable Zhizo	
167	8	2	DB	CS	single line CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

170	8	4	DB	CS & LI	single line of CS and LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	LI	two lines of LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	CS & LI	single line of CS bordering band of LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	CS & LI	single line with multiple bands of LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	CS & LI	single line of CS with multiple bands of LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	CS & LI	single line of CS and LI	N/A	Unknown	Probable Zhizo	
170	8	4	DB	N/A	n/a	red paint	Unknown	unknown	
170	8	4	DB	N/A	n/a	red paint	Unknown	unknown	
176	9	1	DB	CS	two lines	N/A	Unknown	Probable Zhizo	
176	9	1	DB	LI	single line	N/A	Unknown	Probable Zhizo	
179	9	3	DB	li	multiple bands of LI	N/A	Unknown	Probable Zhizo	
181	9	4	DB	CS & LI	single line CS with band of LI	N/A	Unknown	Probable Zhizo	
181	9	4	DB	CS & LI	single CS with band of LI	N/A	Unknown	Probable Zhizo	
181	9	4	DB	CS	single line	N/A	Unknown	Probable Zhizo	
181	9	4	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

181	9	4	DB	CS & LI	single line of CS with band of LI	N/A	Unknown	Probable Zhizo	
181	9	4	DB	CS & LI	two lines of CS bordering a band of angled LI	N/A	Unknown	Probable Zhizo	
181	9	4	DB	LI	multiple LI	N/A	Unknown	Probable Zhizo	
183	9	5	DB	CS & LI	single line of CS with multiple LI	N/A	Unknown	Probable Zhizo	
187	9	7	DB	LI	band of multiple LI	N/A	Unknown	Probable Zhizo	
190	10	2	DB	LI	single LI	N/A	Unknown	Probable Zhizo	
192	10	3	DB	CS	two very close lines of CS	N/A	Unknown	Probable Zhizo	
211	11	4	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
214	12	1	DB	LI	single LI	N/A	Unknown	Probable Zhizo	
215	12	2	DB	CS	three lines of CS	N/A	Unknown	Probable Zhizo	
215	12	2	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
217	12	3	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
219	12	4	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
231	14	3	DB	CS	three lines of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

231	14	3	DB	CS & LI	one line of CS with two lines of LI	N/A	Unknown	Probable Zhizo	
236	15	1	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
236	15	1	DB	LI	two LI	N/A	Unknown	Probable Zhizo	
238	15	2	DB	LI	multiple LI	N/A	Unknown	Probable Zhizo	
240	15	3	DB	CS	two rows of CS	N/A	Unknown	Probable Zhizo	
241	14	4	DB	LI	two lines of LI	N/A	Unknown	Probable Zhizo	
241	14	4	DB	LI	four LI	N/A	Unknown	Probable Zhizo	
241	14	4	DB	LI	single LI	N/A	Unknown	Probable Zhizo	
241	14	4	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
241	14	4	DB	LI	double line of LI	N/A	Unknown	Probable Zhizo	
241	14	4	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
244	15	5	DB	CS & LI	single line of CS with multiple LI	N/A	Unknown	Probable Zhizo	
244	15	5	DB	LI	multiple bands of angled LI separated by large LI	N/A	Unknown	Probable Zhizo	
244	15	5	DB	CS	numerous lines of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

244	15	5	DB	CS & LI	single line of CS with multiple LI	N/A	Unknown	Probable Zhizo	
244	15	5	DB	LI	multiple bands of LI	N/A	Unknown	Probable Zhizo	
246	15	6	DB	CS & LI	two lines of CS with multiple LI	N/A	Unknown	Probable Zhizo	
246	15	6	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
246	15	6	DB	LI	single LI	N/A	Unknown	Probable Zhizo	
246	15	6	DB	LI	two LI	N/A	Unknown	Probable Zhizo	
248	16	1	DB	CS & LI	three lines of CS bordering a band of LI	N/A	Unknown	Probable Zhizo	
250	16	2	DB	CS	single row of CS	N/A	unknown	Probable Zhizo	
250	16	2	DB	CS & LI	single line of CS with multiple bands of LI	N/A	unknown	Probable Zhizo	
250	16	2	DB	CS	single row of CS	N/A	unknown	Probable Zhizo	
250	16	2	DB	CS & LI	single line of CS with band of LI	N/A	unknown	Probable Zhizo	
252	16	3	DB	LI	multiple LI	N/A	unknown	unknown	
254	16	4	DB	CS & LI	single line of CS with multiple bands of LI	N/A	Unknown	Probable Zhizo	
254	16	4	DB	CS & LI	two lines of CS with multiple LI	N/A	Unknown	Probable Zhizo	
254	16	4	DB	CS	single row of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

254	16	4	DB	CS & LI	angled LI band bounded by CS rows	N/A	Unknown	Probable Zhizo	
254	16	4	DB	CS & LI	two rows of angled incisions bounded by CS	N/A	Unknown	Probable Zhizo	
254	16	4	DB	CS & LI	single line of CS with band of LI	N/A	Unknown	Probable Zhizo	
254	16	4	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	
256	16	5	DB	CS or triangular punctate	single row of punctate	N/A	Unknown	Probable Zhizo	
258	16	4	DB	CS & LI	angled LI band bounded by CS rows	N/A	Unknown	Probable Zhizo	
258	16	4	DB	CS	single row of CS	N/A	Unknown	Probable Zhizo	
258	16	4	DB	CS & LI	angled LI band bounded by CS rows	N/A	Unknown	Probable Zhizo	
258	16	4	DB	CS & LI	angled LI band bounded by CS rows	N/A	Unknown	Probable Zhizo	
259	17	1	DB	CS & LI	single row CS with two LI	N/A	Unknown	Probable Zhizo	
259	17	1	DB	LI	two LI	N/A	Unknown	Probable Zhizo	
259	17	1	DB	CS & LI	two rows CS bordering a band of LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

261	17	2	DB	LI	band of LI bordered by a large LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS & LI	single line of CS with a band of angled LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	LI	multiple lines of LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS & LI	single line of CS above a band of angled LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS & LI	single line of CS above a band of angled LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS & LI	two rows of CS bordering a band of LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS & LI	single row of CS with a single LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	
265	17	3	DB	CS	multiple lines of CS	N/A	Unknown	Probable Zhizo	
268	18	1	DB	CS & LI	multiple lines of CS bordered by single LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

268	18	1	DB	CS & LI	band of LI bordered by a large CS	N/A	Unknown	Probable Zhizo	
268	18	1	DB	CS & LI	two bands of LI separated by a line of CS	N/A	Unknown	Probable Zhizo	
270	18	2	DB	CS & LI	band of LI above a single line of CS	N/A	Unknown	Probable Zhizo	
270	18	2	DB	LI	two parallel LI	N/A	Unknown	Probable Zhizo	
270	18	2	DB	CS	numerous lines of CS in a parallel band	N/A	Unknown	Probable Zhizo	
270	18	2	DB	LI	single line of LI	N/A	Unknown	Probable Zhizo	
270	18	2	DB	CS & LI	single line of CS forming a 'V' shape with a LI	N/A	Unknown	Probable Zhizo	
270	18	2	DB	LI	two LI on a raised lip	N/A	Unknown	Probable Zhizo	
281	19	3	DB	CS & LI	single line of CS close and parallel to a LI	N/A	Unknown	Probable Zhizo	
284	19	4	DB	CS	two parallel lines of CS	N/A	Unknown	Probable Zhizo	
284	19	4	DB	CS & LI	single line of CS above a band of angled LI	N/A	Unknown	Probable Zhizo	
284	19	4	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

289	19	6	DB	CS & LI	two lines of CS bordering two bands of LI	N/A	Unknown	Probable Zhizo	
291	20	1	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
293	20	2	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
293	20	2	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
293	20	2	DB	LI	single LI	N/A	Unknown	Probable Zhizo	
293	20	2	DB	LI	band of multiple LI	N/A	Unknown	Probable Zhizo	
293	20	2	DB	N/A	n/a	painted red	Unknown	unknown	
295	20	3	DB	CS & LI	single line of CS with multiple LI	N/A	Unknown	Probable Zhizo	
295	20	3	DB	CS & LI	two lines of CS bordering a band of angled LI	N/A	Unknown	Probable Zhizo	
295	20	3	DB	CS & LI	two lines of CS bordering a band of angled LI	N/A	Unknown	Probable Zhizo	
295	20	3	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
295	20	3	DB	N/A	n/a	painted red	Unknown	unknown	
298	20	4	DB	LI	three lines of dashed LI	N/A	Unknown	Probable Zhizo	
298	20	4	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

307	N106 E120	2	DB	CS + LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	two fragments that refit
308	N87 E134	3	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
308	N87 E134	3	DB	CS + LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
308	N87 E134	3	DB	CS + LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
310	N81 E134	3	DB	CS & LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
318	N79 E151	3	DB	CS & LI	two bands LI bordered by rows of CS	N/A	unknown	Probable Zhizo	
320	N78 E160	3	DB	CS & LI	one line of CS and one of LI	N/A	unknown	Probable Zhizo	
322	N82 E174	3	DB	LI	band of LI	N/A	unknown	Probable Zhizo	
322	N82 E174	3	DB	CS	three horiz lines of CS	N/A	unknown	Probable Zhizo	
327	N91 E155	3	DB	CS & LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	
327	N91 E155	3	DB	CS & LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	
327	N91 E155	3	DB	CS & LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	

Table 13 (cont'd)

328	N95 E153	2	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
328	N95 E153	3	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
328	N95 E153	3	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
329	N96 E 155	2	DB	CS & LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	
330	N97 E158	3	DB	CS	several rows of CS	N/A	unknown	Probable Zhizo	
330	N97 E158	3	DB	CS	several rows of CS	N/A	unknown	Probable Zhizo	
330	N97 E158	3	DB	CS	several rows of CS	N/A	unknown	Probable Zhizo	
331	N91 E151	2	DB	CS	three horiz lines of CS	N/A	unknown	Probable Zhizo	
333	N101 E149	1	DB	LI	band of LI	N/A	unknown	Probable Zhizo	
333	N101 E149	2	DB	CS & LI	multiple rows of CS bordering bands of LI	N/A	unknown	Probable Zhizo	
333	N101 E149	3	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
333	N101 E149	3	DB	CS & LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
333	N101 E149	3	DB	LI	band of LI	N/A	unknown	Probable Zhizo	
333	N101 E149	3	DB	LI	band of LI	N/A	unknown	Probable Zhizo	

Table 13 (cont'd)

333	N101 E149	3	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
334	N102 E141	3	DB	LI	two lines	N/A	unknown	Zhizo	
335	N103 E144	2	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
335	N103 E144	2	DB	CS & LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
337	N108 E142	2	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
337	N108 E142	2	DB	CS & LI	row of CS bordering band of LI	N/A	unknown	Probable Zhizo	
339	N110 E175	2	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
339	N110 E175	2	DB	CS	two rows CS	N/A	unknown	Probable Zhizo	
339	N110 E175	3	DB	round punctate	single curving row round punctate	N/A	unknown	Probable Zhizo	
339	N110 E175	3	DB	CS	rows of CS bordering angled band of CS lines	N/A	unknown	Probable Zhizo	
340	N99 E196	2	DB	CS	single row CS	N/A	unknown	Probable Zhizo	
345	21	1	DB	LI	multiple LI	N/A	Unknown	Probable Zhizo	
345	21	1	DB	CS & LI	two lines of CS bordering a band of LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

345	21	1	DB	CS & LI	single line of CS above a band of angled LI	N/A	Unknown	Probable Zhizo	
345	21	1	DB	CS & LI	single line of CS above a band of angled LI	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS & LI	two lines of CS bordering a band of LI	N/A	Unknown	Probable Zhizo	
346	21	2	DB	LI	band of LI	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS & LI	two lines of CS bordering two bands of LI	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS & LI	two lines of CS bordering two bands of LI	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS	single line of CS	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
346	21	2	DB	CS & LI	one line of CS in between two bands of LI	N/A	Unknown	Probable Zhizo	
348	21	3	DB	CS	two lines of CS	N/A	Unknown	Probable Zhizo	
348	21	3	DB	CS & LI	two lines of CS with a line of LI	N/A	Unknown	Probable Zhizo	
348	21	3	DB	CS	two lines of CS with an obliquely angled LI	N/A	Unknown	Probable Zhizo	

Table 13 (cont'd)

348	21	3	DB	LI	two parallel lines of LI	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	CS & LI	two lines of CS with two bands of LI	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	LI	two LI	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	LI	two LI	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	CS & LI	single line of CS with multiple LI	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	CS	single line	N/A	Unknown	Probable Zhizo	
168/9	8	3	DB	CS & LI	two lines of CS with band of LI	N/A	Unknown	Probable Zhizo	
318	STTP N79 E151	2	DR	Punctate + LI	two rows of short vertical/ oblong punctate bordering three rows of LI; small fragment of diagonal hatching below	red paint	entire rim+neck	Eiland?	see p 229, Huffman 2007
37	5	1	DR	CS & LI	Single CS row above LI band	N/A	lower rim	Probable Zhizo	
43	5	2	DR	CS	two CS lines at oblique angles	N/A	lower rim	Probable Zhizo	
250	16	2	DR	CS	single row of CS	N/A	lower rim	Probable Zhizo	
284	19	4	DR	CS	single line of CS	N/A	lower rim	Probable Zhizo	

Table 13 (cont'd)

329	STTP N96 E 155	3	DR	CS	single row wide CS	N/A	lower rim	Probable Zhizo	
26	4	1	DR	CS & LI	angled bands of CS bordered by row of CS (above) and LI (below)	N/A	lower rim	Zhizo	
154	6	5	DR	CS	two rows CS	N/A	lower rim	Zhizo	
154	6	5	DR	LI	two rows angled incisions sep by single LI	N/A	lower rim	Zhizo	
330	STTP N97 E158	3	DR	LI	horiz LI bordering band of angled LI	N/A	lower rim	Zhizo	
339	STTP N110 E175	3	DR	LI	horiz LI bordering band of angled LI	N/A	lower rim	Zhizo	
25	2	3	DR	CS	two rows CS separated approx 1 cm	N/A	Neck	Probable Zhizo	
22	2	1	DR	CS & LI	multiple banded LI beneath row of CS	N/A	Neck	Zhizo	
146	5	4	DR	LI	single LI with possible CS below	N/A	rim	Probable Zhizo	
146	5	4	DR	LI	single band of LI	N/A	rim	Probable Zhizo	
43	5	2	DR	CS & LI	Single CS row above LI band	N/A	rim	Zhizo	

Table 13 (cont'd)

240	15	3	DR	CS	two rows of CS	N/A	Unknown	Probable Zhizo	
241	14	4	DR	LI	single row of LI	N/A	Unknown	Probable Zhizo	
241	14	4	DR	LI	LI bordering angled band of LI	N/A	Unknown	Probable Zhizo	
241	14	4	DR	CS & LI	single line of CS with one LI	N/A	Unknown	Probable Zhizo	
261	17	2	DR	CS & LI	two lines of CS bordering a band of angled LI	N/A	Unknown	Probable Zhizo	
298	20	4	DR	CS	three parallel lines of CS	N/A	Unknown	Probable Zhizo	
272	18	3	DR	N/A	n/a	painted red	Unknown	unknown	
334	STTP N102 E141	3	DR	CS	three horiz lines of CS	N/A	upper rim	Zhizo	

APPENDIX B

SHELL BEAD DATA

Table 14 Finished OES beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
22	13	2	1	OES	1	4.1	2.2	n	finished	
22	13	2	1	OES	1	7.5	2.3	n	finished	
23	13	2	2	OES	1	6.0	2.1	Y	finished	
24	13	3	1	OES	1	4.0	1.6	n	finished	
24	13	3	1	OES	1	4.9	2.0	n	finished	
24	13	3	1	OES	1	4.8	2.1	n	finished	
24	13	3	1	OES	1	5.1	2.2	n	finished	
24	13	3	1	OES	1	9.5	2.4	n	finished	
24	13	3	1	OES	1	4.3	1.3	Y	finished	
26	13	4	1	OES	1	6.1	2.3	n	finished	
26	13	4	1	OES	1	10.0	3.1	n	finished	
26	13	4	1	OES	1	6.4	1.6	Y	finished	
26	13	4	1	OES	1	5.5	1.9	Y	finished	
28	13	3	1	OES	1	11.1	2.0	n	finished	
28	13	3	1	OES	1	6.6	2.1	n	finished	
28	13	3	1	OES	1	9.3	2.3	n	finished	
28	13	3	1	OES	1	10.9	2.3	n	finished	
28	13	3	1	OES	1	11.1	2.3	n	finished	
28	13	3	1	OES	1	11.0	2.3	n	finished	
28	13	3	1	OES	1	10.8	2.4	n	finished	
28	13	3	1	OES	1	11.2	2.4	n	finished	
28	13	3	1	OES	1	11.3	2.5	n	finished	
28	13	3	1	OES	1	11.1	2.5	n	finished	
28	13	3	1	OES	1	9.7	2.6	n	finished	
28	13	3	1	OES	1	11.3	2.6	n	finished	
28	13	3	1	OES	1	11.2	2.6	n	finished	
28	13	3	1	OES	1	11.0	2.7	n	finished	
28	13	3	1	OES	1	11.0	2.7	n	finished	

Table 14 (cont'd)

28	13	3	1	OES	1	9.5	2.8	n	finished	
28	13	3	1	OES	1	11.1	2.9	n	finished	
28	13	3	1	OES	1	11.0	3.0	n	finished	
28	13	3	1	OES	1	10.9	2.4	Y	finished	
28	13	3	1	OES	1	11.2	2.5	Y	finished	
28	13	3	1	OES	1	11.1	2.6	Y	finished	
29	13	4	2	OES	1	4.8	2.0	n	finished	
33	13	4	3	OES	1	5.8	1.5	Y	finished	
37	13	5	1	OES	1	3.7	1.2	n	finished	
37	13	5	1	OES	1	4.9	1.5	n	finished	
37	13	5	1	OES	1	4.9	1.7	n	finished	
37	13	5	1	OES	1	6.1	1.9	n	finished	
37	13	5	1	OES	1	4.3	2.3	n	finished	
37	13	5	1	OES	1	4.8	1.9	Y	finished	
37	13	5	1	OES	1	5.9	1.9	Y	finished	
43	13	5	2	OES	1	6.6	2.6	n	finished	
43	13	5	2	OES	1	4.3	1.7	Y	finished	
45	13	5	3	OES	1	6.1	1.3	n	finished	
45	13	5	3	OES	1	5.5	1.6	Y	finished	
145	13	5	4	OES	1	3.7	1.5	n	finished	
146	13	5	4	OES	1	6.5	1.7	n	finished	
148	13	6	2	OES	1	5.7	1.7	n	finished	
152	13	6	4	OES	1	7.4	2.2	n	finished	
160	13	7	2	OES	1	3.7	1.7	n	finished	
160	13	7	2	OES	1	4.5	1.8	n	finished	
161	13	7	3	OES	1	8.8	3.0	n	finished	
163	13	7	4	OES	1	8.0	2.7	n	finished	
166	13	8	1	OES	1	9.8	2.1	n	finished	
166	13	8	1	OES	1	6.1	2.7	n	finished	
167	13	8	2	OES	1	5.4	1.8	n	finished	
167	13	8	2	OES	1	10.8	2.2	n	finished	

Table 14 (cont'd)

167	13	8	2	OES	1	10.5	2.4	n	finished	
168	13	8	3	OES	1	4.3	1.6	n	finished	
168	13	8	3	OES	1	5.3	1.7	Y	finished	
168	13	8	3	OES	1	6.2	2.2	n	finished	
170	13	8	4	OES	1	6.0	2.2	n	finished	
175	13	8	N Wall	OES	1	6.1	1.9	n	finished	
176	13	9	1	OES	1	4.9	2.7	n	finished	
177	13	9	2	OES	1	6.6	2.9	n	finished	
181	13	9	4	OES	1	5.1	2.1	n	finished	
181	13	9	4	OES	1	4.5	2.1	Y	finished	
187	13	9	7	OES	1	5.5	1.7	n	finished	
194	13	10	4	OES	1	5.3	2.3	n	finished	
194	13	10	4	OES	1	5.3	2.4	n	finished	
207	13	11	2	OES	1	4.8	2.0	n	finished	
214	13	12	1	OES	1	5.9	1.9	n	finished	
222	13	13	1	OES	1	6.1	1.8	Y	finished	
222	13	13	1	OES	1	6.1	1.9	Y	finished	
222	13	13	1	OES	1	8.3	2.0	Y	finished	
222	13	13	1	OES	1	6.4	2.5	Y	finished	
224	13	13	2	OES	1	5.0	2.0	n	finished	
224	13	13	2	OES	1	6.5	2.2	Y	finished	
224	13	13	2	OES	1	4.9	2.4	Y	finished	
226	13	13	3	OES	1	6.2	2.5	Y	finished	
227	13	14	1	OES	1	7.9	2.0	Y	finished	
227	13	14	1	OES	1	7.5	2.1	Y	finished	
227	13	14	1	OES	1	6.7	2.2	Y	finished	
227	13	14	1	OES	1	8.5	2.3	Y	finished	
227	13	14	1	OES	1	6.9	2.3	Y	finished	
227	13	14	1	OES	1	6.5	2.3	Y	finished	
227	13	14	1	OES	1	6.1	2.9	Y	finished	
229	13	14	2	OES	1	8.3	2.2	Y	finished	

Table 14 (cont'd)

229	13	14	2	OES	1	6.8	2.2	Y	finished	
231	13	14	3	OES	1	6.3	1.8	Y	finished	
231	13	14	3	OES	1	6.8	2.0	Y	finished	
231	13	14	3	OES	1	5.3	2.1	Y	finished	
232	13	14	3	OES	1	6.8	2.0	Y	finished	
236	13	15	1	OES	1	5.3	2.5	n	finished	
236	13	15	1	OES	1	3.5	2.5	n	finished	
236	13	15	1	OES	1	4.1	2.8	n	finished	
240	13	15	3	OES	1	6.3	2.6	n	finished	
241	13	15	4	OES	1	7.5	3.1	n	finished	
244	13	15	5	OES	1	3.2	1.6	n	finished	
244	13	15	5	OES	1	6.9	2.3	n	finished	
246	13	15	6	OES	1	4.7	1.9	Y	finished	
256	13	16	5	OES	1	5.0	1.6	n	finished	
256	13	16	5	OES	1	7.1	1.7	n	finished	
259	13	17	1	OES	1	5.6	1.8	n	finished	
259	13	17	1	OES	1	5.8	2.5	n	finished	
261	13	17	2	OES	1	4.8	1.7	n	finished	
261	13	17	2	OES	1	5.7	2.1	Y	finished	
261	13	17	2	OES	1	4.3	2.2	Y	finished	
265	13	17	3	OES	1	5.4	1.4	n	finished	
265	13	17	3	OES	1	6.9	2.1	n	finished	
267	13	17	4	OES	1	5.9	1.7	n	finished	
270	13	18	2	OES	1	3.3	1.3	n	finished	
270	13	18	2	OES	1	6.9	1.5	n	finished	
270	13	18	2	OES	1	5.6	1.8	n	finished	
275	13	19	1	OES	1	4.2	1.3	n	finished	
275	13	19	1	OES	1	8.7	1.7	n	finished	
276	13	19	2	OES	1	6.5	1.7	n	finished	
276	13	19	2	OES	1	9.0	2.2	n	finished	
276	13	19	2	OES	1	7.7	2.4	n	finished	

Table 14 (cont'd)

276	13	19	2	OES	1	11.2	2.9	n	finished	
276	13	19	2	OES	1	9.3	2.9	n	finished	
276	13	19	2	OES	1	9.9	2.9	n	finished	
281	13	19	3	OES	1	5.4	1.7	n	finished	
281	13	19	3	OES	1	10.9	2.2	n	finished	
281	13	19	3	OES	1	11.0	2.4	n	finished	
281	13	19	3	OES	1	11.1	2.5	n	finished	
281	13	19	3	OES	1	11.3	2.7	n	finished	
281	13	19	3	OES	1	8.7	2.7	n	finished	
281	13	19	3	OES	1	9.4	2.9	n	finished	
281	13	19	3	OES	1	9.3	3.0	n	finished	
281	13	19	3	OES	1	8.6	3.2	n	finished	
281	13	19	3	OES	1	11.2	2.9	Y	finished	
284	13	19	4	OES	1	8.9	2.2	n	finished	
284	13	19	4	OES	1	9.7	2.6	n	finished	
286	13	19	5	OES	1	6.8	2.1	n	finished	
286	13	19	5	OES	1	11.4	2.7	n	finished	
286	13	19	5	OES	1	6.4	2.4	Y	finished	
289	13	19	6	OES	1	10.7	2.9	n	finished	
289	13	19	6	OES	1	5.6	1.8	Y	finished	
291	13	20	1	OES	1	5.3	1.7	n	finished	
295	13	20	3	OES	1	4.6	1.6	n	finished	
295	13	20	3	OES	1	8.1	2.2	n	finished	
301	13	20	5	OES	1	5.2	1.8	Y	finished	
307	13	N106 E120	STR 2	OES	1	6.0	2.2	n	finished	
308	13	N87 E134	STR 3	OES	1	7.6	2.1	n	finished	
312	13	N75 E134	STR 2	OES	1	4.5	2.1	n	finished	
313	13	N75 E135	STR 1	OES	1	6.6	1.7	n	finished	
315	13	N72 E155	STR 2	OES	1	6.2	2.6	n	finished	
316	13	N75 E155	STR 2	OES	1	4.2	1.6	n	finished	
316	13	N75 E155	STR 2	OES	1	6.2	1.7	n	finished	

Table 14 (cont'd)

316	13	N75 E155	STR 2	OES	1	5.9	2.3	n	finished	
316	13	N75 E155	STR 2	OES	1	6.2	2.3	n	finished	
317	13	N76 E153	STR 2	OES	1	6.1	1.8	n	finished	
319	13	N78 E158	STR 3	OES	1	9.6	2.6	n	finished	
321	13	N82 E171	STR 2	OES	1	6.6	1.6	Y	finished	
323	13	N85 E178	STR 2	OES	1	4.6	1.7	n	finished	
328	13	N95 E153	STR 2	OES	1	6.7	1.9	n	finished	
329	13	N96 E155	STR 2	OES	1	7.0	2.1	n	finished	
329	13	N96 E155	STR 3	OES	1	7.2	2.7	n	finished	
330	13	N97 E158	STR 2	OES	1	5.4	1.9	n	finished	
332	13	N100 E154	STR 3	OES	1	7.3	1.6	n	finished	
339	13	N110 E175	STR 3	OES	1	5.9	2.2	Y	finished	
342	13	TTP2	1	OES	1	6.5	3.0	n	finished	
348	13	21	3	OES	1	5.3	1.7	n	finished	
350	13	TTP5	1	OES	1	5.1	2.2	n	finished	
354	13	TTP9	1	OES	1	4.8	2.2	n	finished	
355	13	TTP10	1	OES	1	5.6	2.2	n	finished	V WEATHERED LOOKING
360	13	TTP15	1	OES	1	5.2	1.9	n	finished	
28/36	13	3	3	OES	1	11.2	2.1	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.5	2.3	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.2	2.3	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.2	2.3	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.2	2.3	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.2	2.4	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.2	2.6	n	finished	part of a necklace
28/36	13	3	3	OES	1	11.1	2.9	n	finished	part of a necklace

Table 15 Finished Achatina beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
22	13	2	1	ACH	1	3.13	1.21	n	finished	
22	13	2	1	ACH	1	3.66	1.6	n	finished	
23	13	2	2	ACH	1	4.89	2.04	n	finished	
23	13	2	2	ACH	1	3.27	1.87	n	finished	
23	13	2	2	ACH	1	4.35	1.87	n	finished	
23	13	2	2	ACH	1	3.66	2.19	n	finished	
23	13	2	2	ACH	1	4.95	1.91	Y	finished	
24	13	3	1	ACH	1	4.02	1.97	n	finished	
26	13	4	1	ACH	1	5.35	1.53	n	finished	
28	13	3	1	ACH	1	4.47	1.07	n	finished	
33	13	4	3	ACH	1	4.72	1.27	n	finished	
37	13	5	1	ACH	1	4.78	1.28	n	finished	
37	13	5	1	ACH	1	4.7	1.42	n	finished	
37	13	5	1	ACH	1	3.76	1.5	n	finished	
37	13	5	1	ACH	1	4.85	1.58	Y	finished	
43	13	5	2	ACH	1	3.71	1.39	n	finished	
148	13	6	2	ACH	1	4.71	1.47	n	finished	
149	13	6	3	ACH	1	2.98	1.68	n	finished	
160	13	7	2	ACH	1	5.23	1.18	n	finished	
160	13	7	2	ACH	1	3.84	1.74	n	finished	
160	13	7	2	ACH	1	3.13	.95	n	finished	
163	13	7	4	ACH	1	3.81	1.63	n	finished	
165	13	7	5	ACH	1	4	1.68	n	finished	
165	13	7	5	ACH	1	5.25	1.28	n	finished	
176	13	9	1	ACH	1	4.29	1.55	n	finished	
177	13	9	2	ACH	1	4	1.4	n	finished	
177	13	9	2	ACH	1	2.94	1.71	n	finished	
177	13	9	2	ACH	1	4.61	1.56	Y	finished	
179	13	9	3	ACH	1	5.49	1.34	n	finished	

Table 15 (cont'd)

181	13	9	4	ACH	1	5.21	1.71	n	finished	
181	13	9	4	ACH	1	3.8	1.3	n	finished	
183	13	9	5	ACH	1	3.6	1.32	n	finished	
185	13	9	6	ACH	1	4.35	1.2	n	finished	
192	13	10	3	ACH	1	4.15	1.95	n	finished	
222	13	13	1	ACH	1	4.95	1.72	Y	finished	
222	13	13	1	ACH	1	5.59	1.73	Y	finished	
222	13	13	1	ACH	1	5.01	1.34	Y	finished	
222	13	13	1	ACH	1	5.19	1.81	Y	finished	
222	13	13	1	ACH	1	4.97	1.9	Y	finished	
222	13	13	1	ACH	1	4.51	1.69	Y	finished	
222	13	13	1	ACH	1	5.08	1.68	Y	finished	
224	13	13	2	ACH	1	4.8	1.54	Y	finished	
224	13	13	2	ACH	1	4.72	1.98	Y	finished	
224	13	13	2	ACH	1	5.06	1.54	Y	finished	
224	13	13	2	ACH	1	4.71	1.76	Y	finished	
224	13	13	2	ACH	1	4.66	1.59	Y	finished	
224	13	13	2	ACH	1	4.87	1.71	Y	finished	
224	13	13	2	ACH	1	4.77	1.44	Y	finished	
224	13	13	2	ACH	1	5.41	1.19	Y	finished	
224	13	13	2	ACH	1	4.78	2.08	Y	finished	
224	13	13	2	ACH	1	4.76	1.59	Y	finished	
224	13	13	2	ACH	1	4.28	1.56	Y	finished	
224	13	13	2	ACH	1	5.51	1.62	Y	finished	
226	13	13	3	ACH	1	5.16	2.14	Y	finished	
226	13	13	3	ACH	1	4.81	1.86	Y	finished	
227	13	14	1	ACH	1	4.99	1.97	Y	finished	
227	13	14	1	ACH	1	4.55	1.52	Y	finished	
227	13	14	1	ACH	1	5	2.01	Y	finished	
227	13	14	1	ACH	1	4.92	1.67	Y	finished	
227	13	14	1	ACH	1	4.58	1.33	Y	finished	

Table 15 (cont'd)

227	13	14	1	ACH	1	4.99	1.4	Y	finished	
227	13	14	1	ACH	1	5.08	1.66	Y	finished	
229	13	14	2	ACH	1	3.31	1.98	n	finished	
229	13	14	2	ACH	1	4.56	1.54	Y	finished	
229	13	14	2	ACH	1	4.58	1.69	Y	finished	
229	13	14	2	ACH	1	5.03	1.83	Y	finished	
229	13	14	2	ACH	1	4.6	1.41	Y	finished	
229	13	14	2	ACH	1	4.33	1.74	Y	finished	
231	13	14	3	ACH	1	4.36	1.56	Y	finished	
231	13	14	3	ACH	1	4.76	1.8	Y	finished	
231	13	14	3	ACH	1	5.29	1.42	Y	finished	
231	13	14	3	ACH	1	4.99	1.46	Y	finished	
231	13	14	3	ACH	1	5.38	1.67	Y	finished	
233	13	14	4	ACH	1	4.86	2.06	Y	finished	
233	13	14	4	ACH	1	4.84	1.88	Y	finished	
236	13	15	1	ACH	1	2.77	2.72	n	finished	
238	13	15	2	ACH	1	4.94	2.11	n	finished	
240	13	15	3	ACH	1	3.72	1.76	n	finished	
240	13	15	3	ACH	1	3.52	1.40	n	finished	
240	13	15	3	ACH	1	3.42	1.69	n	finished	
241	13	15	4	ACH	1	4.26	2.08	n	finished	pale color, no striae or other diagnostic markings
241	13	15	4	ACH	1	3.24	1.77	n	finished	
241	13	15	4	ACH	1	3.19	2.21	n	finished	
244	13	15	5	ACH	1	5.12	1.95	n	finished	
246	13	15	6	ACH	1	4.42	1.41	n	finished	
246	13	15	6	ACH	1	3.46	1.66	n	finished	
246	13	15	6	ACH	1	4.34	1.77	n	finished	
250	13	16	2	ACH	1	3.04	1.2	n	finished	
250	13	16	2	ACH	1	2.74	1.31	n	finished	
259	13	17	1	ACH	1	3.39	1.69	n	finished	

Table 15 (cont'd)

259	13	17	1	ACH	1	4.17	2.22	n	finished	
259	13	17	1	ACH	1	3.81	1.56	n	finished	
259	13	17	1	ACH	1	4.27	1.45	n	finished	
259	13	17	1	ACH	1	3.49	1.77	n	finished	
259	13	17	1	ACH	1	3.59	1.56	n	finished	
261	13	17	2	ACH	1	4.25	1.53	n	finished	
265	13	17	3	ACH	1	4.96	1.12	n	finished	
265	13	17	3	ACH	1	4.61	1.22	n	finished	
265	13	17	3	ACH	1	4.07	1.48	n	finished	
265	13	17	3	ACH	1	3.17	1.26	n	finished	
267	13	17	4	ACH	1	3.64	1.76	n	finished	
276	13	19	2	ACH	1	4.69	1.45	n	finished	
284	13	19	4	ACH	1	6.13	1.57	n	finished	
284	13	19	4	ACH	1	2.93	1.45	n	finished	
291	13	20	1	ACH	1	4.27	1.74	n	finished	
295	13	20	3	ACH	1	4.52	1.26	Y	finished	
303	13	N110 E113	STR 1	ACH	1	3.69	1.43	Y	finished	
308	13	N87 E134	STR 3	ACH	1	3.95	1.27	n	finished	
312	13	N75 E134	STR 2	ACH	1	4.55	1.3	n	finished	
316	13	N75 E155	STR 2	ACH	1	3.63	1.59	n	finished	
316	13	N75 E155	STR 2	ACH	1	4.05	1.67	n	finished	
316	13	N75 E155	STR 2	ACH	1	5.03	1.73	n	finished	
322	13	N82 E174	STR 3	ACH	1	3.83	1.6	n	finished	
327	13	N91 E155	STR 2	ACH	1	3.53	1.41	n	finished	
328	13	N95 E153	STR 2	ACH	1	2.86	1.62	n	finished	
330	13	N97 E158	STR 1	ACH	1	4.31	1.05	n	finished	
330	13	N97 E158	STR 3	ACH	1	4.72	1.39	n	finished	
332	13	N100 E154	STR 2	ACH	1	4.23	1.62	n	finished	
333	13	N101 E149	STR 2	ACH	1	4.39	1.05	n	finished	
334	13	N102 E141	STR 1	ACH	1	3.94	1.76	n	finished	
334	13	N102 E149	STR 2	ACH	1	4.18	1.53	n	finished	

Table 15 (cont'd)

336	13	N106 E146	STR 2	ACH	1	3.32	0.88	Y	finished	
350	13	TTP5	1	ACH	1	2.98	1.59	n	finished	
355	13	TTP10	1	ACH	1	5.83	2.15	n	finished	
168/14	13	8	3	ACH	1	4.7	1.55	n	finished	
168/15	13	8	3	ACH	1	3.57	1.34	n	finished	
168/16	13	8	3	ACH	1	3.29	1.43	n	finished	

Table 16 Broken OES beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
24	13	3	1	OES	1	11.4	2.6	n	finished	≥50%
25	13	2	3	OES	1	7.6	2.3	yes	finished	≥50%
26	13	4	1	OES	1	6.4	2.8	yes	broken	≥50%
28	13	3	1	OES	1	11.2	2.9	yes	broken	≥50%
37	13	5	1	OES	1	6.8	3.0	n	finished	≥50%
37	13	5	1	OES	1	5.3	2.4	n	finished	≥50%
37	13	5	1	OES	1	4.8	1.8	n	finished	≥50%
37	13	5	1	OES	1	7.4	2.3	n	irregular	≥50%
149	13	6	3	OES	1	7.3	1.7	yes	irregular	≥50%
160	13	7	2	OES	1	6.5	1.7	yes	finished	≥50%
161	13	7	3	OES	1	6.9	1.4	n	JAGGED	≥50%
163	13	7	4	OES	1	3.8	1.6	yes	finished	≥50%
167	13	8	2	OES	1	8.4	2.5	n	finished	≥50%
167	13	8	2	OES	1	6.9	2.0	yes	finished	≥50%
183	13	9	5	OES	1	5.9	2.2	n	finished	≥50%
185	13	9	6	OES	1	10.3	2.0	yes	irregular	≥50%
199	13	10	5	OES	1	8.4	2.5	n	finished	≥50%
246	13	15	6	OES	1	8.6	1.6	yes	JAGGED	≥50%
259	13	17	1	OES	1	7.6	1.9	n	irregular	≥50%
267	13	17	4	OES	1	7.4	2.6	n	finished	≥50%
267	13	17	4	OES	1	6.4	2.4	n	finished	≥50%
276	13	19	2	OES	1	8.6	2.7	n	irregular	≥50%
281	13	19	3	OES	1	9.4	2.9	n	finished	≥50%
281	13	19	3	OES	1	6.6	2.7	n	irregular	≥50%
281	13	19	3	OES	1	9.9	2.5	yes	irregular	≥50%
284	13	19	4	OES	1	10.9	2.5	n	finished	≥50%
284	13	19	4	OES	1	8.8	2.4	n	finished	≥50%
286	13	19	5	OES	1	7.5	2.5	n	finished	≥50%
289	13	19	6	OES	1	4.6	2.1	n	finished	≥50%

Table 16 (cont'd)

298	13	20	4	OES	1	5.2	2.1	n	broken	≥50%
309	13	N85 E131	STR 2	OES	1	8.2	2.5	n	broken	≥50%
316	13	N75 E155	STR 2	OES	1	6.0	1.5	n	broken	≥50%
317	13	N75 E134	STR 3	OES	1	7.6	1.4	yes	broken	≥50%
327	13	N91 E155	STR 2	OES	1	5.9	2.3	n	broken	≥50%
328	13	N95 E153	STR 2	OES	1	8.9	2.6	n	broken	≥50%
328	13	N95 E153	STR 2	OES	1	5.9	1.9	n	broken	≥50%
330	13	N97 E158	STR 2	OES	1	7.8	2.0	n	broken	≥50%
332	13	N100 E154	STR 3	OES	1	7.0	2.2	n	broken	≥50%
338	13	N107 E150	STR 2	OES	1	5.8	2.3	n	broken	≥50%
168/12	13	8	3	OES	1	6.2	1.9	yes	irregular	≥50%
168/13	13	8	3	OES	1	6.8	2.2	n	finished	≥50%
181	13	9	4	OES	1	4.8	0.0	n	finished	<50% present
209	13	11	3	OES	1	BROKEN	BROKEN	yes	irregular	<50% present
214	13	12	1	OES	1	BROKEN	BROKEN	yes	finished	<50% present
214	13	12	1	OES	1	9.9	8.1	no	finished	Int Diam is probably error; ID'd by EDA as outlier
222	13	13	1	OES	33	BROKEN	BROKEN	yes	irregular	<50% present
224	13	13	2	OES	6	BROKEN	BROKEN	yes	finished	<50% present
224	13	13	2	OES	29	BROKEN	BROKEN	yes	irregular	<50% present
225	13	13	3	OES	4	BROKEN	BROKEN	no	irregular	<50% present

Table 16 (cont'd)

226	13	13	3	OES	5	BROKEN	BROKEN	no	irregular	<50% present
227	13	14	1	OES	7	BROKEN	BROKEN	yes	finished	<50% present
227	13	14	1	OES	35	BROKEN	BROKEN	yes	irregular	<50% present
229	13	14	2	OES	4	BROKEN	BROKEN	yes	finished	<50% present
229	13	14	2	OES	29	BROKEN	BROKEN	yes	irregular	<50% present
231	13	14	3	OES	16	BROKEN	BROKEN	yes	irregular	<50% present
233	13	14	4	OES	3	BROKEN	BROKEN	yes	irregular	<50% present
236	13	15	1	OES	1	BROKEN	BROKEN	no	finished	<50% present
240	13	15	3	OES	1	BROKEN	BROKEN	no	finished	<50% present
240	13	15	3	OES	1	BROKEN	BROKEN	yes	irregular	<50% present
265	13	17	3	OES	1	5.56	2.49	n	broken	<50% present
267	13	17	4	OES	1	6.01	2.47	n	irregular	<50% present
276	13	19	2	OES	1	10.59	2.12	n	irregular	<50% present
281	13	19	3	OES	1	8.25	1.89	n	finished	<50% present
293	13	20	2	OES	1	5.85	2.31	yes	finished	<50% present
298	13	20	4	OES	1	5.55	2.68	yes	broken	<50% present
313	13	N75 E135	STR 3	OES	1	6.7	5.0	n	finished	Int Diam is probably error; ID'd by EDA as outlier
331	13	N91 E151	STR 2	OES	1	8.34	2.41	n	broken	<50% present
357	13	TTP12	1	OES	1	BROKEN	BROKEN	yes	finished	<50% present

Table 17 Broken ACH beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
23	13	2	2	ACH	1	6.04	1.52	n	JAGGED	≥50%
35	13	4	4	ACH	1	7.42	N/A	n	finished	≥50%
167	13	8	2	ACH	1	3.88	1.14	n	finished	≥50%
346	13	21	2	ACH	1	6.6	1.95	n	JAGGED	≥50%
346	13	21	2	ACH	1	5.01	1.84	n	JAGGED	≥50%
348	13	21	3	ACH	1	7.23	1.39	n	JAGGED	≥50%
332	13	N100 E154	STR 3	ACH	1	6.35	1.55	yes	finished	≥50%
322	13	N82 E174	STR 2	ACH	1	4.87	2.15	n	finished	≥50%
326	13	N88 E178	STR 3	ACH	1	4.06	1.52	n	finished	≥50%
33	13	4	3	ACH	1	5.02	1.32	n	JAGGED	<50% present
35	13	4	4	ACH	1	5.78	1.82	n	broken	<50% present
222	13	13	1	ACH	9	BROKEN	BROKEN	yes	finished	<50% present
224	13	13	2	ACH	8	BROKEN	BROKEN	yes	finished	<50% present
226	13	13	3	ACH	4	BROKEN	BROKEN	yes	finished	<50% present
227	13	14	1	ACH	9	BROKEN	BROKEN	yes	finished	<50% present
229	13	14	2	ACH	3	BROKEN	BROKEN	yes	finished	<50% present
231	13	14	3	ACH	6	BROKEN	BROKEN	yes	finished	<50% present
232	13	14	3	ACH	1	BROKEN	BROKEN	yes	finished	<50% present

Table 18 Irregular OES beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
21	13	1	1	OES	1	6.6	1.9	n	irregular	
22	13	2	1	OES	1	5.2	1.9	n	irregular	
22	13	2	1	OES	1	6.9	2.3	n	irregular	
23	13	2	2	OES	1	5.9	2.2	n	irregular	
23	13	2	2	OES	1	5.4	1.6	n	irregular	
24	13	3	1	OES	1	5.3	1.9	n	irregular	
24	13	3	1	OES	1	10.0	1.9	yes	irregular	
28	13	3	1	OES	1	10.4	2.2	n	irregular	
28	13	3	1	OES	1	9.2	1.4	n	irregular	
37	13	5	1	OES	1	9.5	2.2	n	irregular	
37	13	5	1	OES	1	7.2	1.9	n	irregular	
37	13	5	1	OES	1	6.9	1.8	n	JAGGED	
37	13	5	1	OES	1	8.9	2.0	yes	JAGGED	
43	13	5	2	OES	1	8.9	1.9	n	irregular	
149	13	6	3	OES	1	9.0	1.9	yes	JAGGED	
154	13	6	5	OES	1	9.3	1.7	n	JAGGED	
155	13	6	FEA 2	OES	1	4.0	1.9	n	irregular	
177	13	9	2	OES	1	8.5	2.2	n	irregular	
177	13	9	2	OES	1	6.0	2.5	n	irregular	
177	13	9	2	OES	1	6.3	2.2	n	irregular	
177	13	9	2	OES	1	7.6	1.9	yes	JAGGED	
181	13	9	4	OES	1	7.4	2.0	n	irregular	
181	13	9	4	OES	1	5.8	2.2	n	irregular	
181	13	9	4	OES	1	6.9	2.1	yes	irregular	
187	13	9	7	OES	1	6.4	1.9	yes	irregular	
194	13	10	4	OES	1	7.2	2.0	n	irregular	
194	13	10	4	OES	1	7.1	2.0	n	irregular	
221	13	13	1	OES	1	7.7	2.5	yes	irregular	
221	13	13	1	OES	1	7.8	2.1	yes	irregular	

Table 18 (cont'd)

222	13	13	1	OES	1	8.2	2.5	yes	irregular	
222	13	13	1	OES	1	7.7	2.1	yes	irregular	
222	13	13	1	OES	1	8.2	2.1	yes	irregular	
222	13	13	1	OES	1	8.2	2.3	yes	irregular	
222	13	13	1	OES	1	6.1	1.5	yes	irregular	
222	13	13	1	OES	1	7.9	2.0	yes	irregular	
222	13	13	1	OES	1	7.9	2.0	yes	irregular	
222	13	13	1	OES	1	8.4	2.4	yes	irregular	
222	13	13	1	OES	1	7.3	1.9	yes	irregular	
222	13	13	1	OES	1	6.4	1.7	yes	irregular	
222	13	13	1	OES	1	7.4	1.8	yes	irregular	
222	13	13	1	OES	1	6.3	1.8	yes	irregular	
222	13	13	1	OES	1	8.3	1.6	yes	JAGGED	
224	13	13	2	OES	1	6.4	2.1	yes	irregular	
224	13	13	2	OES	1	7.6	2.3	yes	irregular	
224	13	13	2	OES	1	8.8	2.2	yes	irregular	
224	13	13	2	OES	1	7.8	2.2	yes	irregular	
224	13	13	2	OES	1	6.6	2.0	yes	irregular	
226	13	13	3	OES	1	8.1	2.4	yes	irregular	
227	13	14	1	OES	1	7.8	1.9	n	irregular	
227	13	14	1	OES	1	8.1	2.2	yes	irregular	
227	13	14	1	OES	1	8.0	2.4	yes	irregular	
227	13	14	1	OES	1	8.2	2.2	yes	irregular	
227	13	14	1	OES	1	8.7	2.2	yes	irregular	
227	13	14	1	OES	1	7.0	2.2	yes	irregular	
227	13	14	1	OES	1	6.5	1.6	yes	irregular	
227	13	14	1	OES	1	7.8	2.2	yes	irregular	
227	13	14	1	OES	1	7.7	2.5	yes	irregular	
227	13	14	1	OES	1	8.0	1.9	yes	irregular	
227	13	14	1	OES	1	8.9	2.2	yes	irregular	
227	13	14	1	OES	1	7.6	2.5	yes	irregular	

Table 18 (cont'd)

227	13	14	1	OES	1	7.7	2.3	yes	irregular	
227	13	14	1	OES	1	7.6	2.2	yes	irregular	
227	13	14	1	OES	1	7.6	2.4	yes	irregular	
228	13	14	1	OES	1	6.9	2.2	yes	irregular	
229	13	14	2	OES	1	7.8	2.4	n	irregular	
229	13	14	2	OES	1	7.9	2.3	yes	irregular	
229	13	14	2	OES	1	8.8	1.9	yes	irregular	
229	13	14	2	OES	1	8.8	2.2	yes	irregular	
229	13	14	2	OES	1	7.0	2.1	yes	irregular	
229	13	14	2	OES	1	9.5	2.5	yes	irregular	
229	13	14	2	OES	1	6.7	2.2	yes	irregular	
229	13	14	2	OES	1	7.1	2.2	yes	irregular	
229	13	14	2	OES	1	7.5	2.1	yes	irregular	
229	13	14	2	OES	1	7.8	2.2	yes	irregular	
229	13	14	2	OES	1	6.6	2.0	yes	irregular	
229	13	14	2	OES	1	7.8	2.0	yes	irregular	
229	13	14	2	OES	1	8.4	2.1	yes	irregular	
229	13	14	2	OES	1	7.6	1.9	yes	irregular	
231	13	14	3	OES	1	7.6	2.2	yes	irregular	
231	13	14	3	OES	1	6.9	2.0	yes	irregular	
231	13	14	3	OES	1	7.6	2.0	yes	irregular	
232	13	14	3	OES	1	7.5	2.4	yes	irregular	
232	13	14	3	OES	1	6.9	1.7	yes	irregular	
233	13	14	4	OES	1	7.4	3.0	yes	irregular	
233	13	14	4	OES	1	6.2	1.9	yes	irregular	
238	13	15	2	OES	1	5.9	2.6	no	irregular	
238	13	15	2	OES	1	6.9	2.6	yes	irregular	
244	13	15	5	OES	1	6.6	2.4	n	irregular	
248	13	16	1	OES	1	8.7	2.5	n	irregular	
248	13	16	1	OES	1	7.0	2.1	n	irregular	
250	13	16	2	OES	1	6.9	1.7	n	irregular	

Table 18 (cont'd)

259	13	17	1	OES	1	6.7	2.0	n	irregular	
265	13	17	3	OES	1	8.7	1.9	n	irregular	
267	13	17	4	OES	1	7.1	1.8	n	irregular	
272	13	18	3	OES	1	7.7	1.8	n	irregular	
276	13	19	2	OES	1	7.3	1.7	n	irregular	
276	13	19	2	OES	1	9.3	2.2	n	irregular	
276	13	19	2	OES	1	9.9	2.0	n	irregular	
276	13	19	2	OES	1	9.9	2.3	n	irregular	
276	13	19	2	OES	1	9.1	1.8	n	irregular	
276	13	19	2	OES	1	3.7	1.8	n	irregular	
281	13	19	3	OES	1	11.0	2.4	n	irregular	
281	13	19	3	OES	1	11.4	3.0	n	irregular	
281	13	19	3	OES	1	10.0	2.2	n	irregular	
281	13	19	3	OES	1	8.7	1.9	n	irregular	
281	13	19	3	OES	1	10.5	2.6	n	irregular	
281	13	19	3	OES	1	9.7	2.8	n	irregular	
281	13	19	3	OES	1	11.5	2.7	n	irregular	
281	13	19	3	OES	1	11.1	2.5	n	irregular	
281	13	19	3	OES	1	9.9	2.9	n	irregular	
281	13	19	3	OES	1	10.0	2.5	n	irregular	
281	13	19	3	OES	1	8.4	2.9	n	irregular	
281	13	19	3	OES	1	9.6	2.0	yes	irregular	
281	13	19	3	OES	1	8.9	2.1	yes	irregular	
281	13	19	3	OES	1	9.8	2.1	yes	irregular	
281	13	19	3	OES	1	9.3	1.9	yes	irregular	
284	13	19	4	OES	1	9.9	2.0	n	irregular	
284	13	19	4	OES	1	10.0	2.4	yes	irregular	
286	13	19	5	OES	1	8.8	2.0	n	irregular	
286	13	19	5	OES	1	9.9	2.4	n	irregular	
286	13	19	5	OES	1	7.7	1.9	n	irregular	
286	13	19	5	OES	1	8.5	1.8	yes	irregular	

Table 18 (cont'd)

291	13	20	1	OES	1	9.3	2.7	n	irregular	
291	13	20	1	OES	1	5.9	1.8	n	irregular	
295	13	20	3	OES	1	6.9	2.1	n	irregular	
295	13	20	3	OES	1	5.7	1.9	n	irregular	
308	13	N87 E134	STR 3	OES	1	6.9	1.5	n	irregular	
319	13	N78 E158	STR 2	OES	1	9.4	2.1	n	irregular	
329	13	N96 E155	STR 2	OES	1	8.5	2.3	n	irregular	
334	13	N102 E141	STR 3	OES	1	7.0	1.9	n	irregular	
335	13	N103 E144	STR 2	OES	1	6.3	1.8	n	irregular	
342	13	TTP2	1	OES	1	6.4	2.2	N	irregular	
348	13	21	3	OES	1	6.1	1.8	yes	irregular	
361	13	TTP16	1	OES	1	8.1	2.4	yes	irregular	
361	13	TTP16	1	OES	1	7.8	2.0	yes	irregular	
364	13	TTP22	1	OES	1	8.9	2.0	N	irregular	

Table 19 Irregular ACH beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
23	13	2	2	ACH	1	3.53	1.43	n	irregular	
23	13	2	2	ACH	1	5.07	1.73	n	irregular	
23	13	2	2	ACH	1	3.19	1.31	n	irregular	
23	13	2	2	ACH	1	6.04	1.52	n	JAGGED	≥50%
29	13	4	2	ACH	1	6.09	1.82	n	irregular	
33	13	4	3	ACH	1	5.02	1.32	n	JAGGED	<50% present
37	13	5	1	ACH	1	6.48	1.23	n	JAGGED	
37	13	5	1	ACH	1	8.18	1.5	n	JAGGED	
152	13	6	4	ACH	1	3.34	1.88	n	irregular	
170	13	8	4	ACH	1	5.46	1.19	n	irregular	
181	13	9	4	ACH	1	3.42	1.28	n	irregular	
190	13	10	2	ACH	1	2.95	1.51	n	irregular	
209	13	11	3	ACH	1	3.73	1.28	yes	irregular	
224	13	13	2	ACH	1	2.9	1.53	n	irregular	
224	13	13	2	ACH	1	4.91	1.82	yes	irregular	
224	13	13	2	ACH	1	4.71	1.55	yes	irregular	
226	13	13	3	ACH	1	3.13	2.05	n	irregular	
226	13	13	3	ACH	1	4.7	1.7	yes	irregular	
227	13	14	1	ACH	1	4.7	1.44	yes	irregular	
227	13	14	1	ACH	1	5.35	1.24	yes	irregular	
227	13	14	1	ACH	1	4.54	1.79	yes	irregular	
229	13	14	2	ACH	1	4.99	1.8	yes	irregular	
248	13	16	1	ACH	1	3.34	1.27	n	irregular	
259	13	17	1	ACH	1	3.41	1.99	n	irregular	
259	13	17	1	ACH	1	3.68	1.67	n	irregular	
259	13	17	1	ACH	1	3.14	1.61	yes	irregular	
265	13	17	3	ACH	1	3.89	1.18	n	irregular	
265	13	17	3	ACH	1	3.19	1.74	n	irregular	
267	13	17	4	ACH	1	2.83	1.53	n	irregular	

Table 19 (cont'd)

267	13	17	4	ACH	1	3.34	1.65	n	irregular	
267	13	17	4	ACH	1	3.79	1.72	yes	irregular	
281	13	19	3	ACH	1	4.29	1.41	n	irregular	
293	13	20	2	ACH	1	3.66	1.79	n	irregular	
325	13	N87 E173	STR 2	ACH	1	3.82	1.2	n	irregular	
328	13	N95 E153	STR 3	ACH	1	2.94	1.19	n	irregular	
342	13	TTP2	1	ACH	1	5.23	2.11	N	irregular	
346	13	21	2	ACH	1	6.6	1.95	n	JAGGED	≥50%
346	13	21	2	ACH	1	5.01	1.84	n	JAGGED	≥50%
346	13	21	2	ACH	1	6.53	1.87	yes	JAGGED	
346	13	21	2	ACH	1	6.53	1.87	yes	JAGGED	
348	13	21	3	ACH	1	7.23	1.39	n	JAGGED	≥50%
350	13	TTP5	1	ACH	1	3.28	1.25	N	irregular	
355	13	TTP10	1	ACH	1	6.28	1.77	N	irregular	
360	13	TTP15	1	ACH	1	5.68	1.78	N	irregular	V WEATHERED LOOKING

Table 20 OES blanks and fragments

Lot	Site	Unit	Level	Material	Quantity	Length (mm)	Width (mm)	Burnt?	Condition	Notes
37	13	5	1	OES	1	8.8	8.8	n	blank	
37	13	5	1	OES	1	8.8	8.8	n	blank	
332	13	N100 E154	STR 3	OES	1	8.3	8.6	n	blank	
240	13	15	3	OES	1	6.7	4.9	no	blank	
163	13	7	4	OES	1	8.4	8.4	yes	blank	
353	13	TTP8	1	OES	1	8.3	8.3	yes	blank	
353	13	TTP8	1	OES	1	7.5	7.5	yes	blank	
373	12	1	1	OES	1	6.4	4.3	n	fragment	
22	13	2	1	OES	1	8.7	3.8	n	fragment	
23	13	2	2	OES	1	10.2	6.7	n	fragment	
24	13	3	1	OES	1	5.9	4.9	n	fragment	
27	13	3	2(?)	OES	1	5.7	3.6	n	fragment	
27	13	3	2(?)	OES	1	4.4	3.5	n	fragment	
27	13	3	2(?)	OES	1	4.8	4.4	n	fragment	
27	13	3	2(?)	OES	1	4.8	3.3	n	fragment	
27	13	3	2(?)	OES	1	5.8	5.4	n	fragment	
37	13	5	1	OES	1	18.2	22.1	n	fragment	
37	13	5	1	OES	1	19.9	10.0	n	fragment	
37	13	5	1	OES	1	12.5	11.7	n	fragment	
37	13	5	1	OES	1	9.9	7.8	n	fragment	
37	13	5	1	OES	1	14.7	14.6	yes	fragment	
37	13	5	1	OES	1	8.8	7.4	yes	fragment	
43	13	5	2	OES	1	6.9	4.7	n	fragment	
43	13	5	2	OES	1	12.1	6.3	n	fragment	
43	13	5	2	OES	1	8.2	5.9	n	fragment	
145	13	5	4	OES	1	6.4	3.9	n	fragment	
148	13	6	2	OES	1	10.8	9.2	yes	fragment	
149	13	6	3	OES	1	17.1	10.8	yes	fragment	

Table 20 (cont'd)

149	13	6	3	OES	1	14.5	9.8	yes	fragment	
152	13	6	4	OES	1	9.3	6.6	yes	fragment	
154	13	6	4	OES	1	9.8	8.4	yes	fragment	
154	13	6	5	OES	1	6.1	6.6	n	fragment	
163	13	7	4	OES	1	13.2	13.2	yes	fragment	
163	13	7	4	OES	1	6.3	3.4	yes	fragment	
168/169	13	8	3	OES	1	10.5	7.0	n	fragment	
168/169	13	8	3	OES	1	7.9	5.9	yes	fragment	
176	13	9	1	OES	1	16.6	13.9	n	fragment	
176	13	9	1	OES	1	12.8	7.0	n	fragment	
176	13	9	1	OES	1	8.6	5.9	yes	fragment	
176	13	9	1	OES	1	8.9	9.5	yes	fragment	
176	13	9	1	OES	1	5.0	4.5	yes	fragment	
177	13	9	2	OES	1	19.0	11.4	n	fragment	
177	13	9	2	OES	1	4.2	4.0	n	fragment	
177	13	9	2	OES	1	8.0	6.8	yes	fragment	
177	13	9	2	OES	1	6.5	4.6	yes	fragment	
179	13	9	3	OES	1	13.8	12.9	n	fragment	
179	13	9	3	OES	1	13.5	12.3	yes	fragment	
179	13	9	3	OES	1	12.8	9.4	yes	fragment	
179	13	9	3	OES	1	9.6	6.8	yes	fragment	
179	13	9	3	OES	1	5.7	3.4	yes	fragment	
185	13	9	6	OES	1	15.1	10.0	yes	fragment	
187	13	9	7	OES	1	14.8	13.5	n	fragment	
190	13	10	2	OES	1	10.2	10.5	n	fragment	
201	13	10	6	OES	1	12.0	13.3	n	fragment	
207	13	11	2	OES	1	10.2	4.6	yes	fragment	
209	13	11	3	OES	1	7.2	5.1	yes	fragment	
209	13	11	3	OES	1	3.8	2.6	yes	fragment	
209	13	11	3	OES	1	6.8	3.7	yes	fragment	

Table 20 (cont'd)

209	13	11	3	OES	1	6.8	3.8	yes	fragment	
236	13	15	1	OES	1	7.0	4.7	no	fragment	
238	13	15	2	OES	1	11.9	5.1	no	fragment	
238	13	15	2	OES	1	8.8	5.6	no	fragment	
238	13	15	2	OES	1	7.0	6.6	no	fragment	
240	13	15	3	OES	1	13.8	10.7	no	fragment	
240	13	15	3	OES	1	7.7	7.6	no	fragment	
240	13	15	3	OES	1	6.9	6.1	no	fragment	
240	13	15	3	OES	1	7.8	2.8	yes	fragment	
246	13	15	6	OES	1	7.7	6.0	no	fragment	
250	13	16	2	OES	1	12.9	7.1	n	fragment	
250	13	16	2	OES	1	8.2	5.6	n	fragment	
250	13	16	2	OES	1	5.6	4.4	n	fragment	
256	13	16	5	OES	1	8.2	5.0	n	fragment	
256	13	16	5	OES	1	9.3	6.7	n	fragment	
259	13	17	1	OES	1	11.7	7.7	n	fragment	
259	13	17	1	OES	1	6.7	3.1	n	fragment	
261	13	17	2	OES	1	4.0	8.1	n	fragment	
261	13	17	2	OES	1	7.7	6.9	n	fragment	
261	13	17	2	OES	1	5.1	3.4	n	fragment	
261	13	17	2	OES	1	9.4	5.6	n	fragment	
265	13	17	3	OES	1	9.6	9.2	n	fragment	
275	13	19	1	OES	1	6.1	5.4	n	fragment	
281	13	19	3	OES	1	7.7	8.1	n	fragment	
286	13	19	5	OES	1	5.8	5.5	n	fragment	
286	13	19	5	OES	1	6.8	3.9	n	fragment	
289	13	19	6	OES	1	6.1	7.1	n	fragment	
295	13	20	3	OES	1	16.0	13.2	n	fragment	
334	13	N102 E149	STR 2	OES	1	6.3	6.9	n	fragment	
307	13	N106 E120	STR 3	OES	1	7.2	5.9	n	fragment	

Table 20 (cont'd)

338	13	N107 E150	STR 2	OES	1	8.5	3.1	n	fragment	
339	13	N110 E175	STR 3	OES	1	9.8	9.2	yes	fragment	
316	13	N75 E155	STR 2	OES	1	6.0	3.2	n	fragment	
319	13	N78 E158	STR 2	OES	1	4.0	3.2	n	fragment	
321	13	N82 E171	STR 2	OES	1	6.4	4.0	n	fragment	
321	13	N82 E171	STR 2	OES	1	4.3	3.6	n	fragment	
322	13	N82 E174	STR 2	OES	1	9.7	5.4	n	fragment	
322	13	N82 E174	STR 2	OES	1	6.0	3.5	n	fragment	
324	13	N86 E179	STR 2	OES	1	8.1	5.3	n	fragment	
308	13	N87 E134	STR 2	OES	1	9.6	6.3	n	fragment	
326	13	N88 E178	STR 2	OES	1	5.0	5.3	yes	fragment	
331	13	N91 E151	STR 2	OES	1	7.6	3.8	n	fragment	
327	13	N91 E155	STR 3	OES	1	6.1	6.0	n	fragment	
330	13	N97 E158	STR 2	OES	1	7.0	4.5	n	fragment	
357	13	TTP12	1	OES	1	8.0	4.4	yes	fragment	
342	13	TTP2	1	OES	1	9.8	5.0	N	fragment	
365	13	TTP23	1	OES	1	10.0	7.1	yes	fragment	
365	13	TTP23	1	OES	1	4.7	3.8	yes	fragment	

Table 20 (cont'd)

367	13	TTP25	1	OES	18	8.9	6.3	yes	fragment	Total Mass = 1.0 G; Msmt Is For Largest Fragment
368	13	TTP26	1	OES	31	7.4	6.8	yes	fragment	Total Mass = 1.1 G; Msmt Is For Largest Fragment
350	13	TTP5	1	OES	1	4.1	4.9	N	fragment	
353	13	TTP8	1	OES	1	7.3	6.2	yes	fragment	
353	13	TTP8	1	OES	1	7.6	6.1	yes	fragment	

Table 21 ACH blanks and fragments

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (mm)	Int Diam (mm)	Burnt?	Condition	Notes
25	13	2	3	ACH	1	7.36	0	n	blank	
350	13	TTP5	1	ACH	1	7.15	3.89	N	fragment	
350	13	TTP5	1	ACH	1	6.35	4.86	N	fragment	
353	13	TTP8	1	ACH	1	20.47	14.51	N	fragment	
353	13	TTP8	1	ACH	1	13.33	8.55	N	fragment	
353	13	TTP8	1	ACH	1	9.18	6.69	N	fragment	
348	13	21	3	ACH	1	6.23	6.01	n	fragment	
148	13	6	2	ACH	1	11.62	9.72	n	fragment	
154	13	6	5	ACH	1	7.51	7.65	n	fragment	
149	13	6	3	ACH	1	12.91	8.76	n	fragment	
161	13	7	3	ACH	1	16.76	10.08	n	fragment	
161	13	7	3	ACH	1	9.31	7.12	n	fragment	
161	13	7	3	ACH	1	4.83	5.63	n	fragment	
165	13	7	5	ACH	1	18.34	10.97	n	fragment	
165	13	7	5	ACH	1	6.11	4.68	n	fragment	
165	13	7	5	ACH	1	3.12	2.08	n	fragment	
168/169	13	8	3	ACH	1	5.1	4.58	n	fragment	
179	13	9	3	ACH	1	14.45	11.48	n	fragment	
186	13	9	6	ACH	1	5.99	7.83	n	fragment	
186	13	9	6	ACH	1			n	fragment	tiny
186	13	9	6	ACH	1			n	fragment	tiny
215	13	12	2	ACH	1	19.89	14.17	n	fragment	
215	13	12	2	ACH	1	13.23	12.53	n	fragment	
215	13	12	2	ACH	1	21.25	15.98	n	fragment	
217	13	12	3	ACH	1	27.49	16.22	n	fragment	
22	13	2	1	ACH	1	12.59	7.16	n	fragment	
22	13	2	1	ACH	1	12.7	11.03	n	fragment	

Table 21 (cont'd)

224	13	13	2	ACH	1	7.71	5.76	n	fragment	prob non-cultural (tear-drop-shaped)
24	13	3	1	ACH	1	5.98	3.02	n	fragment	
248	13	16	1	ACH	1	16.17	13.35	n	fragment	
248	13	16	1	ACH	1	8.17	6.35	n	fragment	
248	13	16	1	ACH	1	11.94	8.58	n	fragment	
25	13	2	3	ACH	1	14.32	9.18	n	fragment	
250	13	16	2	ACH	1	16.3	6.57	n	fragment	
250	13	16	2	ACH	1	10.13	8.27	n	fragment	
250	13	16	2	ACH	1	12.98	10.31	n	fragment	
250	13	16	2	ACH	1	17.5	10.56	n	fragment	
265	13	17	3	ACH	1	8.13	5.98	n	fragment	
280	13	19	3	ACH	1	14.3	12.3	n	fragment	
281	13	19	3	ACH	1	18.53	14.7	n	fragment	
307	13	N106 E120	STR 2	ACH	1	7.1	5.57	n	fragment	
310	13	N81 E134	STR 3	ACH	1	13.69	10.16	n	fragment	
314	13	N70 E132	STR 3	ACH	1	34.14	20.28	n	fragment	
314	13	N70 E132	STR 1	ACH	1	6.17	2.63	n	fragment	
326	13	N88 E178	STR 2	ACH	1	20.66	13.15	n	fragment	
326	13	N88 E178	STR 2	ACH	1	10.96	6.94	n	fragment	
330	13	N97 E158	STR 3	ACH	1	11.38	6.73	n	fragment	
336	13	N106 E146	STR 1	ACH	1	10.04	8.65	n	fragment	
336	13	N106 E146	STR 2	ACH	1	6.58	6.04	n	fragment	

Table 21 (cont'd)

337	13	N108 E142	STR 2	ACH	1	37.75	21.77	n	fragment	
337	13	N108 E142	STR 2	ACH	1	17.96	8.22	n	fragment	
342	13	TTP2	1	ACH	1	8.13	8.85	N	fragment	
346	13	21	2	ACH	1	22.1	16.34	n	fragment	
346	13	21	2	ACH	1	15.51	11.11	n	fragment	part of inner spiral
346	13	21	2	ACH	1	17.71	12.5	n	fragment	part of inner spiral
346	13	21	2	ACH	1	17.41	8.21	n	fragment	
346	13	21	2	ACH	1	17.58	7.46	n	fragment	
346	13	21	2	ACH	1	18.71	9.47	n	fragment	
346	13	21	2	ACH	1	21.17	16.49	n	fragment	
346	13	21	2	ACH	1	7.06	6.84	n	fragment	
346	13	21	2	ACH	1	4.91	4.1	n	fragment	
348	13	21	3	ACH	1	18.31	8.5	n	fragment	
348	13	21	3	ACH	1	9.49	4.97	n	fragment	
348	13	21	3	ACH	1	17.47	9.95	n	fragment	
348	13	21	3	ACH	1	13.51	11.77	n	fragment	
348	13	21	3	ACH	1	14.34	9.67	n	fragment	
348	13	21	3	ACH	1	7.17	5.52	n	fragment	
349	13	N40 E99	1	ACH	1	6.75	5.31	N	fragment	
349	13	N40 E99	1	ACH	1	5.04	4.79	N	fragment	or blank - is squarish
349	13	N40 E99	1	ACH	1	5.88	4.23	N	fragment	
357	13	TTP12	1	ACH	1	13.54	11.21	N	fragment	
357	13	TTP12	1	ACH	1	11.97	6.47	N	fragment	
357	13	TTP12	1	ACH	1	4.25	3.54	N	fragment	
361	13	TTP16	1	ACH	1	28.13	17.41	N	fragment	
363	13	TTP21	1	ACH	1	10.59	7.67	N	fragment	
364	13	TTP22	1	ACH	1	11.55	8.56	N	fragment	
366	13	TTP24	1	ACH	1	11.93	8.47	N	fragment	
366	13	TTP24	1	ACH	1	10.2	6	N	fragment	
214	13	12	1	ACH	1	17.64mm	9.54mm	no	fragment	

Table 21 (cont'd)

214	13	12	1	ACH	1	18.42mm	7.43mm	no	fragment	
214	13	12	1	ACH	1	9.75mm	4.85mm	no	fragment	
214	13	12	1	ACH	1	7.05mm	6.17mm	no	fragment	
227	13	14	1	ACH	1	7.15mm	4.73mm	no	fragment	
236	13	15	1	ACH	1	22.40mm	16.61mm	no	fragment	
240	13	15	3	ACH	1	22.61mm	12.98mm	no	fragment	
240	13	15	3	ACH	1	16.44mm	7.42mm	no	fragment	
246	13	15	6	ACH	1	8.33mm	5.67mm	no	fragment	
365	13	TTP23	1	ACH	1	7.94	7.31	no	fragment	
370	13	TTP28	1	ACH	1	9.42	6.96	no	fragment	
45	13	5	3	ACH	32	small	n/a	n/a	fragments	numerous small intact shells
161	13	7	3	ACH	1			n		natural shell

Table 22 River mussel beads

Lot	Site	Unit	Level	Material	Quantity	Ext Diam (or length)	Int Diam (or width)	Burnt?	Condition	Notes
259	13	17	1	Mussel	1	8.65	6.36	n	fragment	
325	13	N87 E173	STR 2	Mussel	1	5.21	1.6	n	irregular	

APPENDIX C

METAL DATA

Table 23 Ferrous beads

Lot	Unit #	Level #	Material type	Mass (g)	Magnet	Shape	Color	Length	Width	Gap Width	Strip Width	Thickness	Notes
24	3	1	ferr metal bead	0.2	strong	c	rust	6.32	9.04	3.81	2.83	2.54	
24	3	1	ferr metal bead	0.5	strong	c	rust	6.17	10.99	6.34	2.13	4.78	
27	3	2	ferr metal bead	0.1	strong	c	rust	5.72	8.28	4.44	2.8	1.95	
27	3	2	ferr metal bead	0.2	strong	horseshoe	rust	8.41	8.53	1.19	3.06	2.47	
36	3	3	ferr metal bead	0.5	strong	closed circle	rust	8.46	9.31	0	2.96	3.52	
36	3	3	ferr metal bead	0.4	strong	Cuff	rust	7.91	8.37	0	2.48	3.79	heavily corroded; raised bump, center back
36	3	3	ferr metal bead	0.3	strong	Cuff	rust	7.77	6.8	0	1.88	3.94	raised bump, center back - part of helix?
36	3	3	ferr metal bead	0.2	strong	horseshoe	rust	8.31	8.16	1.01	3.52	2.42	heavily corroded
29	4	2	ferr metal bead	0.4	strong	Cuff	rust	7.6	8.41	1.7	2.07	4.44	

Table 23 (cont'd)

37	5	1	ferr metal bead	0.3	strong	butted circle	rust	8.05	8.7	0	2.42	4.69	
37	5	1	ferr metal bead	0.6	strong	c	rust	7.46	13.03	5.49	4.41	2.89	
37	5	1	ferr metal bead	0.5	strong	c	rust	8.47	11.63	4.76	4.74	2.97	
37	5	1	ferr metal bead	0.2	strong	c	rust	5.43	8.06	4.67	2.13	2.68	
37	5	1	ferr metal bead	0.5	strong	Cuff	rust	6.46	9.09	5.3	2.04	6.13	
37	5	1	ferr metal bead	0.4	strong	Cuff	rust	4.63	8.05	4.39	2.71	7.63	part of helix?
37	5	1	ferr metal bead	0.4	strong	horseshoe	rust	7.14	10.37	2.34	3.45	3.44	
43	5	2	ferr metal bead	0.6	strong	c	rust	9.23	12.6	5.31	5.32	3.23	
43	5	2	ferr metal bead	0.2	strong	c	rust	5.3	8.76	4.09	2.65	2.95	
43	5	2	ferr metal bead	0.2	strong	c	rust	5.45	7.47	3.97	2.53	2.6	

Table 23 (cont'd)

43	5	2	ferr metal bead	0.5	strong	horseshoe	rust	9.13	9.62	0.92	2.73	4.12	
43	5	2	ferr metal bead	0.3	strong	horseshoe	lt rust	8.03	7.62	0.52	1.24	3.54	
152	6	4	ferr metal bead	0.4	strong	Cuff	rust	8.31	9.41	3.48	2.69	4.4	raised bump, center back
154	6	5	ferr metal bead	0.9	strong	butted circle	rust	9.55	8.98	0	2.97	5.65	
157	6	feat 2	ferr metal bead	0.3	moderate	Cuff		6.84	9.97	5.58	2.15	5.16	prob fe, c/ cuff
177	9	2	ferr metal bead	0.1	strong	c	rust	3.82	6.85	3.4	2.37	2.59	
179	9	3	ferr metal bead	0.5	strong	Cuff	rust	7.94	8.28	2.25	2.22	5.23	
181	9	4	ferr metal bead	0.6	strong	butted circle	rust	8.71	9.05	0	2.27	4.46	
181	9	4	ferr metal bead	0.4	strong	butted circle	rust	8.14	8.16	0	2.72	3.91	heavily corroded
185	9	6	ferr metal bead	0.2	strong	c	rust	5.13	8.83	3.7	3.31	3.66	

Table 23 (cont'd)

187	9	7	ferr metal bead	0.1	strong	c	rust	4.73	6.91	3.15	2.28	2.14	
236	15	1	ferr metal bead	0.2	strong	c	rust	9.3	6.69	3.34	3.54	1.64	
240	15	3	ferr metal bead	0.2	strong	butted circle	rust	6.68	6.78	0	2.7	2.02	
250	16	2	ferr metal bead	0.4	strong	c	rust	8.27	9.39	4.88	3.98	5.03	
250	16	2	ferr metal bead	0.3	strong	c	rust	5.87	10.33	4.97	3.91	3.98	
272	18	3	ferr metal bead	0.4	strong	closed circle	rust	7.36	7.55	0	2.47	3.59	
281	19	3	ferr metal bead	0.3	strong	horseshoe	rust	6.63	10.25	2.65	3.96	1.96	
289	19	6	ferr metal bead	0.2	strong	horseshoe	rust	8.71	8.23	1.06	2.78	2.13	
293	20	2	ferr metal bead	0.3	strong	c	rust	4.81	8.41	6.69	2.91	3.67	
295	20	3	ferr metal bead	0.7	strong	Cuff	rust	9.78	9.64	2.09	3.25	6.69	

Table 23 (cont'd)

298	20	4	ferr metal bead	0.4	strong	c	rust	8.37	12.05	4.88	2.93	2.33	
359	PTTP 14	1	ferr metal bead	0.4	moderate	butted circle		7.3	7.65	NA	1.82	3.58	prob fe, butted circle
359	PTTP 14	1	ferr metal bead	0.3	moderate	closed circle		7.07	7.51	NA	1.62	3.52	prob fe, closed circle
362	PTTP 20	1	ferr metal bead	0.2	moderate	c		5.52	8.81	4.05	2.6	1.28	prob fe, c-shape, very low surface corrosion
313.3	STTP N75 E135	3	ferr metal bead	0.4	moderate	closed circle		8.38	7.62	NA	2.78	2.41	prob fe, closed circle

Table 24 Non-ferrous beads

Lot	Unit #	Level #	Material type	Mass (g)	Magnet	Shape	Color	Length	Width	Gap Width	Strip W	Thickness	Notes
24	3	1	non ferr metal bead	0.5	non	flat link	br-blk	11.57	5.04	0	2.34	1.88	prob cu
24	3	1	non ferr metal bead	0.4	non	horseshoe	br-blk	9.44	9.45	2.16	3.11	1.39	prob cu
28	3	2	non ferr metal bead	0.4	non	c		6.97	8.37	3.83	2.97	1.94	prob cu, c-shape
36	3	3	non ferr metal bead	0.2	non	butted circle	br-blk	6.05	6.9	0	1.09	2.63	prob cu
34	3	3	non ferr metal bead	0.2	non	flat horseshoe	br-blk	8.79	6.27	4.43	3.05	1.43	prob cu
36	3	3	non ferr metal bead	0.2	non	flat horseshoe	br-blk	8.07	6.4	3.83	2.84	1.38	prob cu
37	5	1	non ferr metal bead	0.4	non	closed circle	gray-blk	9.22	8.27	0	1.2	2.6	prob cu
45	5	3	non ferr metal bead	0.3	non	horseshoe	gray-blk	8.92	8.22	0.86	2.4	1.6	prob cu
146	5	4	non ferr metal bead	0.2	non	c	br-blk	6.84	12.23	5.6	3.95	1.68	prob cu
163	7	4	non ferr metal bead	0.3	non	horseshoe	gray-blk	8.55	7.03	1.48	3.05	1.47	prob cu
168/9	8	3	non ferr metal bead	0.2	non	c	ylw-brwn	7.48	7.39	4.15	3.52	2.18	prob cu
181	9	4	non ferr metal bead	0.4	non	horseshoe	br-blk	6.92	9.77	3.2	1.72	2.28	prob cu
226	13	3	non ferr metal bead	0.1	non	c	gray-blk	4.99	6.66	4.45	1.44	2.12	prob cu
238	15	2	non ferr metal bead	0.2	non	flat horseshoe	ylw-brwn	8.44	6.27	4.34	1.86	3.42	prob cu
240	15	3	non ferr metal bead	0.3	non	horseshoe	gray-blk	7.01	7.49	1.36	1.24	2.7	prob cu

Table 24 (cont'd)

241	15	4	non ferr metal bead	0.5	non	horseshoe	br-blk	10.55	8.72	1.98	2.11	3.53	prob cu
244	15	5	non ferr metal bead	0.4	non	butted circle	br-blk	8.62	7.77	0	1.63	3.43	prob cu
248	16	1	non ferr metal bead	0.2	non	c	br-blk	4.29	8.19	5.73	2.3	3.5	prob cu
248	16	1	non ferr metal bead	0.8	non	horseshoe	green-blk	10.64	12.03	2.04	5.16	3.32	prob cu
259	17	1	non ferr metal bead	0.2	non	horseshoe	gray-blk	6.03	6.71	2.88	1.37	3.07	prob cu
265	17	2	non ferr metal bead	0.5	non	c	ylw-brwn	6.43	10.07	3.4	4.36	3.22	prob cu
276	19	2	non ferr metal bead	0.2	non	flat horseshoe	gray-blk	8.23	6.3	4.03	3.15	1.52	prob cu
281	19	3	non ferr metal bead	0.4	non	flat horseshoe	gray-blk	8.84	6.51	4.37	3.11	2.92	prob cu
281	19	3	non ferr metal bead	0.7	non	flat horseshoe	gray-blk	9.6	7.08	3.12	3.19	3.5	prob cu
281	19	3	non ferr metal bead	0.2	non	flat horseshoe	gray-blk	7.78	6.23	4.35	2.76	1.16	prob cu
281	19	3	non ferr metal bead	0.2	non	flat horseshoe	gray-blk	7.07	8.21	3.97	2.91	1.38	prob cu
298	20	4	non ferr metal bead	0.3	non	butted circle	gray-blk	8.76	6.74	0	1.06	3.49	prob cu
346	21	2	non ferr metal bead	0.4	non	horseshoe	gray-blk	8.51	9.77	1.33	2.51	1.28	prob cu
352	PTTP 7	1	non ferr metal bead	0.3	non	horseshoe		9.45	13.25	7.02	2.68	1.09	prob cu, horsehoe
315.1	STTP N72 E155	1	non ferr metal bead	1.1	non	horseshoe		11.09	12.54	1.71	4.14	1.54	prob cu, horsehoe

Table 24 (cont'd)

315.2	STTP N72 E155	2	non ferr metal bead	0.5	non	c		3.74	6.21	4.78	2.31	3.11	prob cu, c-shape
315.2	STTP N72 E155	2	non ferr metal bead	0.6	non	flat horseshoe		7.08	6.16	4.98	2.22/0.83	1.45	prob cu, flat horse

Table 25 Metal fragments, bar and wire

Lot	Unit	Level	Mat'l type	Mass	Magnet	Shape	Color	LENGTH	WIDTH	HEIGHT	Notes
22	2	1	ferr metal rod/bar	0.6	strong	rectangular, with lump/ protrusion on one side		13.63	10.72/7.2	2.99	width/width is w/ w/o protrusion
28	3	2	ferr metal rod/bar	2.9	strong	evenly rectang.		30.12	6.85	3.77	
36	3	3	ferr	0.2	strong	wire/cylinder	rust	15.39	3.43	2.18	
43	5	2	ferr	1.6	strong	wire/cylinder	rust	32.6	6.24	4.5	
43	5	2	ferr	1.2	strong	wire/cylinder	rust	25.07	6.68	3.97	
43	5	2	ferr	0.8	strong	wire/cylinder	rust	20.24	4.22	5.74	
43	5	2	ferr	0.7	strong	wire/cylinder	blk	19.37	5.64	2.17	
43	5	2	ferr	0.5	strong	rectangular	rust	9.87	3.92	6.91	
240	15	3	non-ferr	11.4	non	coil of round wire	gry-blk, red flecks	39.08	40.81	3.51	height is wire thickness; prob cu
244	15	5	ferr	0.3	strong	end-flattened cylinder	rust	15.21	2.97	1.67	
250	16	2	non-ferr	0.5	non	rect	blk	20.15	6.42	2.4	
252	16	3	non-ferr	0.1	non	wire/cylinder	blk	11.25	1.48		
252	16	3	ferr	0.6	strong	rect	rust	12.34	7.14	6.25	
259	17	1	ferr	0.5	strong	rect	rust	17.06	5.53	1.71	
261	17	2	ferr	0.5	strong	rect	rust	13.31	6.31	3.78	
293	19	6	ferr	0.3	strong	rect	rust	8.74	4.16	4.2	
322	N82 E174		ferr metal frag/ flake	0.3	strong	approx rectang		11.89	6.42	2.89	
322	N82 E174		ferr metal frag/ flake	0.6	strong	approx rectang		13.06	13.41	2.58	
322	N82 E174		ferr metal frag/ flake	0.1	strong	rectang		9.04	3.45	1.88	

Table 25 (cont'd)

308	N87 E134	2	ferr metal wire/rod	0.4	strong	slighttly assym (prob from corrosion) rectang strip		19.31	3.12	2.21	

Table 26 Slag

Lot	Site #	Unit #	Level #	Material type	Quantity	Mass (g)	Magnetism	Texture	Color	Width (mm)	Length (mm)	Height (mm)	Notes
24	13	3	1	ferr	1	0.1	strong	semi-spng	gray-blk, red-brown flecks	6.31	4.58		
27	13	3	2	ferr	1	0.4	weak	spongy	ylw-brwn, blk-gray	8.75	8.45	6.03	
34	13	3	3	non ferr	1	3	non	spongy	blue-blk, ylw	23.21	19.09	11.45	
34	13	3	3	non ferr	1	0.2	non	spongy	blk/green, ylw	8.09	7.4	4.67	
238	13	15	2	non ferr	1	1.4	non	spongy	ylw-brwn, blk-gray	20.78	15.41	10.72	
241	13	15	4	ferr	1	0.2	weak	spongy	gry-ylw	7.08	5.99	4.16	
248	13	16	1	ferr	1	0.6	strong	semi-spng	red-brown	13.35	7.2	5.33	
248	13	16	1	ferr	1	0.2	strong	smooth	red-brown	10.48	6.34	3.84	
248	13	16	1	non ferr	1	0.8	non	spongy	gry-ylw	10.85	9.49	7.26	
248	13	16	1	non ferr	1	0.1	non	spongy	black	6.24	5	3.89	
250	13	16	2	ferr	2	9.4	strong	smooth	non-spng; red-brwn; surf corrosion				
250	13	16	2	ferr	4	0.9	strong	smooth	red-brown				
250	13	16	2	ferr	1	1.2	weak	spongy	red-brown	16.38	12.89	8.47	
250	13	16	2	ferr	1	3.6	weak	spongy	blk-brown	18.64	17.75	13.91	
250	13	16	2	non ferr	2	0.5	non	spongy	black	13.05	9.47	6.35	
250	13	16	2	non ferr	3	0.5	non	spongy	gry-ylw	11.53	7.9	4.13	
252	13	16	3	ferr	1	0.2	strong	smooth	red-brown	9.71	5.52	2.18	
252	13	16	3	ferr	3	0.8	strong	spongy	ylw-brwn, blk-gray	61.3	51.39	27.63	
252	13	16	3	non ferr	2	69.7	non	spongy	gry-ylw	10	11.54	7.84	

Table 26 (cont'd)

254	13	16	4	ferr	2	8.1	strong	smooth	non-spng; red-brwn; one piece may be slag attached to a piece of calcrete				
254	13	16	4	non ferr	1	2.2	non	spongy	spng; ylw-gry; could be vit dung	18.63	20.6	8.39	
254	13	16	4	non ferr	3	5.1	non	spongy	spng; blk-gry-ylw-grn				could be vd?
254	13	16	4	non ferr	1	2.3	non	spongy	gry-ylw	20.24	18.7	7.98	
256	13	16	5	ferr	1	1.6	strong	spongy	red-brown	14	12.35	8.98	
256	13	16	5	ferr	1	3.2	strong	granular	red-brown	20.56	14.4	9.92	
256	13	16	5	non ferr	1	2.5	strong	semi-spng	blk-gry-red	18.98	13.49	9.31	
256	13	16	5	non ferr	1	5.6	non	smooth	green-black	24.74	16.78	9.79	
256	13	16	5	non ferr	1	0.3	non	smooth	gry-ylw	8.69	6.29	4.41	
265	13	17	2	ferr	1	0.5	weak	granular	red-brown	10.87	8.32	6.95	
267	13	17	4	ferr	1	0.1	strong	smooth	non-spng; red-brwn				
276	13	19	2	non ferr	1	0.3	non	spongy	wht-gry-blk	8.51	6.05	4.95	
276	13	19	2	non ferr	1	0.2	non	spongy	ylw-brwn, blk-gray	4.88	8.73	3.61	
276	13	19	2	non ferr	1	0.1	non	semi-spng	ylw-brwn, blk-gray	5.67	4.22	3.46	

Table 26 (cont'd)

276	13	19	2	non ferr	1	0.3	non	semi-spng	ylw-brwn, blk-gray	10.04	8.25	6.13	
281	13	19	3	ferr	2	0.9	strong	spongy	red-brown	9.07	7.85	5.88	
281	13	19	3	ferr	1	0.7	strong	spongy	black	12.66	8.33	7.23	
281	13	19	3	non ferr	3	2.4	non	spongy	black	18.18	11.09	8.24	
281	13	19	3	non ferr	2	5.2	non	spongy	ylw-brwn, blk-gray	24.67	20.27	11.65	
284	13	19	4	non ferr	1	1.2	non	semi-spng	black	16.9	12.66	5.88	
284	13	19	4	non ferr	1	0.3	non	semi-spng	black	11.29	7.38	7.2	
295	13	20	3	non ferr	1	0.7	non	granular	black	14.1	11.86	10.09	
295	13	20	3	non ferr	1	0.6	non	granular	black	13.15	9.32	7.48	
305.3	13	STTP N102 E117	3	non ferr	1	4.8	non	smooth	non-spng; blk-gry	12.02	19.87	10.51	
308.3	13	STTP N87 E134	3	non ferr	1	0.3	non	spongy	spng; ylw-gry; could be vit dung	8.14	7.42	6.22	
311.2	13	STTP N77 E133	2	ferr	1	0.5	strong	spongy	spng; blk-gry-ylw				
313.2	13	STTP N75 E135	2	ferr	1	0.1	strong	smooth	non-spng; blk-gry				
319.3	13	STTP N78 E158	3	non ferr	1	0.6	non	spongy	spng; ylw-gry				could be vd?
320.2	13	STTP N78 E160	2	non ferr	1	1.7	non	smooth	non-spng; blk-gry	8.53	12.96	7.3	

Table 26 (cont'd)

320.3	13	STTP N78 E160	3	ferr	1	0.2	strong	spongy	spng; red-brwn				
320.3	13	STTP N78 E160	3	ferr	1	0.3	strong	spongy	spng; blk-gry-ylw				
322.1	13	STTP N82 E174	1	ferr	3	2.6	strong	spongy	spng; red-brwn				
322.1	13	STTP N82 E174	1	ferr	3	1.4	strong	spongy	spng, blk-gry				
322.2	13	STTP N82 E174	2	ferr	5	6.7	strong	spongy	spng, blk-gry				
322.2	13	STTP N82 E174	2	ferr	2	0.6	strong	spongy	spng; red-brwn				
322.2	13	STTP N82 E174	2	non ferr	5	1.4	non	smooth	non-spng; blk-gry				
322.2	13	STTP N82 E174	2	non ferr	8	8	non	spongy	spng; blk-gry-ylw				could be vd?
322.3	13	STTP N82 E174	3	ferr	1	0.8	strong	smooth	non-spng; red-brwn				
322.3	13	STTP N82 E174	3	ferr	3	1.6	strong	spongy	spng; blk-gry-ylw				

Table 26 (cont'd)

327.2	13	STTP N91 E155	2	non ferr	1	0.2	non	spongy	spng; blk-gry-ylw				could be vd?
328.2	13	STTP N95 E153	2	ferr	1	0.2	strong	spongy	spng; blk-gry-ylw	8.45	8.46	5.33	
328.3	13	STTP N95 E153	3	non ferr	7	14.9	non	spongy	spng; blk-gry-ylw-grn, sml spots of red				could be vd?
346	13	21	2	non ferr	1	5.4	non	spongy	spng; ylw-gry; could be vit dung; high qtz content	17.24	29.03	17.6	this is remarkably dense in compariso n with other non-spng pieces of similar size
346	13	21	2	non ferr	1	5.4	non	spongy	ylw-brwn, blk-gray	28.8	17.1	17.99	grains of sand attached?
356	13	PTTP 11	1	non ferr	1	0.8	non	spongy	spng; blk-gry. attached to ceramic fragment	9.8	1026	9.12	msmts and mass inc ceramic frag
375	12	1	2	non ferr	2	0.1	non	spongy	blk-red-brwn	4.44	5.44		
393	33	1	2	ferr	1	1.6	strong	semi-spng	red-brown	11.1	9.2		

Table 26 (cont'd)

395	33	1	3	ferr	1	0.2	strong	smooth	gray-blk, red-brown flecks	26.47	20.81		
168 /9	13	8	3	ferr	1	5.6	strong	spongy	ylw-brwn, blk-gray	24.61	20.78	14.39	

Graphs

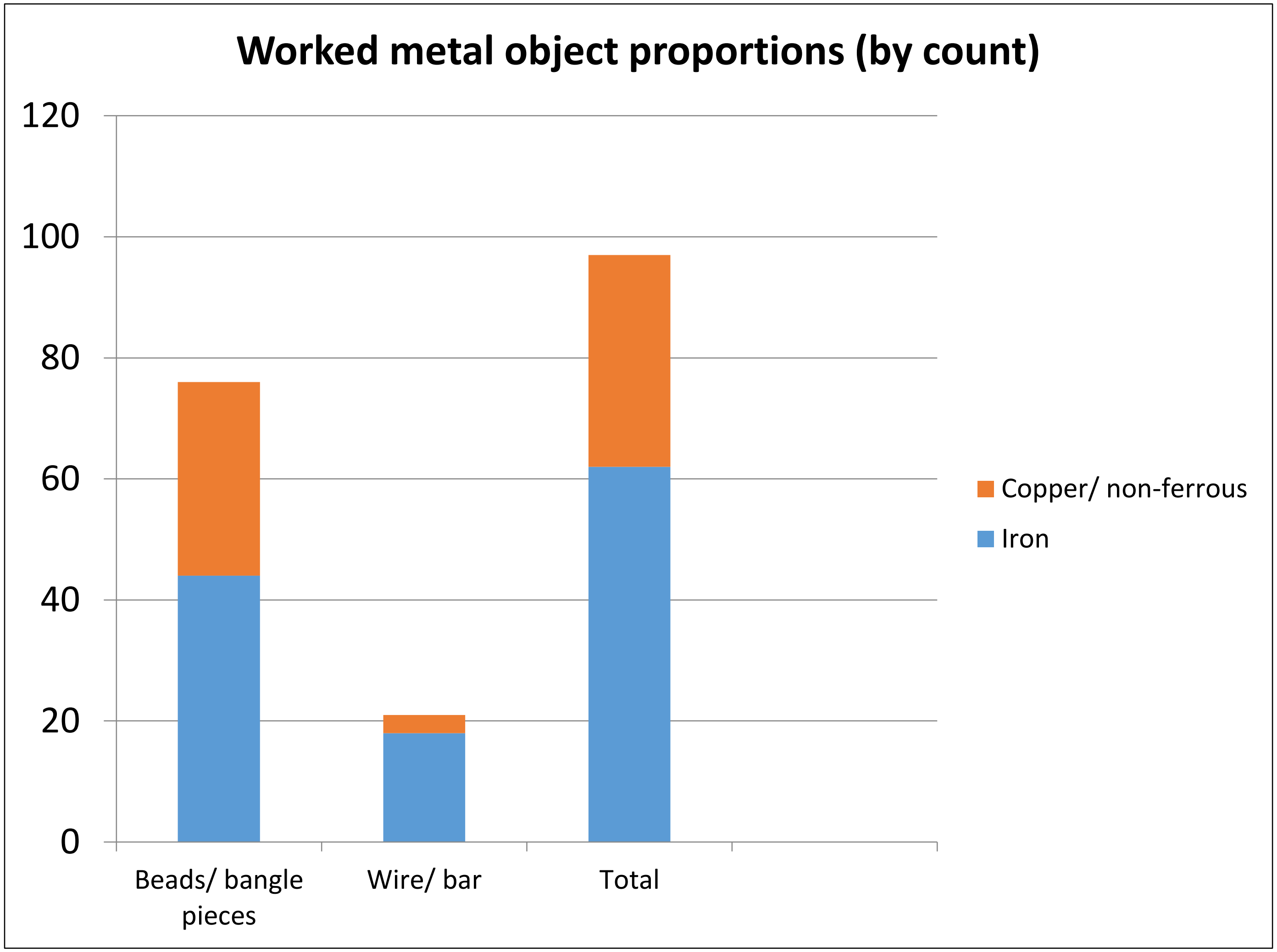

Figure 50 Worked metal object proportions (by count)

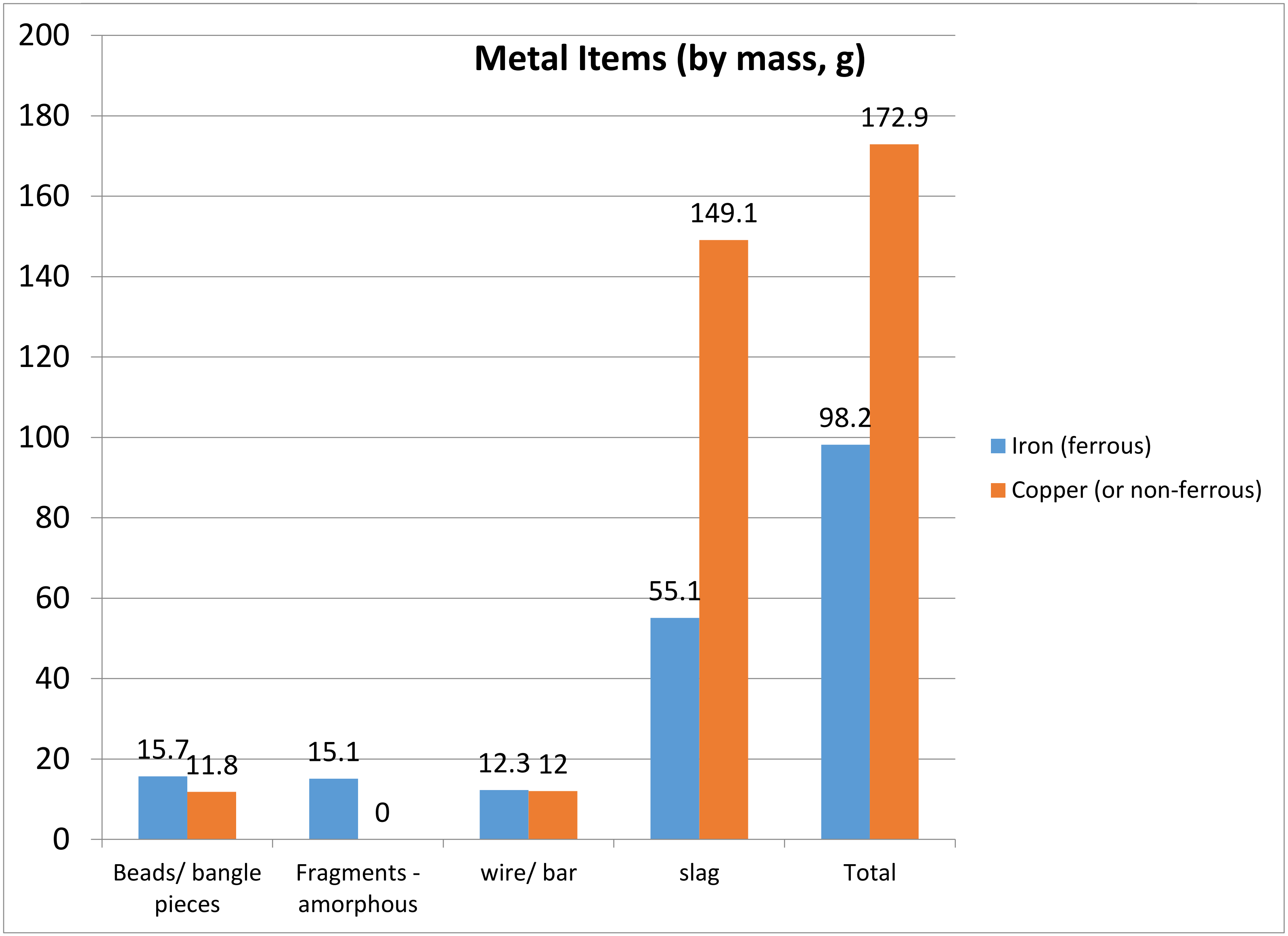

Figure 51 Metal items by mass

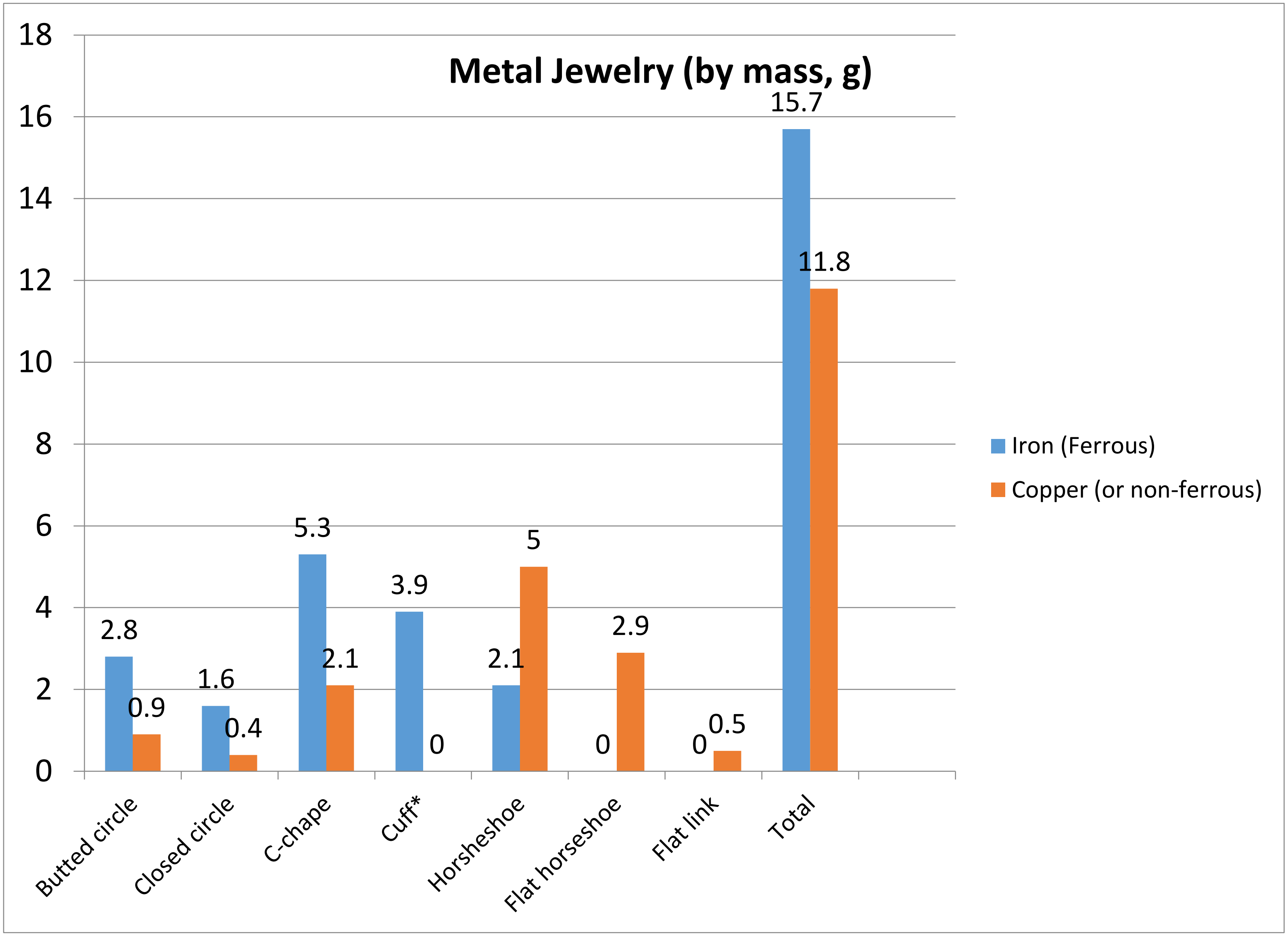

Figure 52 Metal jewelry by mass

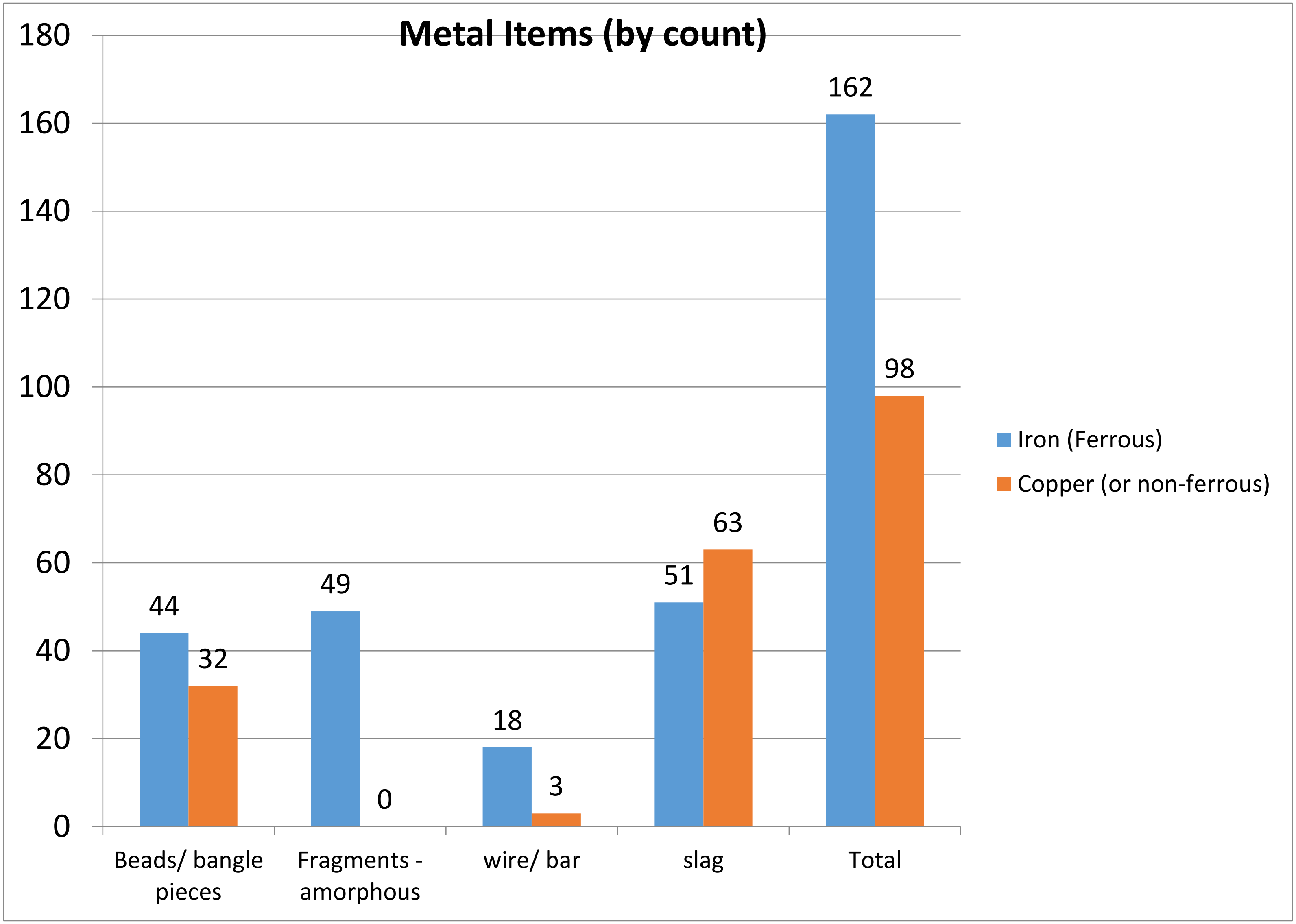

Figure 53 Metal items by count

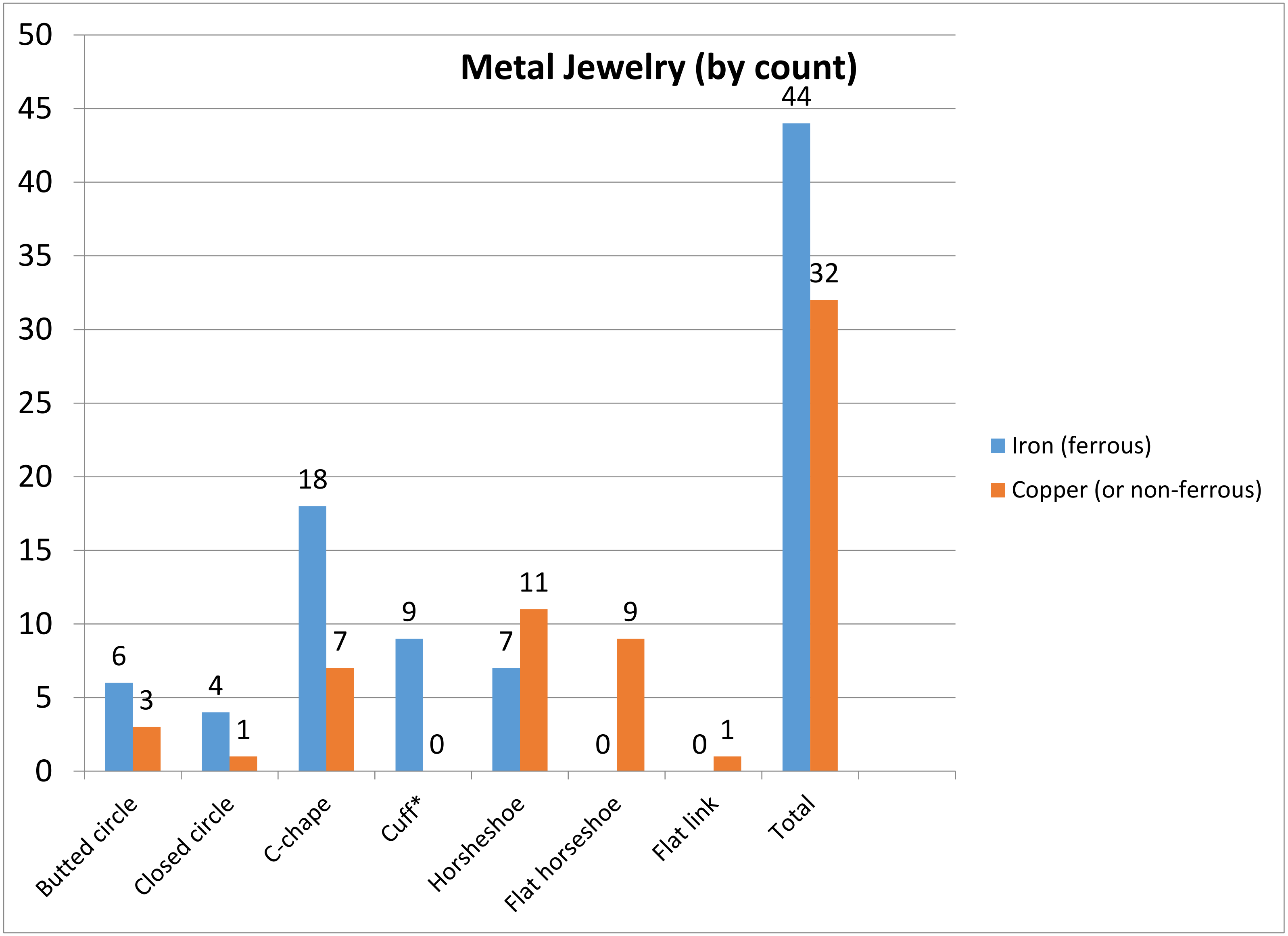

Figure 54 Metal jewelry by count

APPENDIX D

OSL REPORT

LUMINESCENCE DATING IN KALAHARI DESERT, BOTSWANA

27 October 2014
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Two sediment samples from an archaeological site in Botswana were submitted for luminescence dating by Adrianne Daggett, Michigan State University. The site is located on a hilltop in the Kalahari Desert near the Makgadikgadi Pans. The sediments are sandy, much of it aeolian in origin, but contain gravel and small stones as well. Table 1 lists the samples. Laboratory procedures are given in the appendix.

Table 27 OSL Samples

Lab #	Site	lot	Burial Depth (cm)
UW2850	16: A1.13	278	5-10
UW2851	16: A1.13	279	15-20

Dose rate was determined by alpha counting, beta counting and flame photometry as described in the appendix. Table 28 gives the relevant concentrations as determined from alpha counting (U and Th) and flame photometry (K). The beta dose rate calculated from these concentrations is compared with that measured directly by beta counting, and this is also given in Table 28. There are no significant differences that might be caused, for example, by U-Th disequilibrium in the U decay chain. Moisture content was estimated at 6 ± 3 %, which is more than the measured values of about 1%, which, however, do not reflect seasonal change. Table 29 gives the estimated dose rates, which are similar for both samples.

Table 28 Radiation

Sample	*^{238}U (ppm)*	*^{233}Th (ppm)*	*K (%)*	*Beta dose rate (Gy/ka)*	
				ß-counting	α-counting/ flame photometry
UW2850	1.30±0.12	4.84±0.86	1.38±0.04	1.49±0.14	1.46±0.04
UW2851	0.77±0.08	3.00±0.60	1.49±0.03	1.43±0.13	1.42±0.04

*Table 29 Dose rates (Gy/ka)**

Sample	*alpha*	*beta*	*gamma*	*cosmic*	*total*
UW2850	0.01±0.01	1.22±0.05	0.56±0.05	0.27±0.05	2.06±0.09
UW2851	0.01±0.01	1.21±0.05	0.53±0.03	0.25±0.05	1.99±0.08

Luminescence was measured on single-grain quartz using a green laser. Equivalent dose was determined as described in the appendix. Table 30 gives the number of grains measured, the number rejected using the criteria given in the appendix, and the number accepted. The samples showed relatively high luminescence sensitivity for quartz. The acceptance rate for signals from which an equivalent dose could be measured averaged 13%. A high number of zero-aged grains in UW2850 suggests some contamination from the surface.

*Table 30 Acceptance rates**

Sample	N	No signal	Recycle	Too high	Recuperation	Feldspar	Zero dose	Accepted	Rate (%)
UW2850	878	679	47	7	0	4	41	100	11.4
UW2851	876	672	36	19	2	4	15	128	14.6
total	**1754**	**1351**	**83**	**26**	**2**	**8**	**56**	**228**	**13.0**

* N refers to the number of grains measured, no signal refers to grains that had no measurable signal, recycle refers to number of grains rejected for failing the recycle test and for no other reason, too high refers to natural signals higher than the signal from the highest regeneration point, recuperation refers to significant signal after zero dose and preheat, feldspar refers to feldspar contaminated as detected by sensitivity to IRSL, zero dose refers to grains rejected because the equivalent dose was not significantly different from zero. Parameters of the criteria are given in the appendix.

A dose recovery test was conducted on 400 grains from both samples, of which 57 passed all the acceptance criteria. The central tendency of the derived/administered (~16 Gy) ratio, from the central age model, is 0.96 ± 0.02, which is satisfactory. The derived dose of 61% of the grains was within 1σ of the administered dose, and 84% between 2σ. The over-dispersion of the ratio distribution is 7.5%, which is a measure of intrinsic variation due to machine and sample factors and which can be taken as the minimum over-dispersion expected for a single-aged sample. A value of 10% was taken as typical for a single-age sample when evaluating age distributions.

Table 31 gives the equivalent dose from the central age model (Galbraith and Roberts 2012) and the over-dispersion for each sample. The over-dispersion is quite high for both samples. A finite mixture model was applied to divide the sample into single-value components (see appendix). These are shown in Table 32. The samples appear quite mixed. Given the mode of deposition, it is unlikely the samples are partially bleached. The younger components probably represent downward movement of grains exposed at the surface in these shallow deposits. Also unlikely to be correct are the old components in UW2851, particularly the fifth one, which would give a late Pleistocene age. Radial graphs are shown in **Figure 1**. For UW2850 most values seem to cluster around the third component. This probably best represents the depositional age. For UW2851, even discounting the larger and smaller values, there is still substantial scatter. Short of any better information, the central age model, represented by the red line with a value similar to the third component, may present the best estimate, although arguments could be made for a younger age.

Table 31 Equivalent dose (central age model)

Sample	N	Corrected Age (ka)	Over-dispersion (%)
UW2850	100	0.80±0.08	82.6±8.3
UW2851	128	2.53±0.34	144±10

Table 32 Finite Mixture Model components

Sample	Component	Equivalent dose (Gy)	Proportion (%)
UW2850	1	0.20±0.02	18.6
	2	0.63±0.03	29.9
	3	1.33±0.06	43.1
	4	2.29±0.31	8.4
UW2851	1	0.41±0.03	12.9
	2	1.21±0.06	32.7
	3	2.36±0.09	29.2
	4	6.16±0.36	5.7
	5	29.4±1.57	19.5

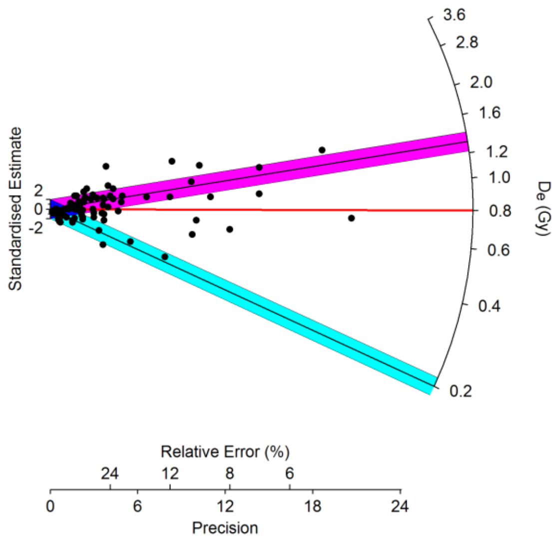
Table 33 gives the ages. Using the largest component on UW2851 makes that sample about the same age as UW2850, which would suggest rapid deposition of the deposit. The older age, from the central age model, separates the layers in time and also agrees with a radiocarbon date (Daggett, personal communication)

Table 33 Ages

Sample	Age (ka)	Error (%)	basis	Calendar (years AD)
UW2850	0.65 ± 0.04	6.9	Largest component	1370 ± 40
UW2851	1.27 ± 0.18	14.3	Central age model	740 ± 180
UW2851	0.61 ± 0.04	6.8	Largest component	1410 ± 40

Radial graphs of each sample. A radial graph plots precision against the equivalent dose, standardized to the number of standard errors the value is from a reference point. The middle reference point in both graphs, shown as the red line is from the central age model. Reference points for UW2850 are the first (pink) and third (blue) components. Shaded areas encompass all points within two standard errors of the reference. Reference points for UW2851 are also the first and third components.

UW2850



UW2851

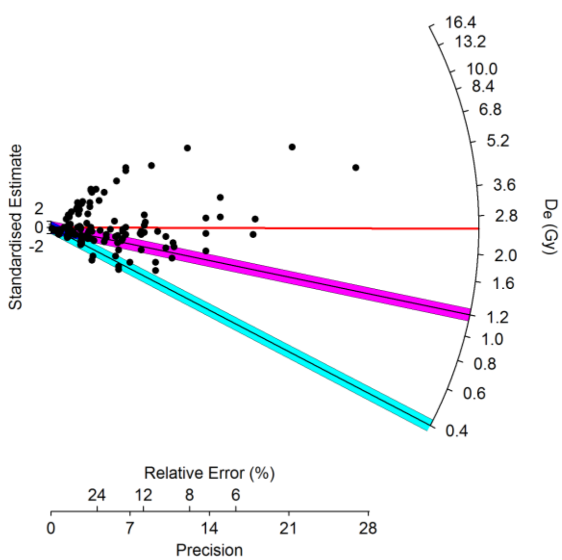


Figure 55 Radial graphs of each OSL sample

Procedures for Luminescence Analysis of Coarse-grained Quartz from Sediment Samples

Sample preparation

Sample material is removed from the collection container, leaving aside any portions (such as the ends of tubes) that may have been exposed to light. The latter may be used for dose rate information. From the unexposed portions, about ¼ is set aside as a voucher (material that can be used at a latter date if necessary). If separate samples for measuring moisture content have not been collected, the voucher can be used for this. For moisture the sample is simply weighed wet, and then dried for several days at 50°C before weighing again. The wet minus the dry weight divided by the dry weight gives the percent moisture by weight.

Remaining unexposed material is separated into size fractions by sieving. If the material contains abundant silt or clay, the sample is wet sieved through a 90µm screen. Otherwise it is sieved dry. The greater than 90µm fraction is treated with HCl and H_2O_2, rinsed three times with water and dried. It is then dry sieved to retrieve the 180-212µm fraction (or any other fraction deemed appropriate). This fraction is etched for 40 minutes in HF and then rinsed with water, HCl and water again. After drying, it is passed through the 180µm screen to remove any degraded feldspar. The material caught in the screen is density separated using a lithium metatungstate solution of 2.67 specific gravity.

Equivalent dose

Grains are placed in specially-manufactured disks for single-grain measurement. Luminescence is measured on either a Risø TL-DA-15 reader or a Risø TL/OSL –DA-20 reader with single-grain attachment. Stimulation is by a 532nm laser delivering 45 W/cm^2. Detection is through 7.5 mm U340 (ultraviolet) filters. Exposure is for 0.8s on each grain at 125°C. The first 0.06s is used for analysis and the last 0.15s for background. Measurements using different preheats are made to determine a "preheat equivalent dose plateau." A preheat within the plateau region is chosen for analysis. Most commonly, a preheat of 240°C for 10 seconds follows each dose, except for the calibrating test doses after which a 200°C for 1 second preheat is employed. The test dose usually employed is about 5 Gy. Doses are delivered by a ^{90}Sr beta source which provides about 0.1 Gy per second to coarse-grained quartz.

Equivalent dose (D_e), which is a measure of the total absorbed dose through time, is determined using the single-aliquot regenerative dose (SAR) protocol (Murray and Wintle 2000, Wintle and Murray 2006). The SAR method measures the natural signal and the signal from a series of regeneration doses on a single aliquot. The method uses a small test dose to monitor and correct for sensitivity changes brought about by preheating, irradiation or light stimulation. SAR consists of the following steps: 1) preheat, 2) measurement of natural signal (OSL or IRSL), L(1), 3) test dose, 4) cut heat, 5) measurement of test dose signal, T(1), 6) regeneration dose, 7) preheat, 8) measurement of signal from regeneration, L(2), 9) test dose, 10) cut heat, 11) measurement of test dose signal, T(2), 12) repeat of steps 6 through 11 for various regeneration doses. A growth curve is constructed from the L(i)/T(i) ratios and the equivalent dose is found by interpolation of L(1)/T(1). A zero regeneration dose and a repeated regeneration dose are employed to insure the procedure is working properly.

An advantage of single-grain dating is the opportunity to remove from analysis grains with unsuitable characteristics by establishing a set of criteria grains must meet. Grains are eliminated from analysis if they (1) had poor signals (as judged from errors on the test dose greater than 30 percent or from net natural signals not at least three times above the background standard deviation), (2) did not produce, within 20 percent, the same signal ratio (often called recycle ratio) from identical regeneration doses given at the beginning and end of the SAR sequence, suggesting inaccurate sensitivity correction, (3) yielded natural signals that did not intersect saturating growth curves, (4) after a zero dose had a signal larger than 10 percent of the natural signal or a signal not distinguishable from background, (5) produced a zero D_e (within 1-sigma of zero), or (6) contained feldspar contaminates (judged visually on growth curves by a reduced signal from infrared stimulation before the OSL measurement; done on two doses to lend confidence the reduction in signal is due to feldspar contamination). At the end of each SAR sequence, linear-modulated OSL (where the laser power is ramped from 0 to 90% power in 30 seconds) is measured for each grain. Grains clearly dominated by a component other than the fast component (judged visually) are marked, and if the D_e from these differ significantly from those of fast-component grains, they are also removed from analysis.

A dose recovery test is performed on some grains. The luminescence of the grains is first removed by exposure to the laser (using the same parameters mentioned earlier). A dose of known magnitude is then administered. The SAR procedure is then applied to see if the known dose can be obtained. Successful recovery is an indication that the procedures are appropriate.

A D_e value is obtained for each suitable grain. Because of varying precision from grain to grain, the same value is not obtained for each grain even if all are of the same age. Instead a distribution is produced. The common age model and central age model of Galbraith (Galbraith et al. 1999, 2005, Galbraith and Roberts 2012) are statistical tools used in evaluation of D_e distributions. These models are used in reference to D_e and not "age" per se, although dividing the D_e values by the bulk dose rate provides an "age" for each grain (not accounting for differential dose rates for individual grains). The common age model controls for differential precision by computing a weighted average using log D_e values. The central age model is similar except rather than assuming a single true value it assumes a normally-distributed natural distribution of D_e values, even for single-aged samples, because of non-statistical sources of variation. The central age is the mean of that distribution and the standard deviation is the over-dispersion (σ_b), which represents that deviation beyond what can be accounted for by measurement error. Empirical evidence suggests that σ_b of between 10 to 20 percent are typical for single-aged samples (Olley et al. 2004, Jacobs et al. 2006). For samples of mixed ages, either a minimum age model or a finite mixture model is employed for evaluation. The minimum age (Galbraith et al. 1999) calculates a statistical minimum using a truncated normal distribution and is suitable for partially bleached samples. Finite mixture model (Roberts et al. 2000) uses maximum likelihood to separate the grains into single-aged components based on the input of a given σ_b value and the assumption of a log normal distribution of each component. The model estimates the number of components, the weighted average of each component, and the proportion of grains assigned to each component. The model provides two statistics for estimating the most likely number of components, maximum log likelihood (llik) and Bayes Information Criterion (BIC). The finite mixture model is appropriate for samples that have been post-depositionally mixed (although with limitations).

Dose Rate

Radioactivity is measured by alpha counting in conjunction with atomic emission for ^{40}K. Samples for alpha counting are crushed in a mill to flour consistency, packed into plexiglass containers with ZnS:Ag screens, and sealed for one month before counting. The pairs technique is used to separate the U and Th decay series. For atomic emission measurements, samples are dissolved in HF and other acids and analyzed by a Jenway flame photometer. K concentrations for each sample are determined by bracketing between standards of known concentration. Conversion to ^{40}K is by natural atomic abundance. Radioactivity is also measured, as a check, by beta counting, using a Risø low level beta GM multicounter system. About 0.5 g of crushed sample is placed on each of four plastic sample holders. All are counted for 24 hours. The average is converted to dose rate following Bøtter-Jensen and Mejdahl (1988) and compared with the beta dose rate calculated from the alpha counting and flame photometer results.

Additional soil samples are analyzed where the environment is complex, and gamma contributions determined by gradients (after Aitken 1985: appendix H). For some samples, *in situ* measurements are done using a $CaSO_4$:Dy dosimeter. About 0.1 g of the powder is sealed in a copper capsule. After heating to remove any latent luminescence, the capsule is placed in the ground as near to the location of the sample as possible and left for one year. The dosimeter is returned to the laboratory accompanied by a travel dosimeter which measures any radiation absorbed enroute. In the laboratory, the luminescence from the $CaSO_4$ is measured by thermoluminescence and the signal calibrated against a beta source. The source is used with the shutter closed to provide a low calibrating dose, about 0.001 Gy/1000s.

Cosmic radiation is determined after Prescott and Hutton (1988). Radioactivity concentrations are translated into dose rates following Guérin et al. (2011).

Age is calculated using a laboratory constructed spreadsheet based on Aitken (1985). All given error terms are computed at one-sigma.

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APPENDIX E

GLASS BEAD ANALYSIS REPORT

Report on Thaba di Masego glass beads

Prepared by Marilee Wood, Dec. 1 2013

Description

The two sites at Thaba di Masego (16-A1-13 and 16-A1-12) combined produced 48 glass beads and one fragment of a substance that might be glass. Only the beads will be discussed. Forty-two of the beads belong to the Zhizo series of which 3 are too corroded to allow determination of color, 36 are light cobalt blue (the most common color found in this series), one is yellow and two are rather vivid bluish-green (a very unusual color but glass quality and bead shape indicate they do belong to the Zhizo group). Six beads may belong to the Chibuene series of which 2 are light grayish cobalt blue and 4 are grayish blue-green. Most of the beads are corroded to varying degrees, a condition that is often found with the Zhizo series due to the composition of the glass from which the beads are made. I cleaned some of them with an ultrasonic cleaner but determined the color of others by scraping away a small section of patina.

All of the beads were made from drawn tubes that were cut into bead lengths and left in that condition (rather than being reheated to round the sharp ends). This lack of secondary heating is typical of the Zhizo series. The glass used to make both the Zhizo and Chibuene series beads was probably made in the Near East, east of the Euphrates (Robertshaw *et al.* 2010:1903; Wood *et al.* 2012:71) – possibly in Persia or nearby. The drawing method used to make the beads, however, is a south Asian technology so they were probably made by south Asian artisans - possibly by ones who worked in the Persian Gulf region. This proposition - that the beads were made in that region - is based on the probability that the glass was manufactured there and the likelihood that the beads were brought to Southern Africa by traders from Oman and the Persian Gulf, whose ships were the most active in the western Indian Ocean from the 7th or 8th century CE to the mid-10th century (Wood 2011: Introduction:28-29).

Interpretation

This assemblage of beads adds important new evidence of Indian Ocean trade reaching the interior of Southern Africa before the end of the first millennium CE. Zhizo and Chibuene series beads are the only types that have been found in the interior prior to the mid-10th century. The Chibuene series has up to now only been recognized at the port site of Chibuene, in Southern Mozambique, and at Nqoma (Wood *et al.* 2012:67), in the Tsodilo Hills well west of Thaba di Masego. Archaeologists working at Nqoma have proposed that the trade bringing foreign goods may have travelled via a Zambezi route, rather than a more southerly one. They have not, however, been able to identify any Zhizo beads in the Zambezi region. The presence of such a large number of Zhizo beads, along with potential Chibuene series beads, at the edge of the Sowa Pan suggests that a trade route originating at the port of Chibuene and reaching as far as Nqoma may have passed through the Sowa Pan region.

At the site of Chibuene most of the Chibuene series beads were found near the base of the occupation layers so it is believed they slightly predate the Zhizo series (Wood *et al.*2012:66). If this is the case, Thaba di Masego's origins may date somewhat farther back than the mid-9th c. radiocarbon date for the site.

The assemblages of both 16-A1-13 and 16-A1-12 are very similar and the latter, even though few beads are present, contains one possible Chibuene series bead. This suggests that the two sites were occupied more or less contemporaneously. Finally, because no beads of any later series are present, it suggests that the sites were abandoned sometime before the mid-10th century.

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Table 34 Glass bead compositions (major and minor oxides only)

Sample ID	Lot #	Bead ID	Diaphaneity	Munsell #	Color group	Series	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	SnO_2	PbO_2
13Lot21	21	TDM07	tsp-tsl	2.5PB 5/4	blue	Zhizo	66.73%	12.69%	3.23%	3.66%	0.21%	0.73%	4.42%	5.23%	0.94%	1.39%	0.08%	0.07%	0.54%
13Lot23R	23	TDM8	tsp-tsl	2.5PB 5/4	blue	Indet.	71.42%	0.15%	0.61%	8.14%	0.18%	0.21%	1.29%	10.76%	4.00%	2.48%	0.04%	0.00%	0.06%
13Lot26	26	TDM09	tsp	2.5PB 5/4	blue	Zhizo	64.14%	13.57%	4.00%	3.25%	0.17%	1.34%	5.12%	5.61%	0.94%	1.32%	0.11%	0.04%	0.35%
13Lot27	27	TDM02	tsp-tsl	5PB 4/6	blue	Zhizo	64.63%	15.82%	3.96%	2.94%	0.10%	1.81%	3.74%	4.89%	0.78%	0.77%	0.08%	0.03%	0.38%
13Lot36R	36	TDM1	opaque	NA	black	Indet.	63.26%	0.94%	2.24%	5.50%	0.42%	0.09%	4.59%	22.68%	0.17%	0.11%	0.00%	0.00%	0.00%
13Lot37A	37A	TDM03	tsp-tsl	2.5PB 5/4	blue	Zhizo	63.07%	15.25%	3.64%	3.36%	0.21%	1.21%	4.26%	5.79%	1.36%	1.11%	0.08%	0.05%	0.53%
13Lot37B	37B	TDM04	tsp-tsl	2.5PB 5/4	blue	Zhizo	65.35%	13.35%	3.87%	3.24%	0.22%	1.37%	3.95%	5.38%	1.49%	1.02%	0.07%	0.07%	0.58%
13Lot37C1	37C-1	TDM05	tsl	5BG 5/1	gray-b-g	CHB	66.79%	14.67%	2.40%	3.37%	0.49%	1.87%	4.47%	3.37%	0.53%	1.68%	0.19%	0.01%	0.07%
13Lot37C2	37C-2	TDM05	tsl	5BG 5/1	gray-b-g	CHB	65.66%	14.60%	2.32%	3.58%	0.54%	1.97%	5.30%	3.43%	0.57%	1.63%	0.20%	0.01%	0.08%
13Lot37C3	37C-3	TDM05	tsl	5BG 5/1	gray-b-g	CHB	65.57%	14.87%	2.43%	3.51%	0.50%	1.95%	5.02%	3.53%	0.58%	1.68%	0.21%	0.01%	0.07%
13Lot37D	37D	TDM06	tsl-tsp	5PB 4/6	blue	Zhizo	64.48%	14.26%	4.57%	2.93%	0.13%	1.17%	4.27%	5.08%	0.90%	0.87%	0.08%	0.14%	1.08%
13Lot37F	37F	TDM48	tsl	2.5PB 5/4	blue	CHB	65.53%	16.03%	2.29%	3.12%	0.41%	1.87%	4.80%	3.52%	0.59%	1.40%	0.32%	0.00%	0.03%
13Lot37G	37G	TDM47	tsp-tsl	2.5PB 5/4	blue	Zhizo	65.28%	13.84%	4.62%	2.72%	0.12%	1.22%	4.47%	5.62%	1.02%	0.92%	0.08%	0.00%	0.03%
13Lot37H	37H	TDM46	tsl	5Y 6/8	yellow	Zhizo	64.86%	14.86%	4.79%	2.53%	0.19%	0.60%	3.24%	5.77%	0.82%	0.55%	0.00%	0.27%	1.51%
13Lot45	45	TDM10	tsp-tsl	2.5PB 5/4	blue	CHB	68.56%	15.59%	2.10%	3.09%	0.39%	0.72%	3.76%	2.91%	0.40%	1.83%	0.22%	0.03%	0.28%

Table 34 (cont'd)

13Lot146R	146	TDM 11	tsp-tsl	2.5PB 5/4	blue	Indet.	75.80%	0.02%	0.59%	7.24%	0.08%	0.15%	2.02%	4.53%	0.04%	9.49%	0.03%	0.00%	0.00%
13Lot159	159	TDM 12	tsp	2.5PB 5/4	blue	Zhizo	64.08%	13.95%	4.43%	3.27%	0.14%	1.12%	4.18%	5.48%	0.79%	1.18%	0.09%	0.12%	1.12%
13Lot162-3	162-3	TDM 14	tsp-tsl	2.5PB 5/4	blue	Zhizo	65.07%	14.04%	3.48%	2.52%	0.13%	0.66%	3.66%	4.24%	1.19%	0.47%	0.00%	0.80%	3.68%
13Lot163	163	TDM 13	tsp-tsl	2.5PB 5/4	blue	Zhizo	66.41%	15.12%	3.88%	3.45%	0.14%	0.51%	3.41%	4.94%	0.55%	1.11%	0.06%	0.03%	0.35%
13Lot166	166	TDM 15	tsl-tsp	5PB 4/6	blue	Zhizo	65.84%	14.25%	4.29%	2.97%	0.19%	1.55%	3.92%	4.73%	0.80%	0.82%	0.04%	0.05%	0.51%
13Lot172R	172	TDM 16	tsl-tsp	2.5PB 5/4	blue	Zhizo	65.03%	14.24%	3.62%	3.39%	0.27%	0.53%	4.21%	6.49%	0.03%	2.18%	0.02%	0.00%	0.00%
13Lot181	181	TDM 17	tsl-tsp	2.5PB 5/4	blue	CHB	67.36%	14.08%	2.49%	3.63%	0.54%	0.62%	3.89%	3.94%	0.46%	1.79%	0.59%	0.09%	0.44%
13Lot201	201	TDM 18	tsl	10B 3/2	blue	CHB	65.19%	15.18%	2.86%	3.90%	0.60%	0.54%	5.02%	3.66%	0.57%	1.63%	0.53%	0.02%	0.21%
13Lot205	205	TDM 19	tsp-tsl	5PB 4/6	blue	Zhizo	66.02%	14.83%	5.05%	2.85%	0.18%	0.44%	3.88%	4.61%	0.74%	0.70%	0.06%	0.08%	0.51%
13Lot222A	222A	TDM 21	tsp-tsl	5PB 4/6	blue	Zhizo	66.18%	14.42%	3.58%	3.14%	0.24%	0.39%	4.63%	4.68%	0.93%	1.11%	0.09%	0.08%	0.47%
13Lot222B	222B	TDM 20	tsp-tsl	2.5PB 5/4	blue	Zhizo	64.44%	14.38%	2.87%	4.03%	0.30%	0.71%	4.25%	6.51%	0.89%	1.35%	0.05%	0.02%	0.10%
13Lot223	223	TDM 22	tsl-tsp	5PB 4/6	blue	Zhizo	66.73%	14.07%	4.17%	3.00%	0.22%	0.49%	3.38%	4.71%	1.11%	0.97%	0.08%	0.16%	0.84%
13Lot224A	224A	TDM 24	tsp-tsl	2.5PB 5/4	blue	Zhizo	68.92%	14.64%	4.16%	2.71%	0.14%	0.34%	3.84%	4.44%	0.11%	0.63%	0.04%	0.00%	0.01%
13Lot224B	224B	TDM 23	tsp-tsl	7.5BG 5/6	bluish-green	Indet.	32.77%	6.67%	2.25%	1.84%	0.15%	0.23%	1.79%	2.93%	0.03%	0.51%	0.63%	0.13%	49.93%

Table 34 (cont'd)

13Lot227AR	227A	TDM 25/26	Indet.	Indet.	Indet.	Indet.	68.67%	15.20%	4.22%	2.81%	0.17%	0.50%	3.39%	5.00%	0.01%	0.02%	0.00%	0.00%	0.00%
13Lot227B	227B	TDM 27	tsp-tsl	2.5PB 5/4	blue	Zhizo	65.76%	17.04%	4.36%	2.67%	0.14%	0.37%	3.90%	4.25%	0.26%	0.72%	0.06%	0.05%	0.36%
13Lot227C	227C	NA	Indet.	Indet.	Indet.	Indet.	63.27%	16.51%	3.43%	3.45%	0.23%	0.41%	3.73%	5.45%	1.17%	1.46%	0.07%	0.09%	0.62%
13Lot227D	227D	TDM 28	tsp-tsl	2.5PB 5/4	blue	Zhizo	65.94%	16.73%	4.11%	2.92%	0.13%	0.36%	3.52%	4.24%	0.49%	0.81%	0.06%	0.07%	0.55%
13Lot229	229	TDM 29	tsp-tsl	2.5PB 5/4	blue	Zhizo	70.16%	12.99%	3.23%	3.33%	0.28%	0.50%	4.09%	3.97%	0.44%	0.91%	0.05%	0.00%	0.02%
13Lot232	232A	TDM 31	tsl-tsp	5BG 5/1	gray-b-g	CHB	65.85%	16.50%	2.30%	3.90%	0.49%	0.64%	4.09%	3.48%	0.47%	1.89%	0.24%	0.01%	0.06%
13lot232BR	232B	TDM 30	Indet.	Indet.	blue	Indet.	67.61%	0.00%	0.56%	8.24%	0.19%	0.26%	1.19%	16.11%	0.05%	5.77%	0.01%	0.00%	0.00%
13Lot259	259A	TDM 33	tsl	2.5PB 5/4	blue	CHB	65.14%	16.65%	2.45%	3.79%	0.60%	0.62%	4.71%	3.37%	0.37%	1.63%	0.38%	0.03%	0.20%
13lot259BR	259B	TDM 32	Indet.	Indet.	blue	Zhizo	64.91%	14.88%	3.89%	3.06%	0.25%	0.60%	3.99%	5.27%	0.02%	3.11%	0.02%	0.00%	0.00%
13Lot261	261	TDM 34	tsl-tsp	5PB 4/6	blue	Zhizo	66.31%	14.03%	3.88%	3.20%	0.24%	0.55%	3.91%	5.49%	1.07%	0.86%	0.07%	0.05%	0.32%
13Lot281	281	TDM 35	tsl	2.5PB 5/4	blue	CHB	66.13%	15.88%	2.44%	3.71%	0.61%	0.60%	4.44%	3.67%	0.40%	1.69%	0.24%	0.02%	0.10%
13Lot284	284	TDM 36	tsl-tsp	2.5PB 5/4	blue	Zhizo	63.84%	15.11%	3.63%	3.42%	0.27%	0.70%	4.42%	6.41%	0.97%	0.96%	0.04%	0.03%	0.15%
13Lot295	295	TDM 37	tsl	5BG 5/1	gray-b-g	CHB	66.40%	16.03%	2.33%	3.72%	0.48%	0.62%	4.33%	3.65%	0.46%	1.58%	0.30%	0.00%	0.02%
13Lot328	328	TDM 38	Indet.	Indet.	blue	CHB	64.99%	15.62%	2.73%	3.78%	0.65%	0.63%	4.21%	3.91%	0.60%	1.83%	0.76%	0.03%	0.17%
13Lot330	330	TDM 39	tsl-tsp	2.5PB 5/4	blue	Zhizo	67.32%	12.54%	3.36%	3.39%	0.22%	0.53%	4.35%	6.08%	0.70%	1.28%	0.06%	0.02%	0.11%

Table 34 (cont'd)

13lot3 46R	346	TDM 40	tsl-tsp	2.5PB 5/4	blue	Zhizo	65.4 1%	15.2 5%	4.8 0%	2.7 1%	0.1 6%	0.5 1%	4.1 5%	5.80 %	0.0 1%	1.1 8%	0.0 1%	0.0 0%	0.00 %
S12Lot 373	373	TDM 41	tsp-tsl	7.5BG 5/6	bluish -green	Zhizo	63.0 8%	11.8 9%	3.8 7%	2.4 9%	0.1 9%	1.1 8%	3.5 1%	5.58 %	0.2 3%	0.9 5%	1.7 9%	0.2 4%	4.56 %
S12Lot 375A	375 A	TDM 42	Indet.	Indet.	Indet.	Indet.	66.3 3%	12.7 8%	3.6 6%	2.4 9%	0.1 8%	0.9 8%	5.0 2%	5.12 %	1.2 2%	0.5 9%	0.0 0%	0.1 1%	1.47 %
S12Lot 375B	375 B	TDM 43	tsl-tsp	5BG 5/1	gray- b-g	CHB	64.5 2%	14.3 5%	2.6 7%	4.3 3%	0.5 7%	1.7 5%	4.6 7%	3.70 %	0.5 0%	1.9 7%	0.6 9%	0.0 2%	0.20 %
S12Lot 377	377	TDM 44	tsl-tsp	2.5PB 5/4	blue	CHB	66.6 1%	14.2 9%	2.2 4%	3.8 1%	0.4 2%	1.1 6%	5.1 2%	3.49 %	0.4 9%	1.9 1%	0.2 7%	0.0 1%	0.08 %
12Lot3 79R	379	TDM 45	Indet.	Indet.	blue	Zhizo	65.6 5%	13.8 7%	4.3 2%	2.8 7%	0.1 9%	0.4 3%	3.7 7%	5.25 %	0.9 8%	1.5 1%	0.1 4%	0.1 7%	0.77 %

Table 35 Mean values (%) of major and minor oxides for Site 12 and 13 beads

(As compared to published values for established bead series; source for bead series values: Robertshaw et al. 2010)

Bead Series	SiO_2	Na_2O	MgO	Al_2O_3	K_2O	CaO	Fe_2O_3
Zhizo	69.62	13.15	4.31	3.26	3.23	5.5	0.94
K2	64.51	16.22	0.43	11.85	3.34	2.34	1.3
K2 GR	61.05	14.36	0.37	16.63	3.39	2.85	1.35
Indo-Pacific	63.08	14.75	0.59	13	3.46	2.85	2.27
Islamic	63.21	13.71	4.83	6.05	3.91	6.63	1.66
Mapungubwe Oblate	61.88	13.47	5.8	7.67	3.47	6.66	1.04
Zimbabwe	60.98	15.81	4.33	6.71	3.74	6.94	1.48
Khami	61.4	18.66	1.21	9.81	2.82	3.39	2.7
Thabadimasego (Site 13) & Site 12	65.69%	14.67%	3.46%	3.26%	4.21%	4.68%	1.25%

Table 36 Elements and oxides included in principal components analysis and their PCA values

Variable	PC1	PC2
ZrO_2	0.087	-0.495
Cr	-0.182	-0.423
HfO_2	0.134	-0.351
Al_2O_3	0.182	-0.325
NbO_2	0.271	-0.249
Ti	0.185	-0.239
CaO	-0.207	-0.222
V	0.269	-0.144
Y_2O_3	0.305	-0.044
ThO_2	0.23	-0.034
U_3O_8	0.257	0.024
Rb_2O	0.279	0.034
MgO	-0.223	0.053
BaO	0.271	0.061
Cs_2O	0.307	0.091
SrO	0.2	0.142
Li	0.268	0.182
K_2O	0.217	0.187
Na_2O	0.14	0.224

Table 37 Series determinations for glass beads from Site 12 and Thabadimasego

Site #	Zhizo	Chibuene	Undetermined
12	Lot 373	Lot 375B	
	Lot 375A	Lot 377	
	Lot 379		
Thabadimasego	Lot 159	Lot 181	Lot 23
	Lot 162-3	Lot 201	Lot 36
	Lot 163	Lot 232	Lot 146
	Lot166	Lot259A	Lot 232B
	Lot 172	Lot 281	Lot 224B
	Lot 205	Lot 295	
	Lot 21	Lot 328	
	Lot 222A	Lot 37C-1	
	Lot 222B	Lot 37C-2	
	Lot 223	Lot 37C-3	
	Lot 224A	Lot 37F	
	Lot 227A	Lot 45	
	Lot 227B		
	Lot 227C		
	Lot 227D		
	Lot 229		
	Lot 259B		
	Lot 26		
	Lot 261		
	Lot 27		
	Lot 284		
	Lot 330		
	Lot 346		
	Lot 37A		
	Lot 37B		
	Lot 37D		
	Lot 37G		
	Lot 37H		

APPENDIX F

MATERIAL DISTRIBUTION HISTOGRAMS FOR THE ORIGINAL DATA

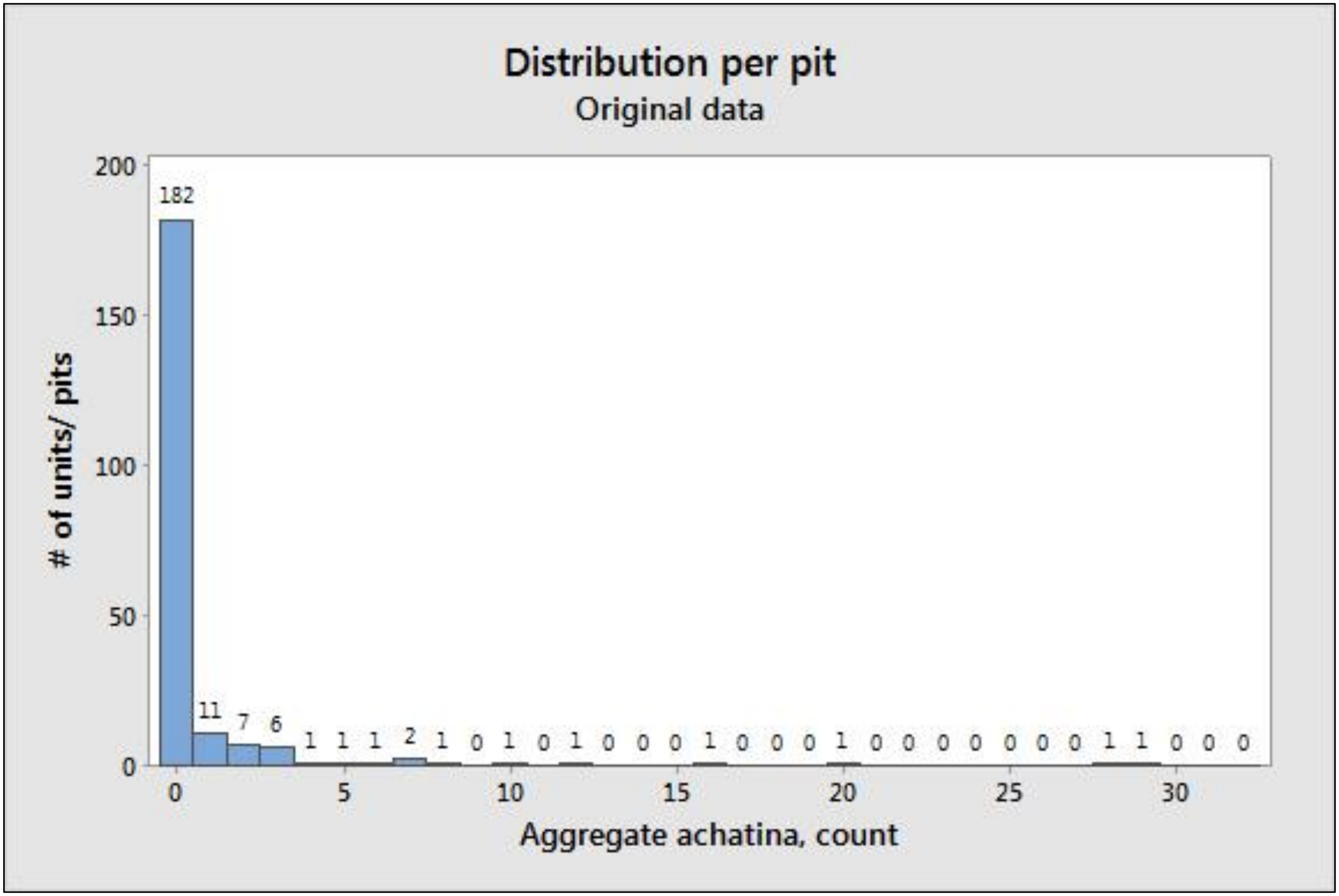

Figure 56 Achatina total, count, per pit

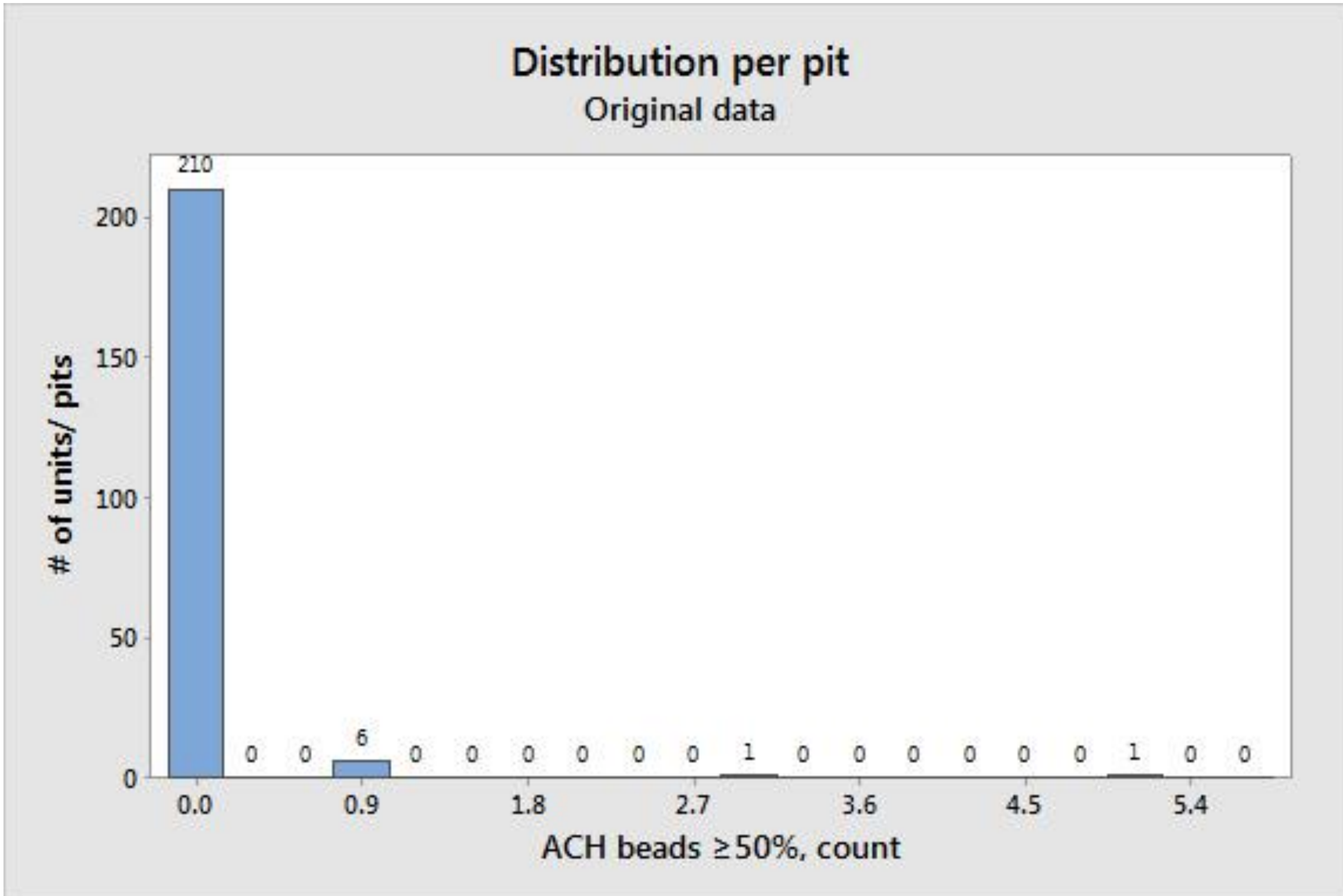

Figure 57 Achatina >50%, count, per pit

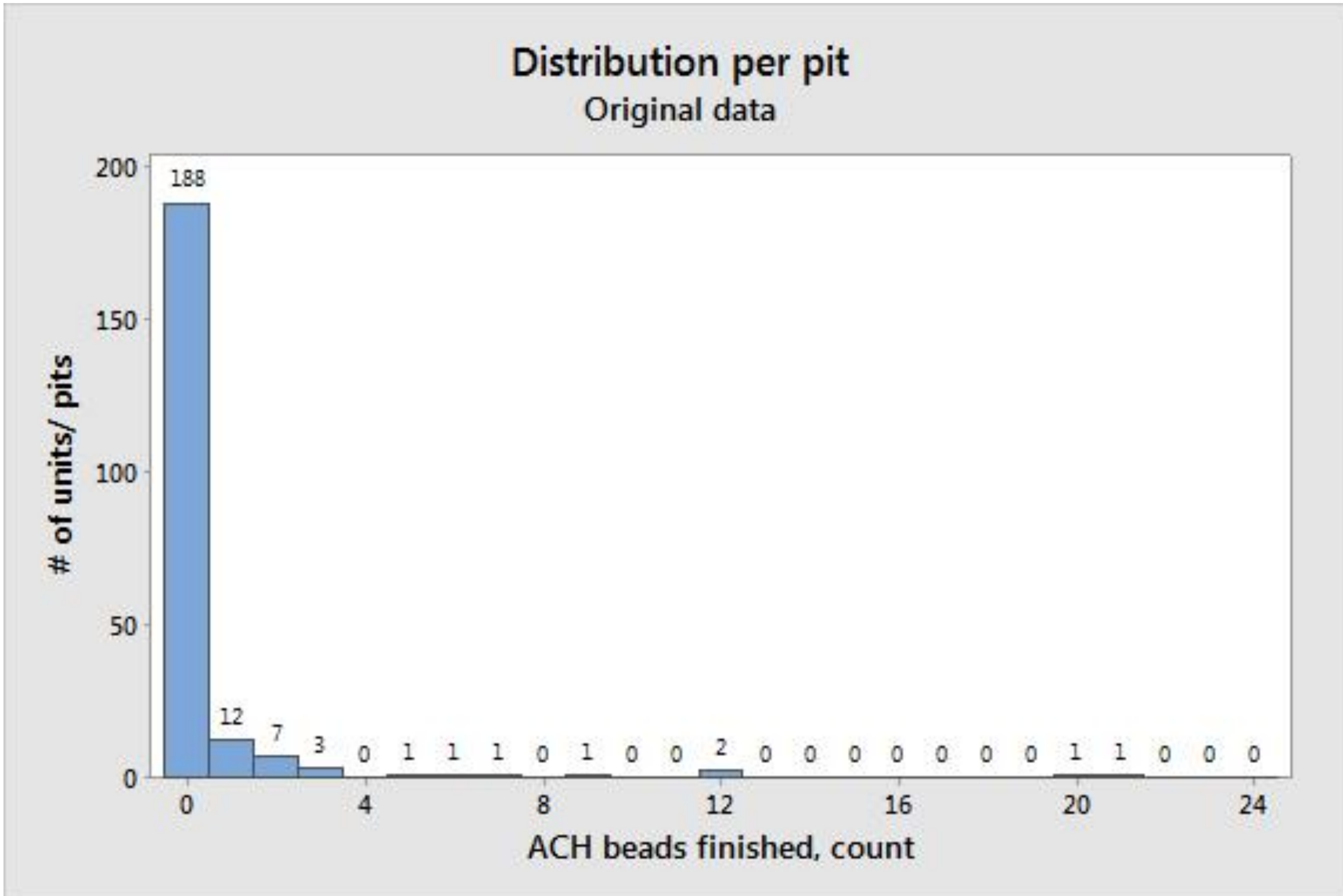

Figure 58 Finished Achatina beads, count, per pit

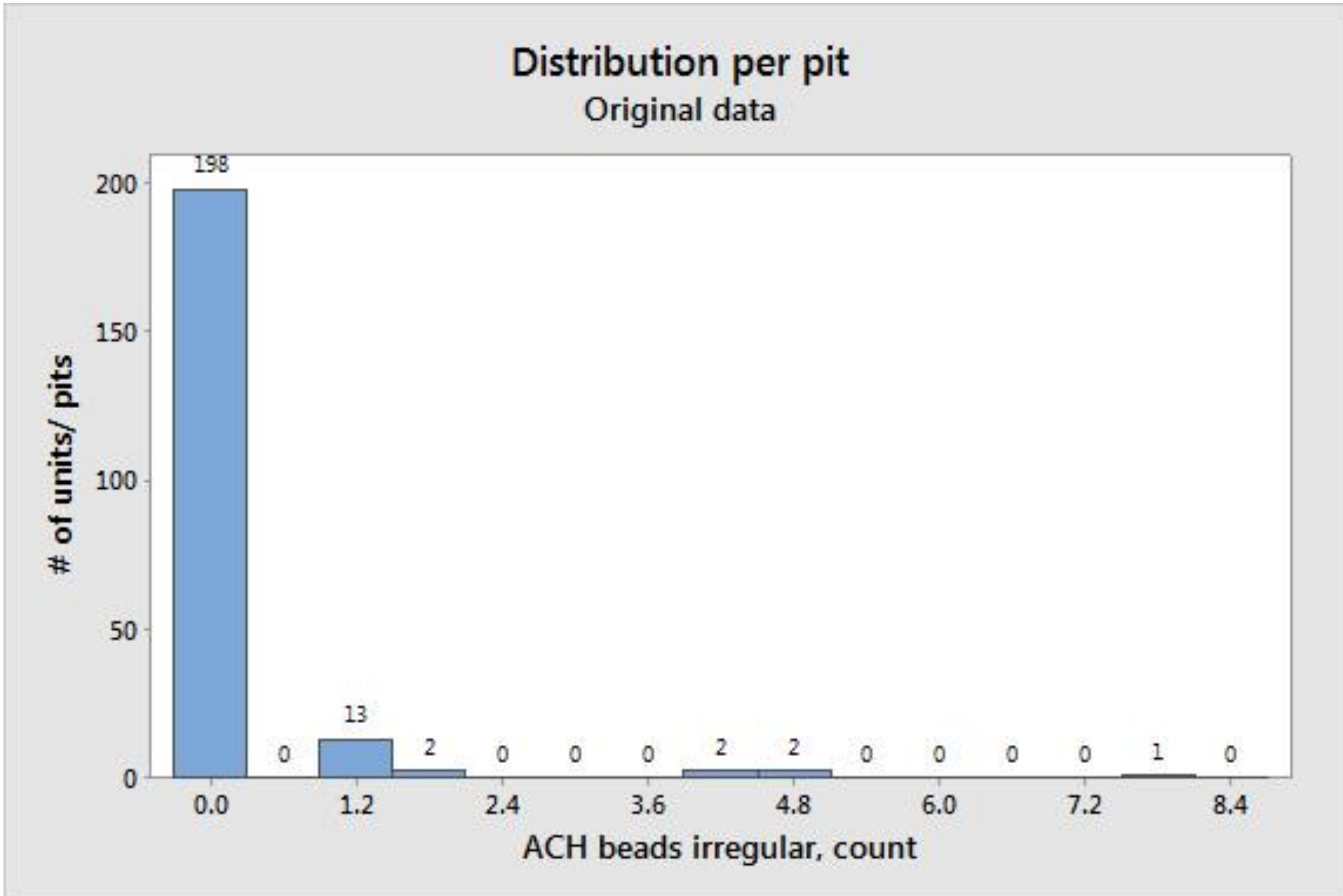

Figure 59 Irregular Achatina beads, count, per pit

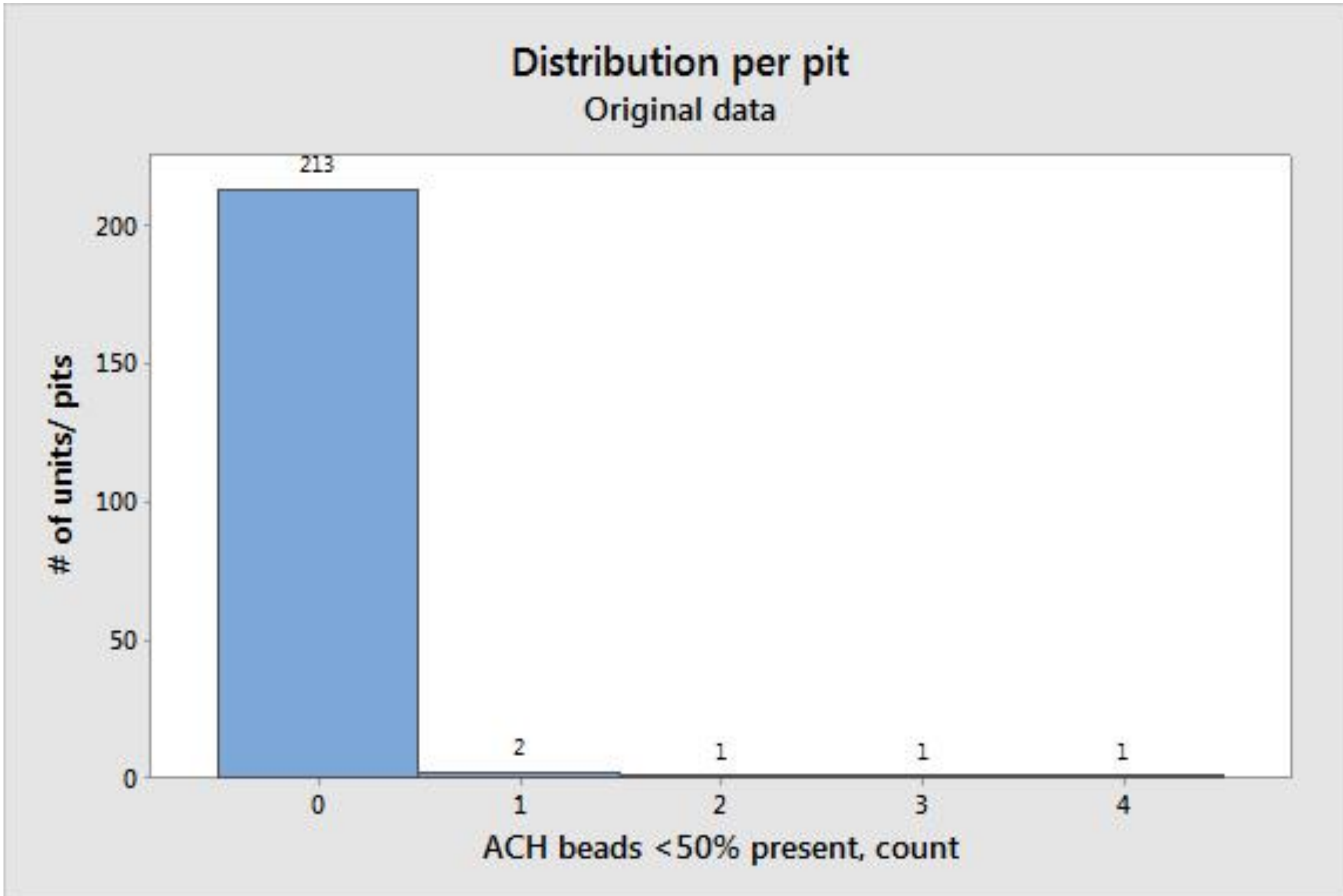

Figure 60 Achatina <50% beads, count, per pit

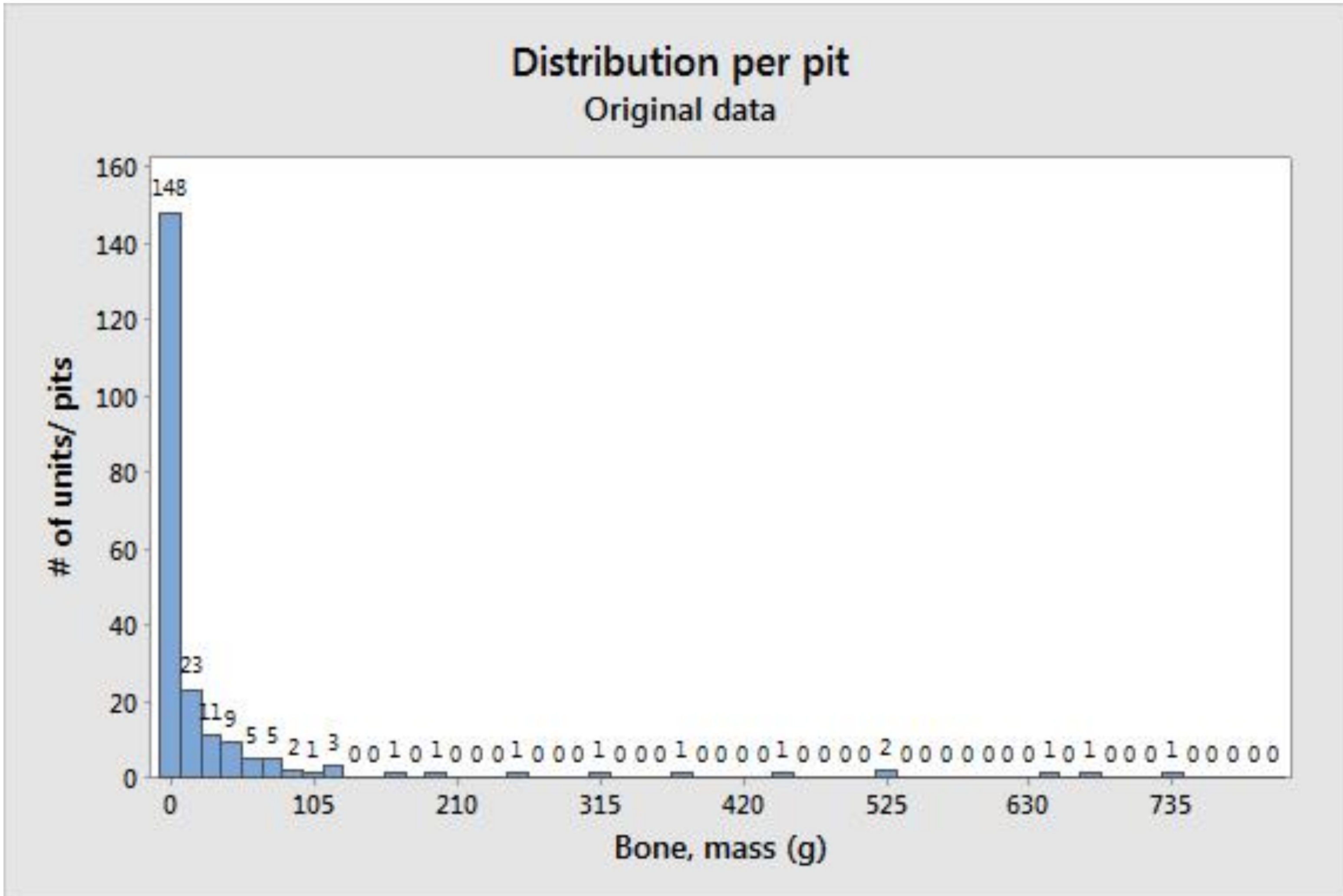

Figure 61 Bone, mass, per pit

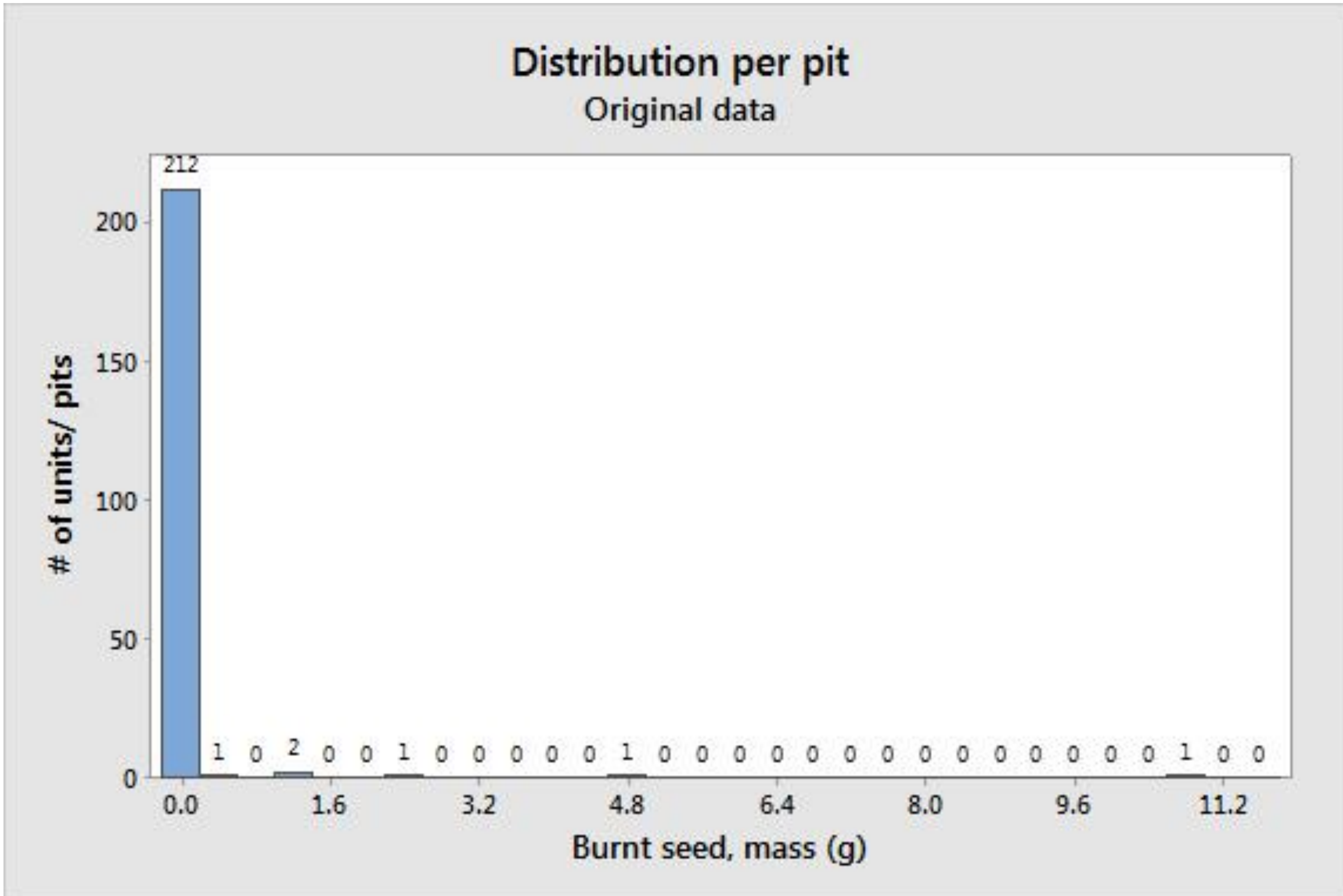

Figure 62 Burnt seed, mass, per pit

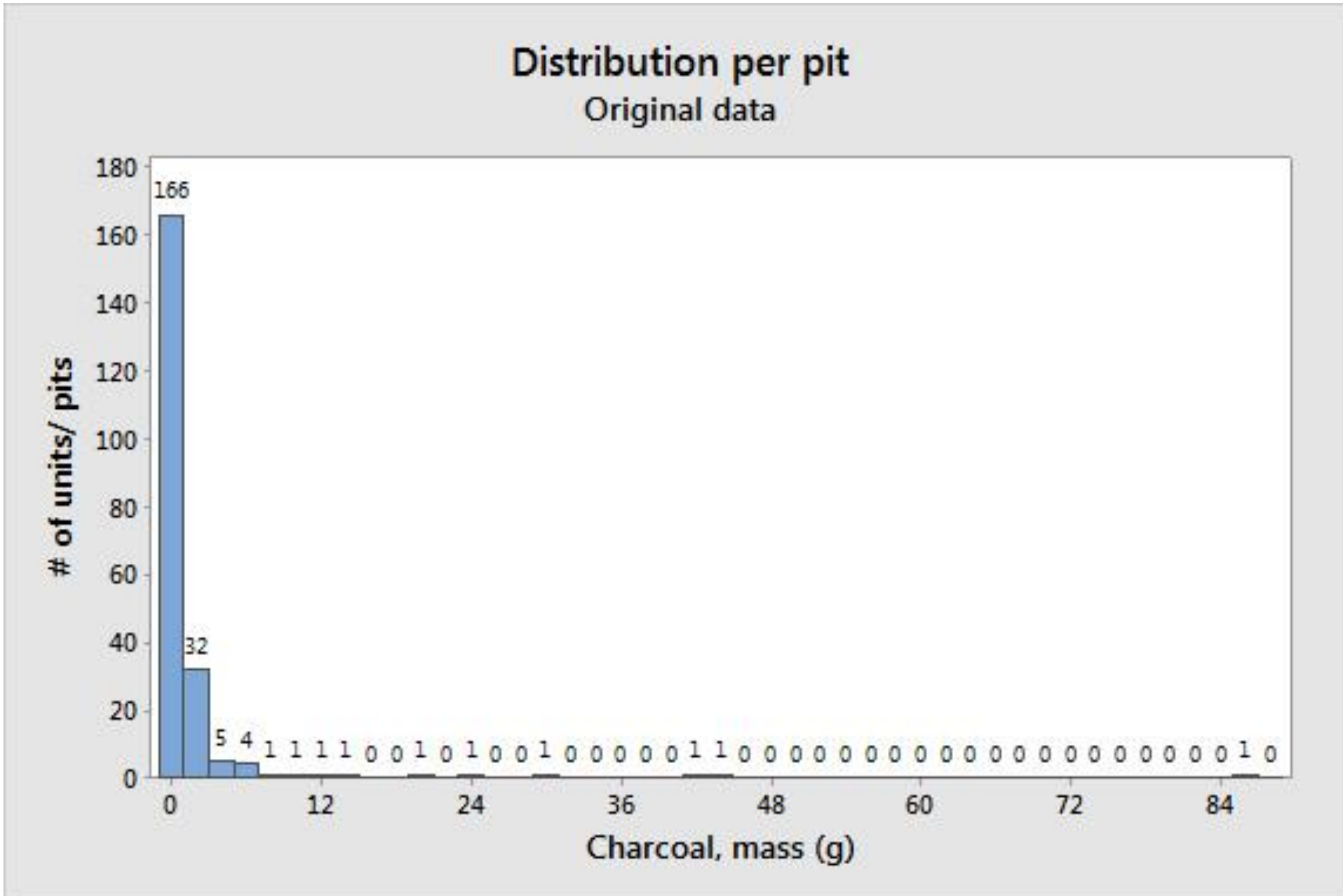

Figure 63 Charcoal, mass, per pit

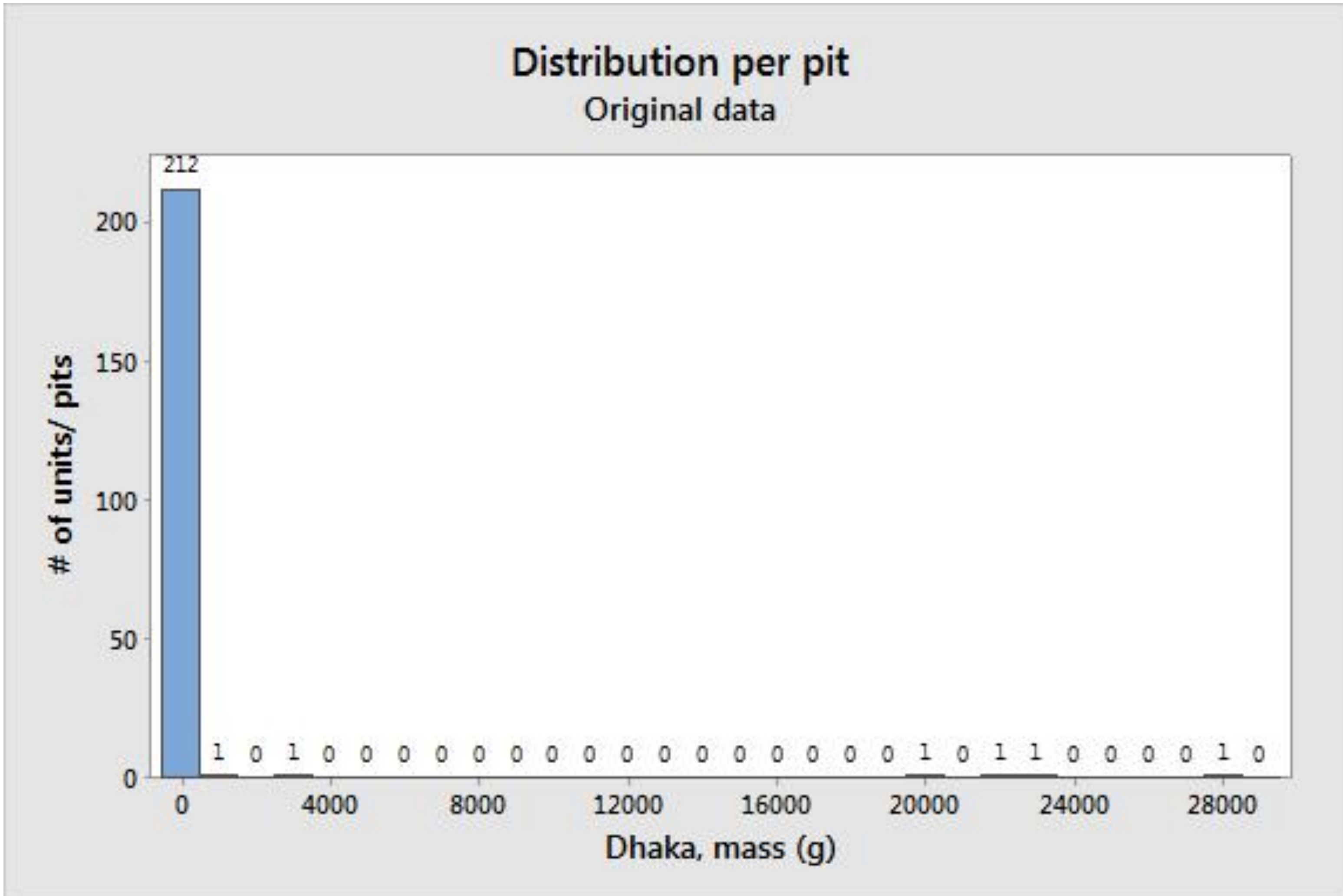

Figure 64 Dhaka, mass, per pit

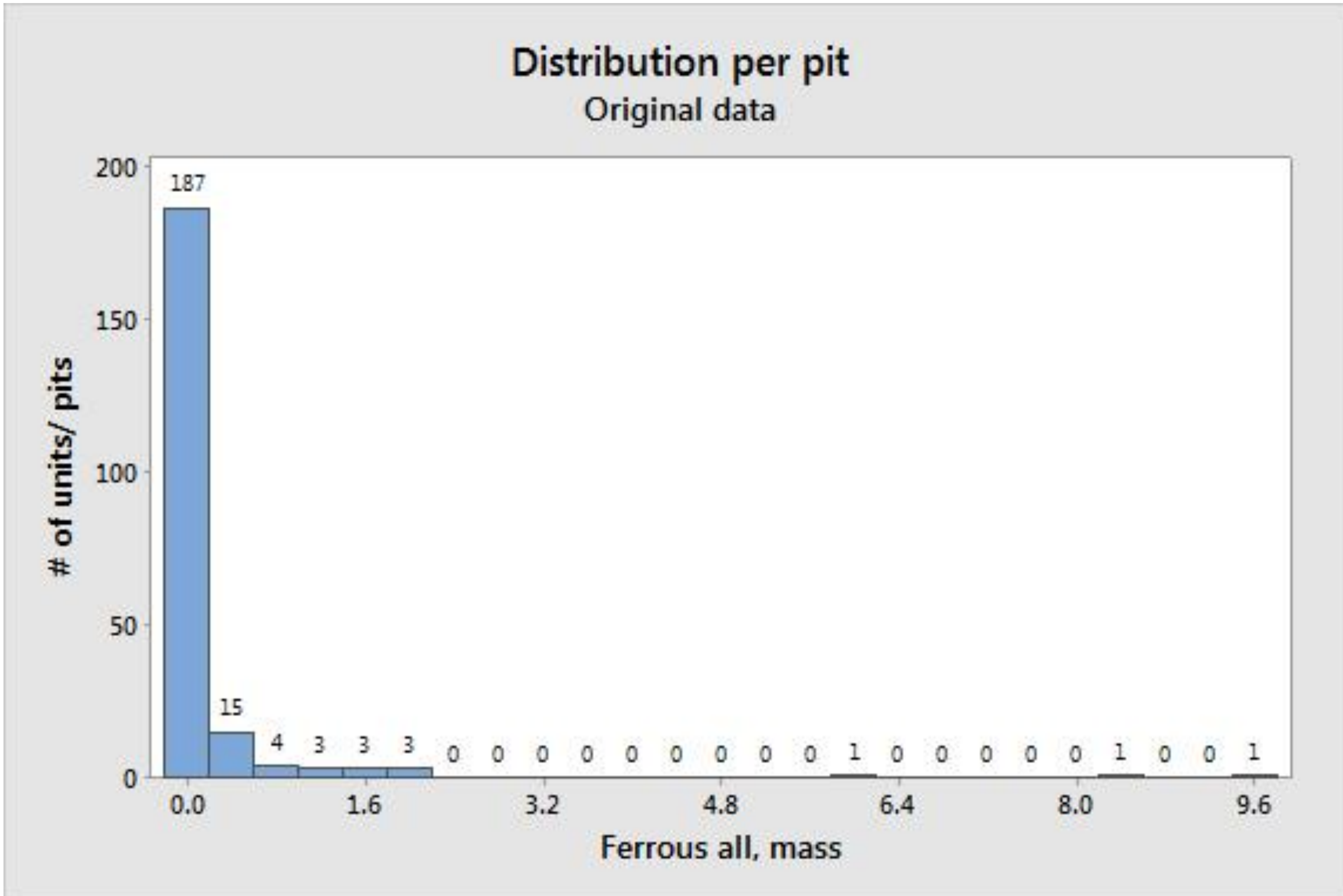

Figure 65 Ferrous material, mass, per pit

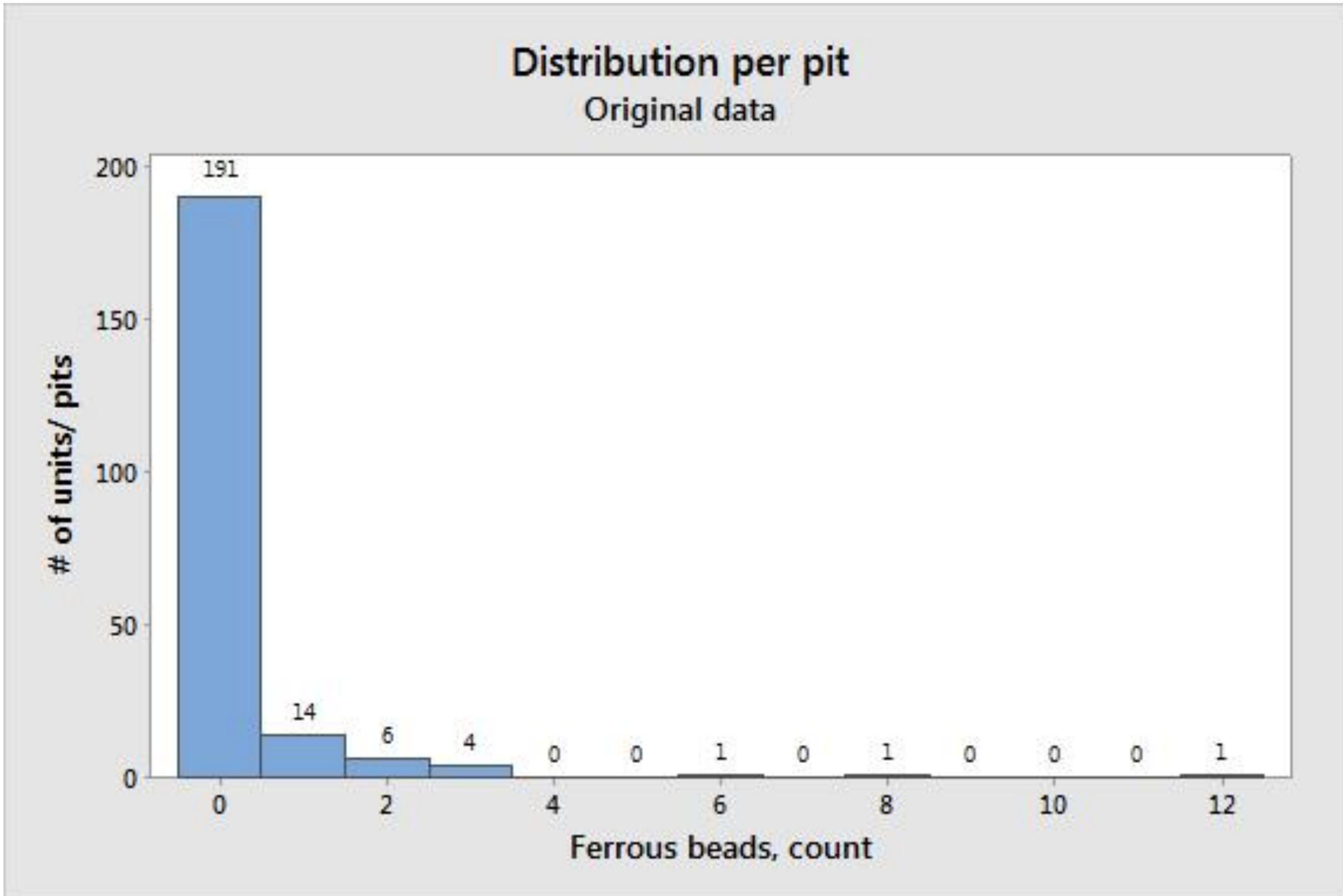

Figure 66 Ferrous beads, count, per pit

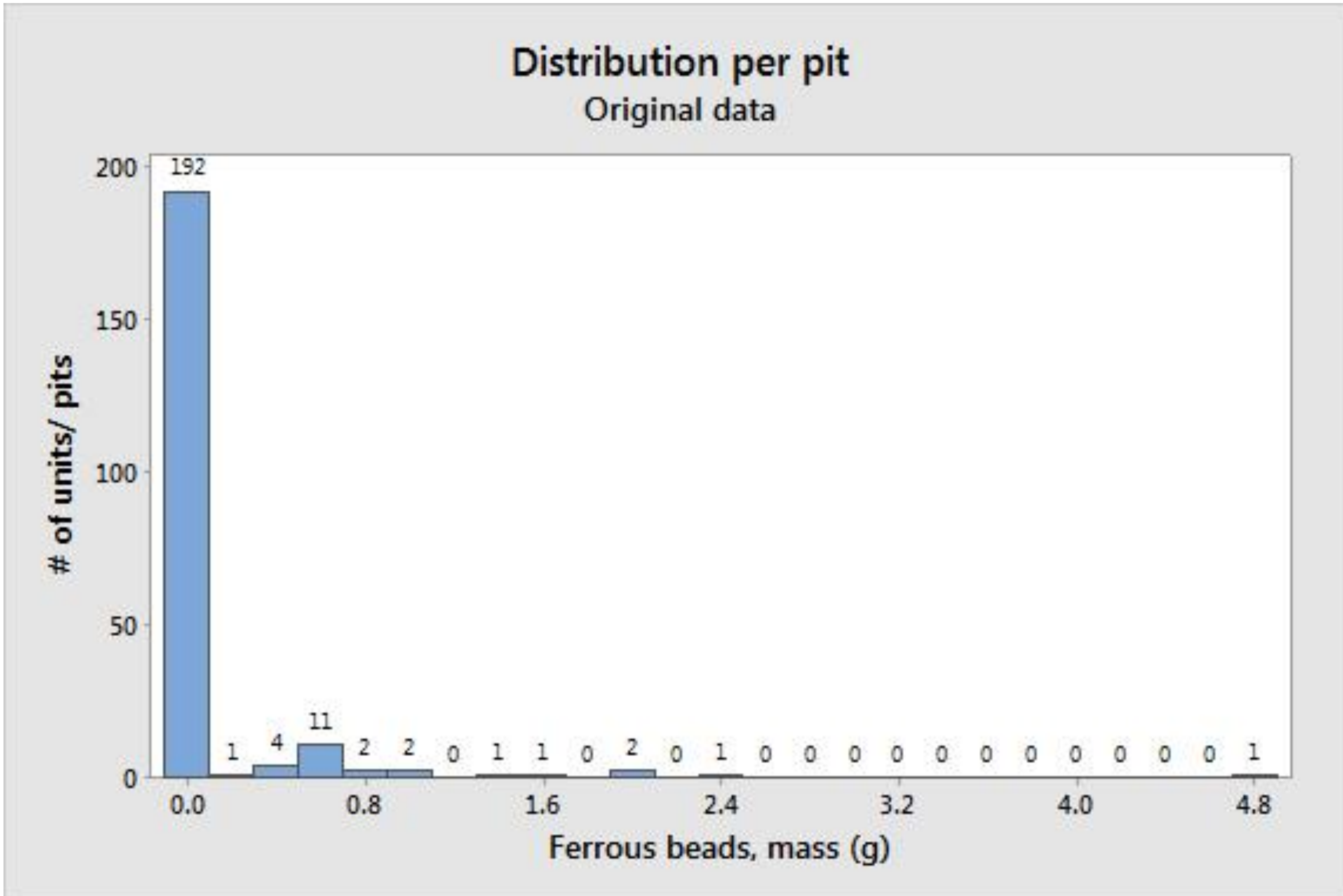

Figure 67 Ferrous beads, mass, per pit

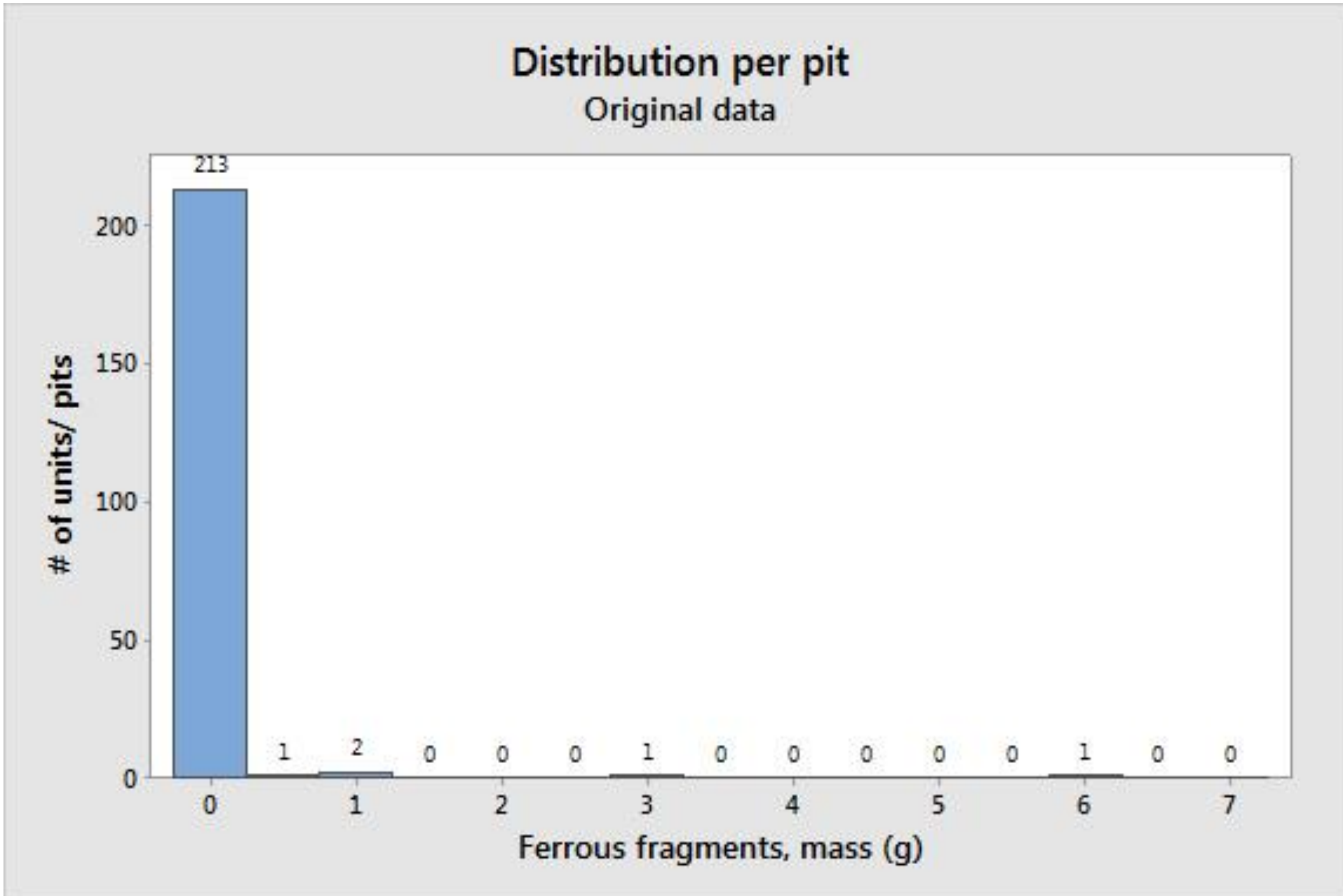

Figure 68 Ferrous fragments, mass, per pit

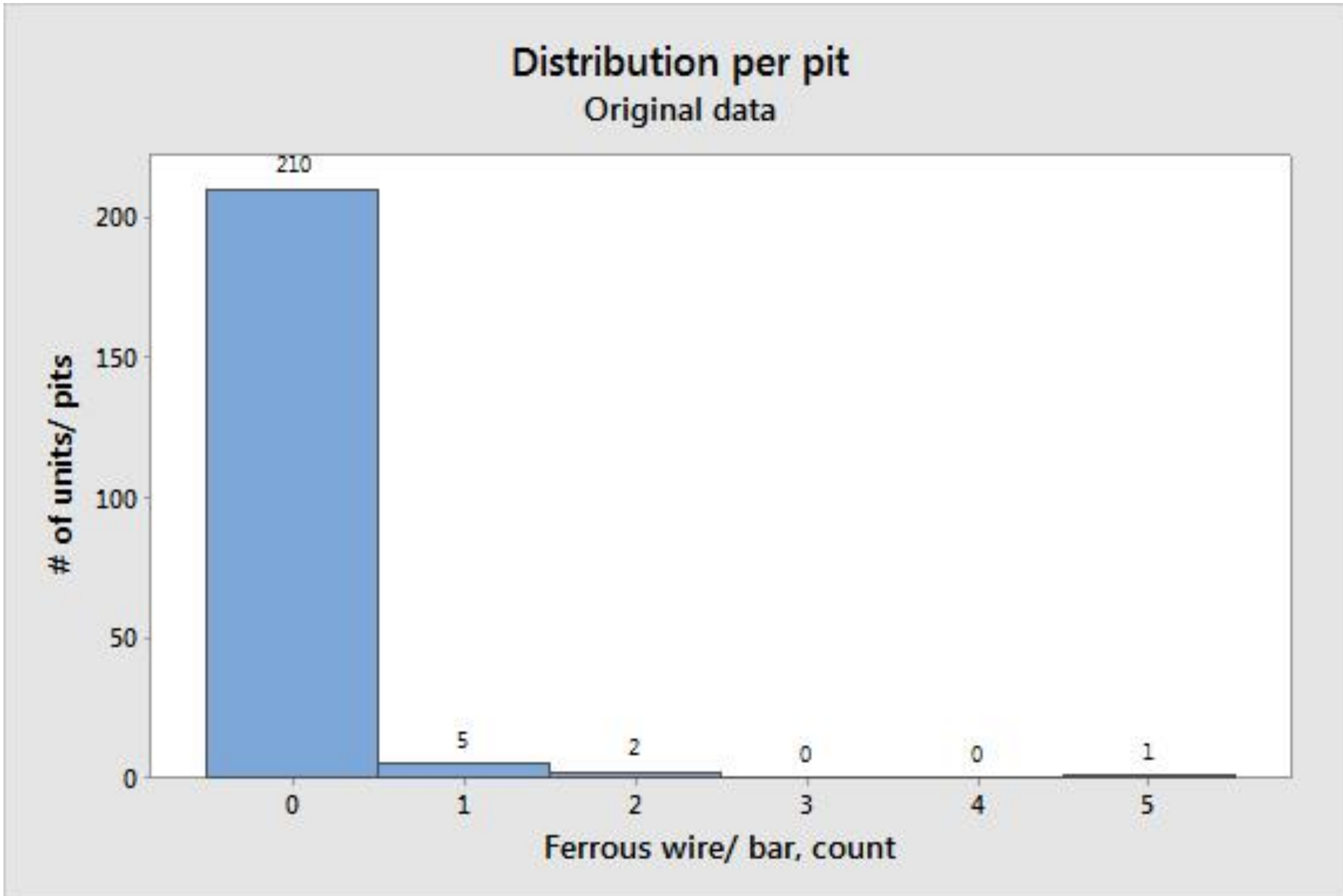

Figure 69 Ferrous wire, count, per pit

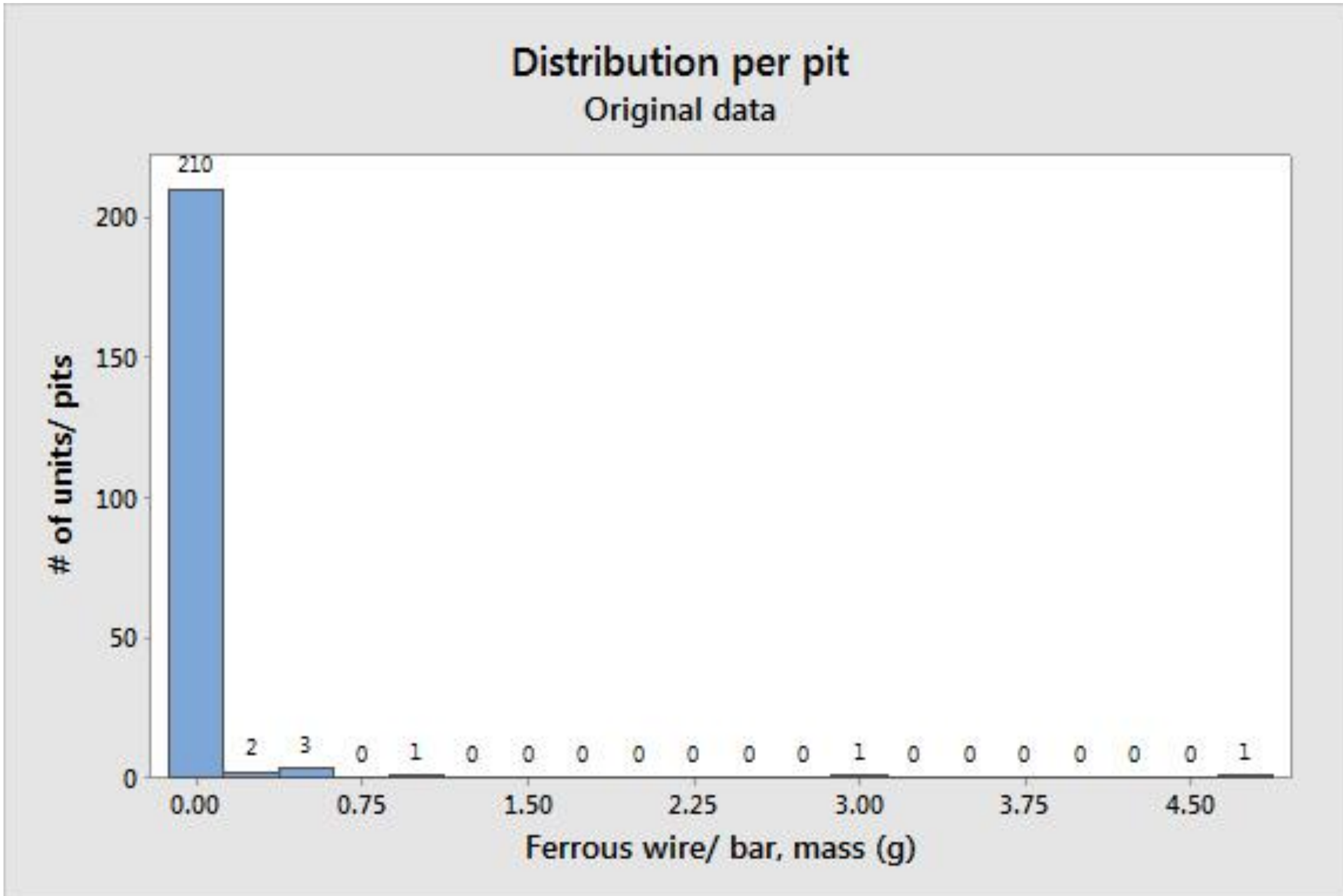

Figure 70 Ferrous wire, mass, per pit

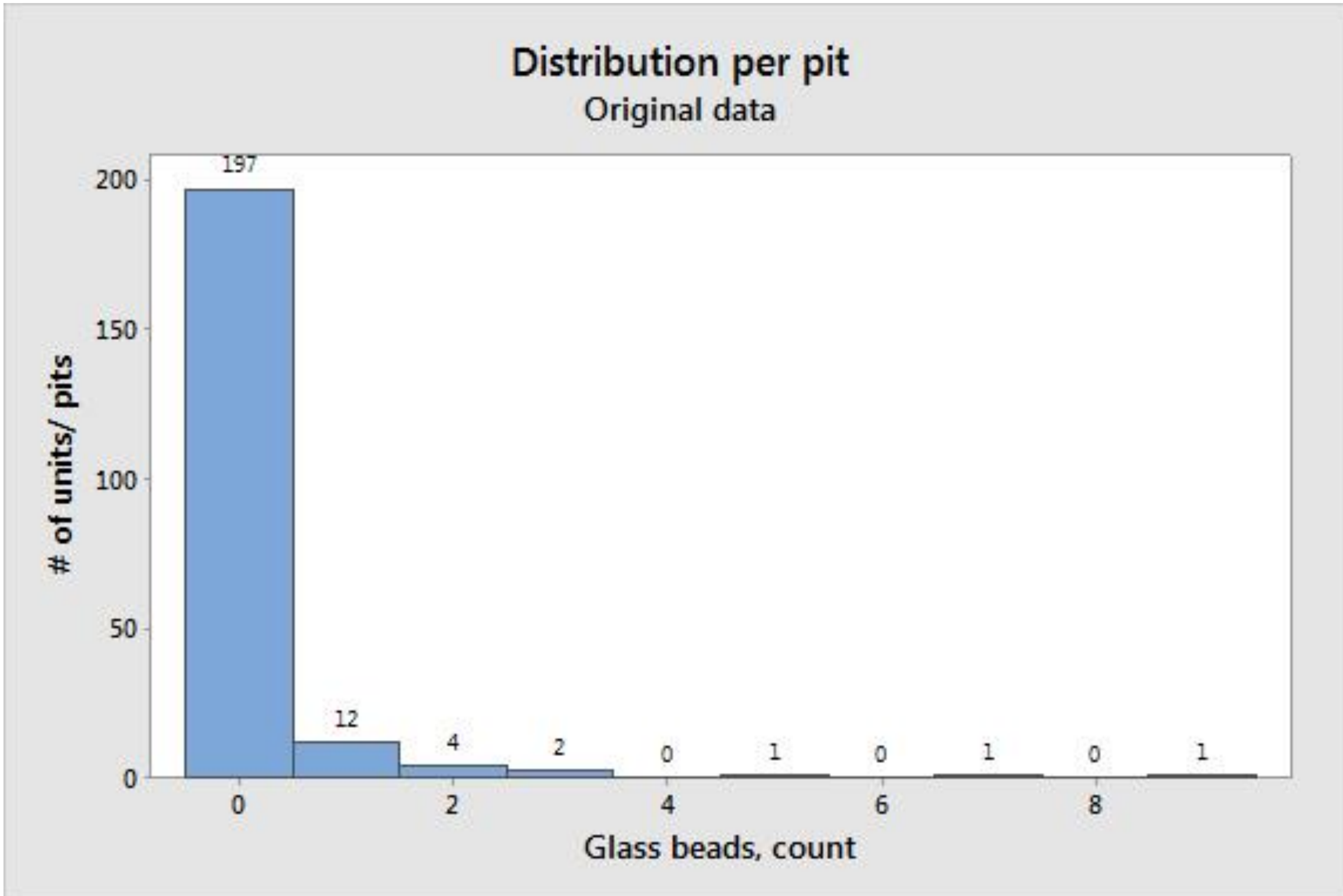

Figure 71 Glass beads, count, per pit

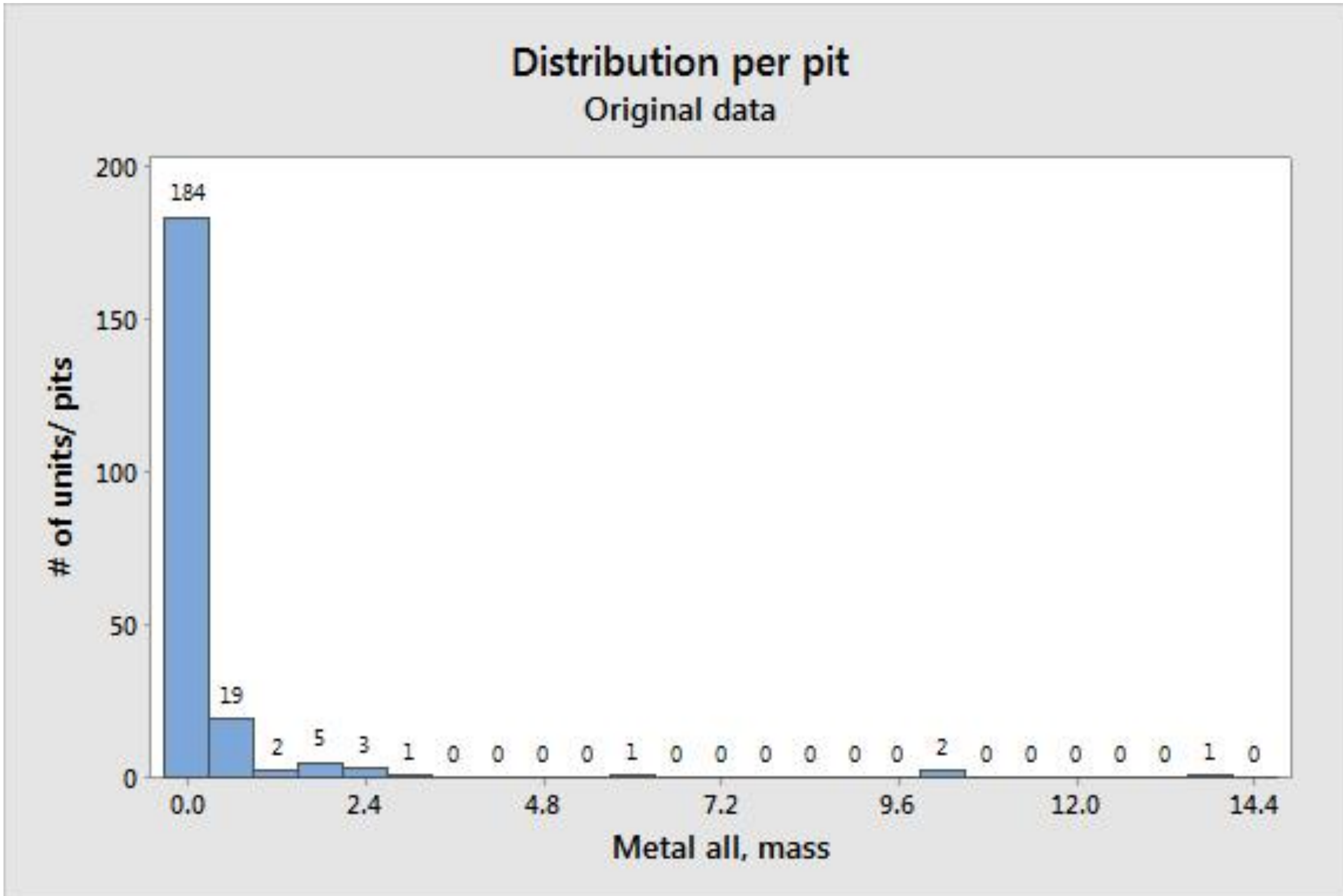

Figure 72 Metal, mass, per pit

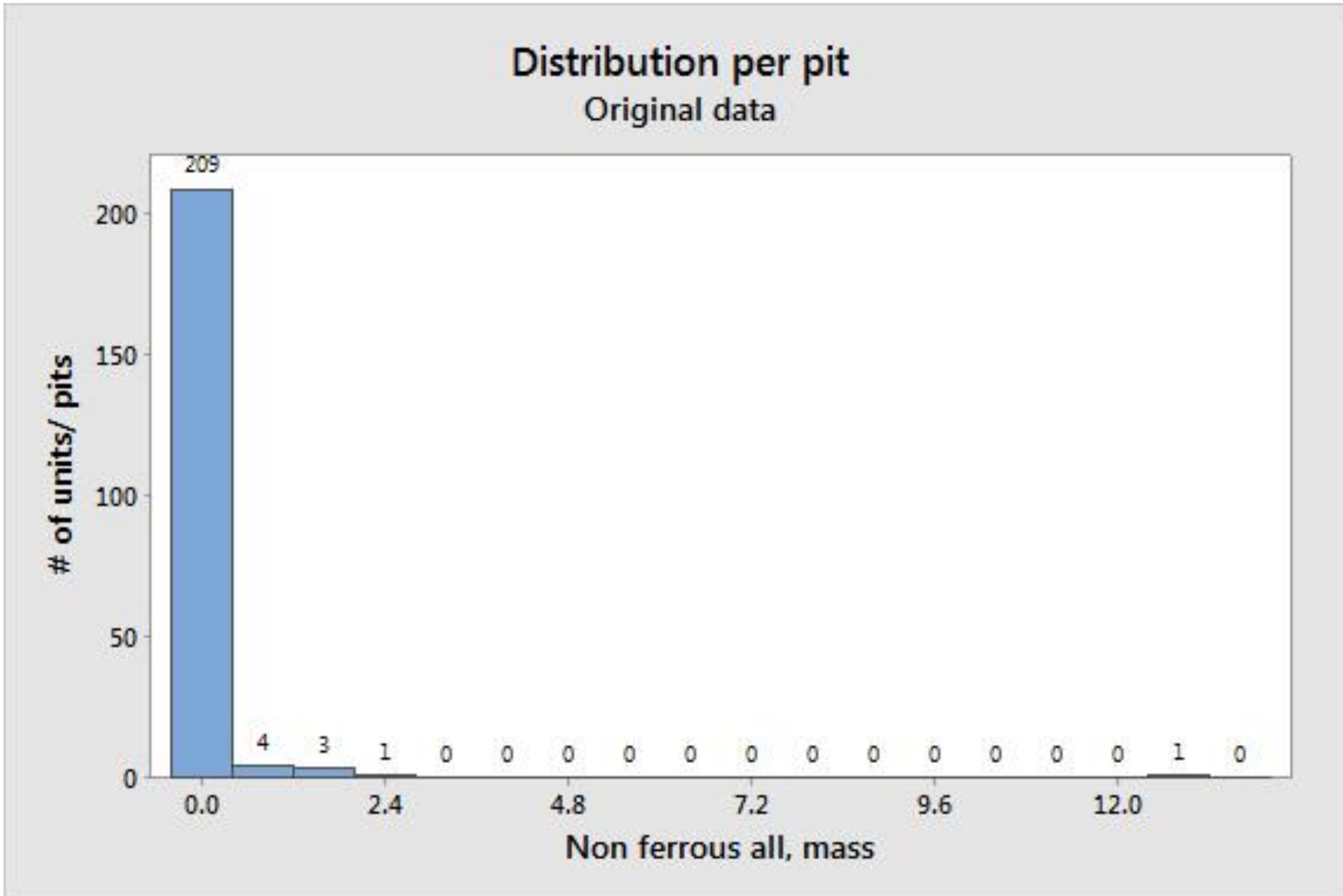

Figure 73 Non-ferrous metal, mass, per pit

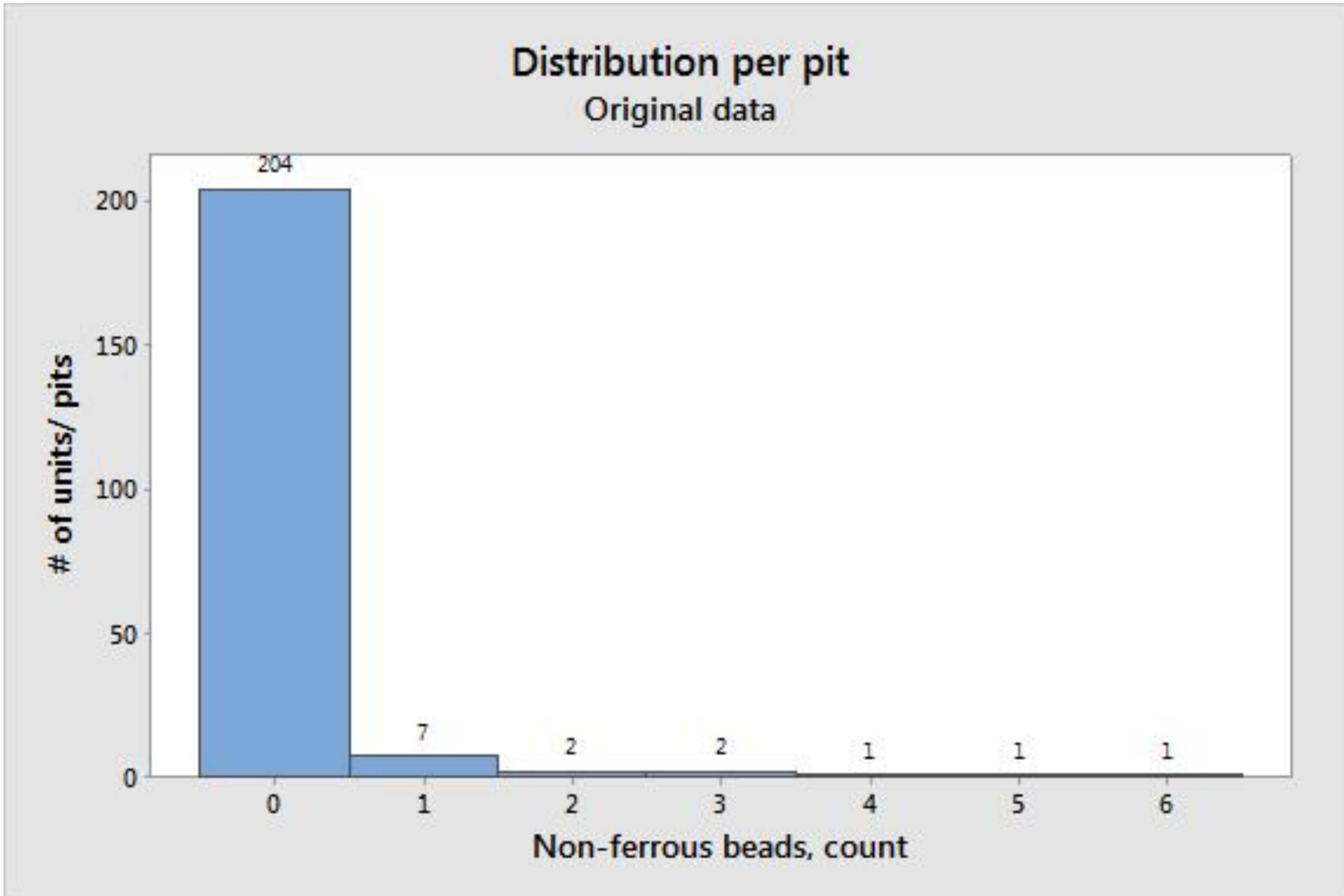

Figure 74 Non-ferrous beads, count, per pit

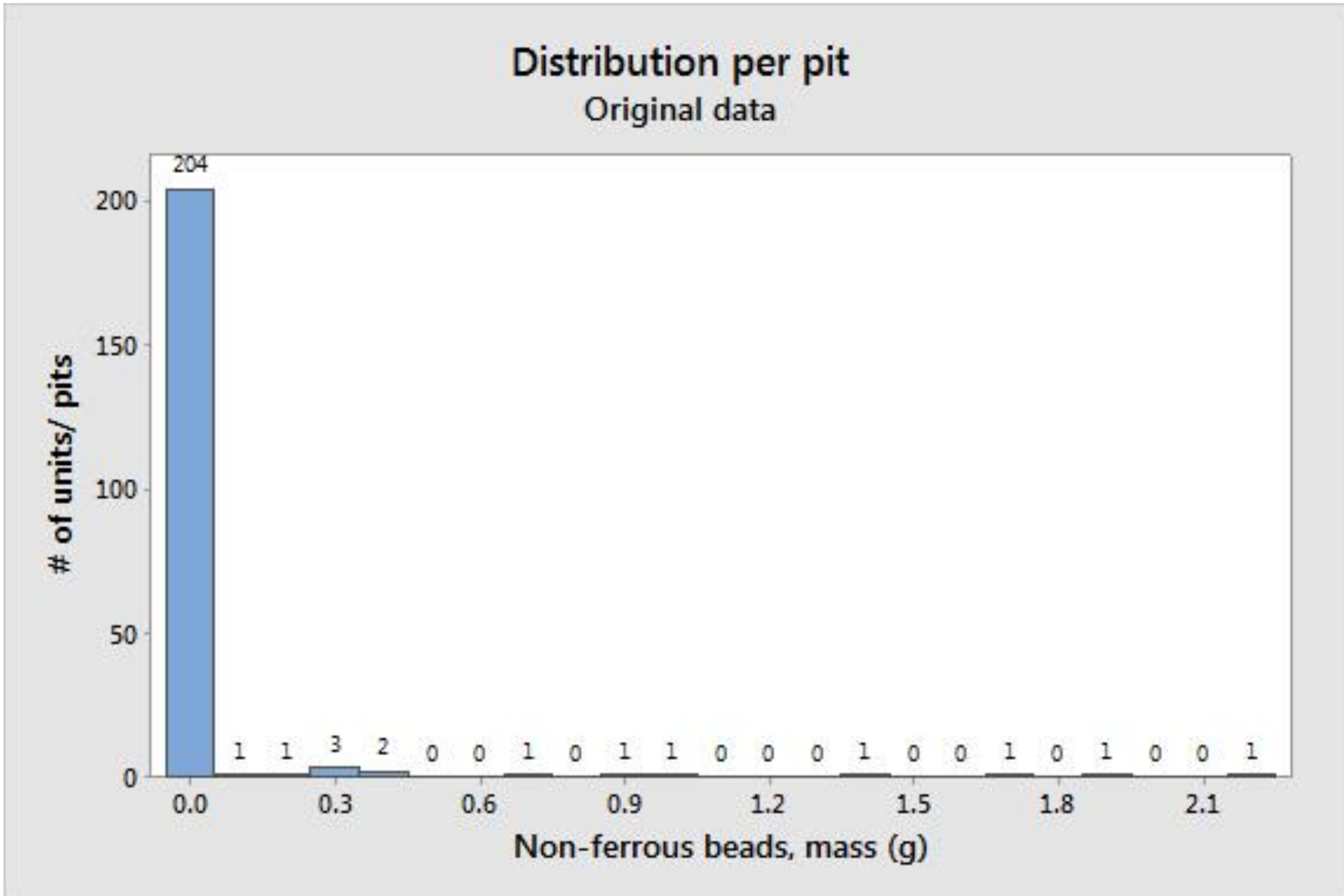

Figure 75 Non-ferrous beads, mass, per pit

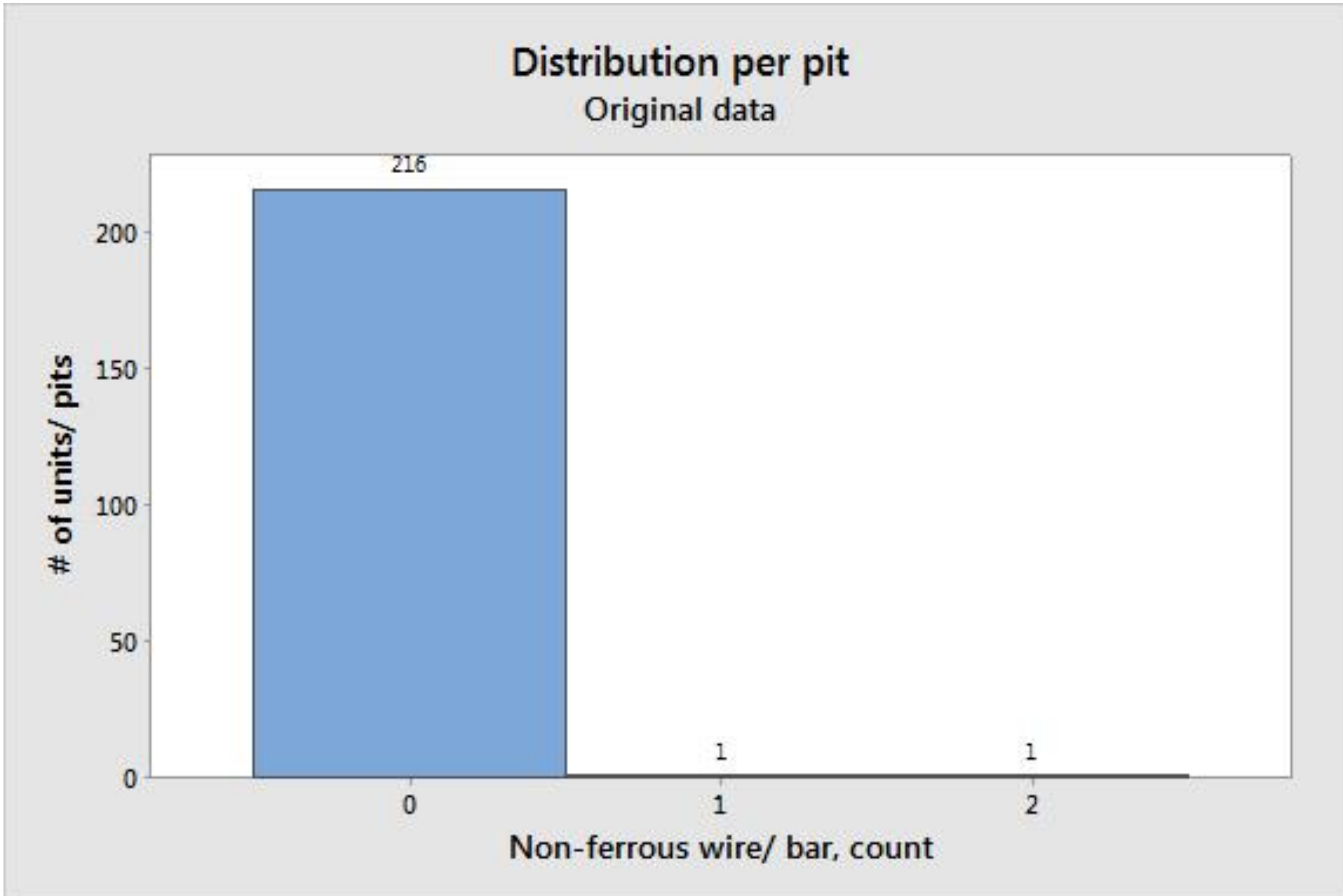

Figure 76 Non-ferrous wire, count, per pit

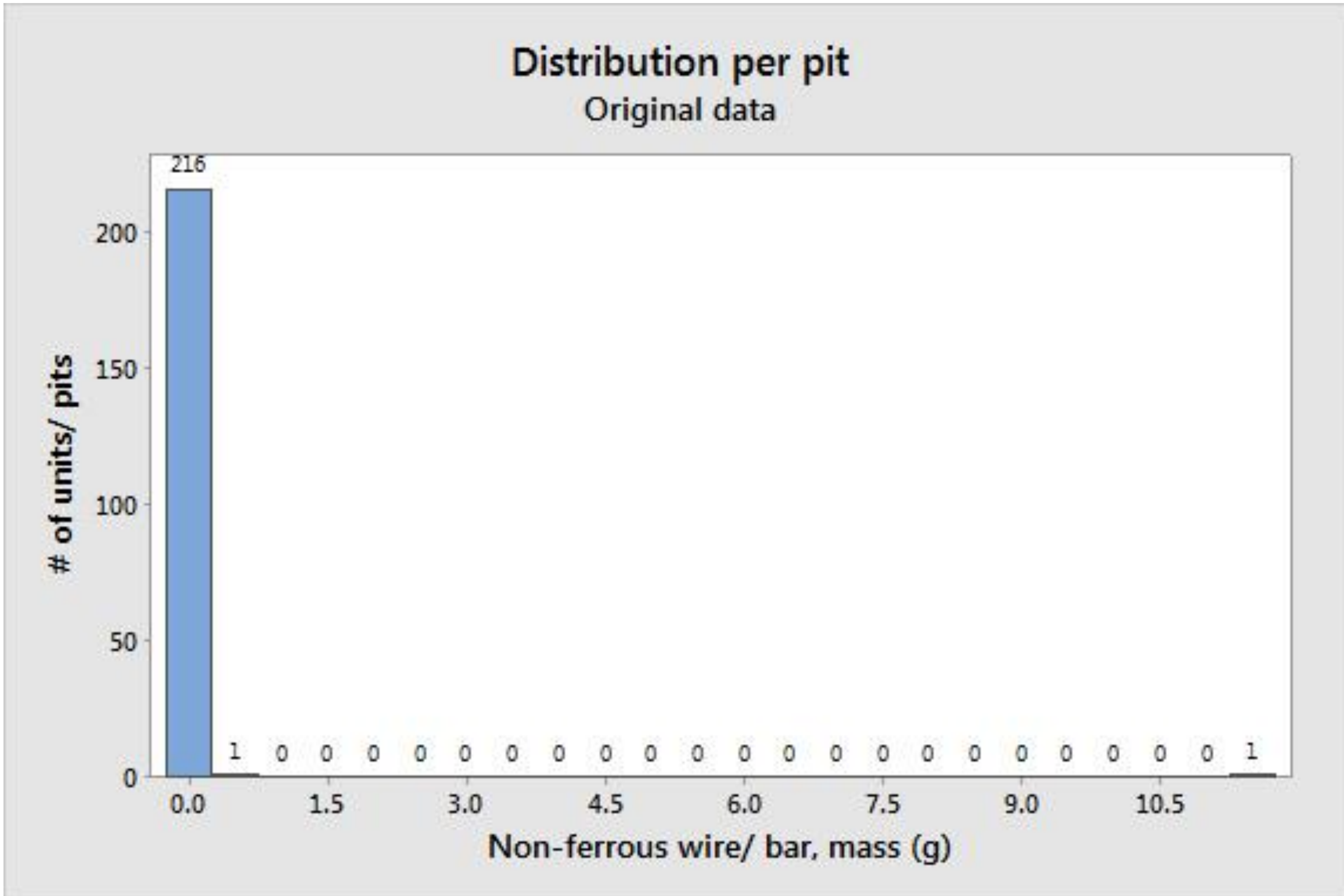

Figure 77 Non-ferrous wire, mass, per pit

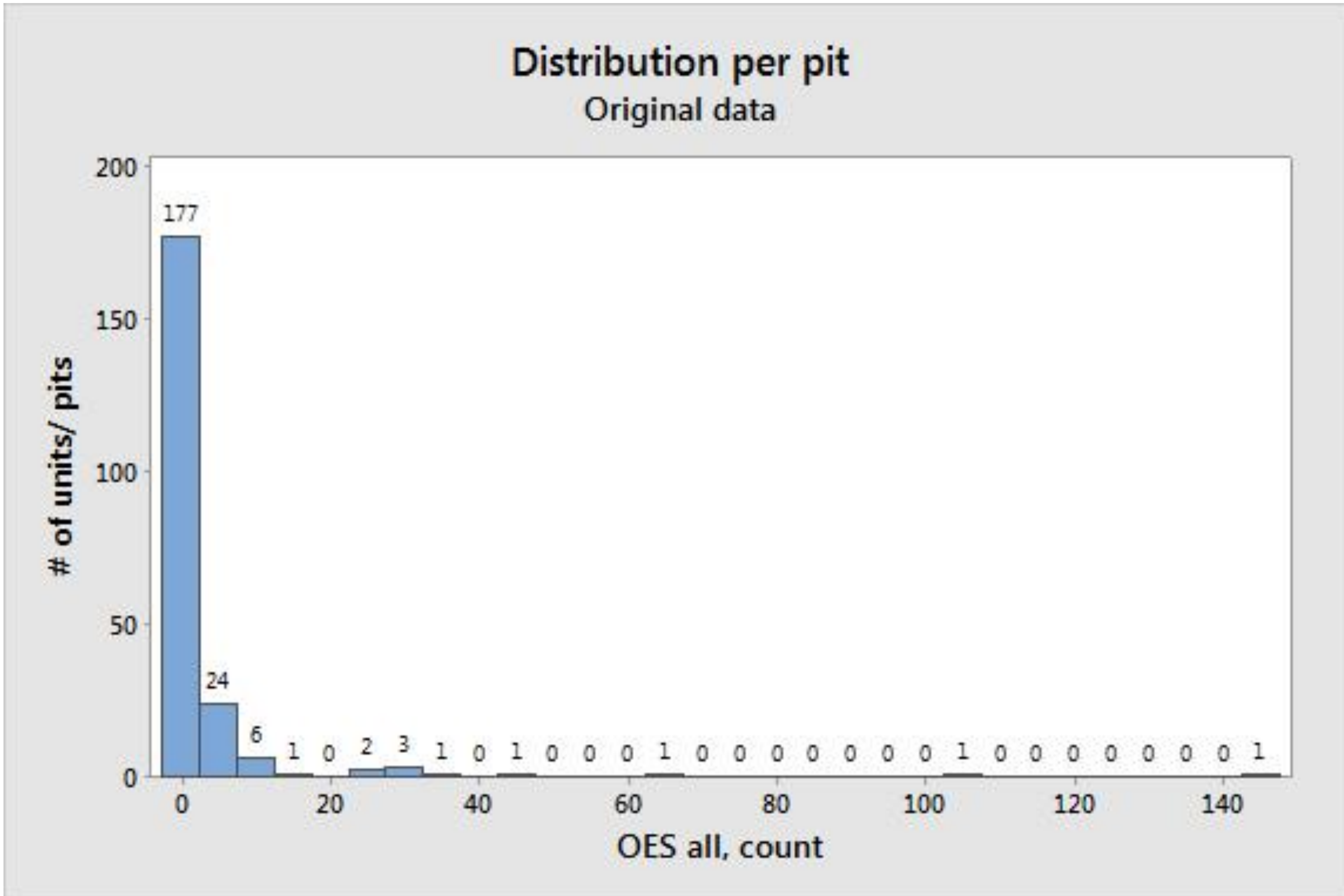

Figure 78 OES, count, per pit

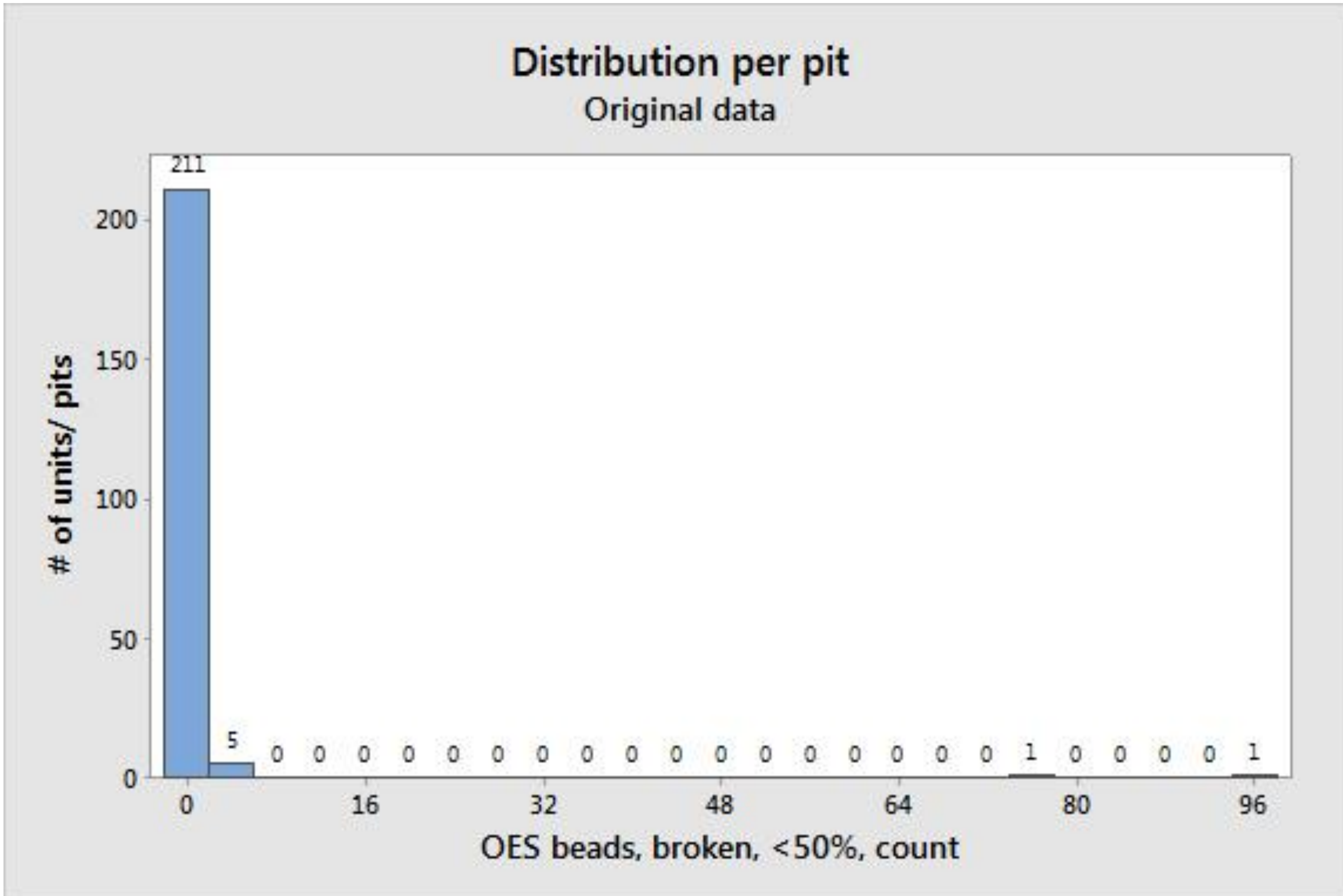

Figure 79 OES <50%, count, per pit

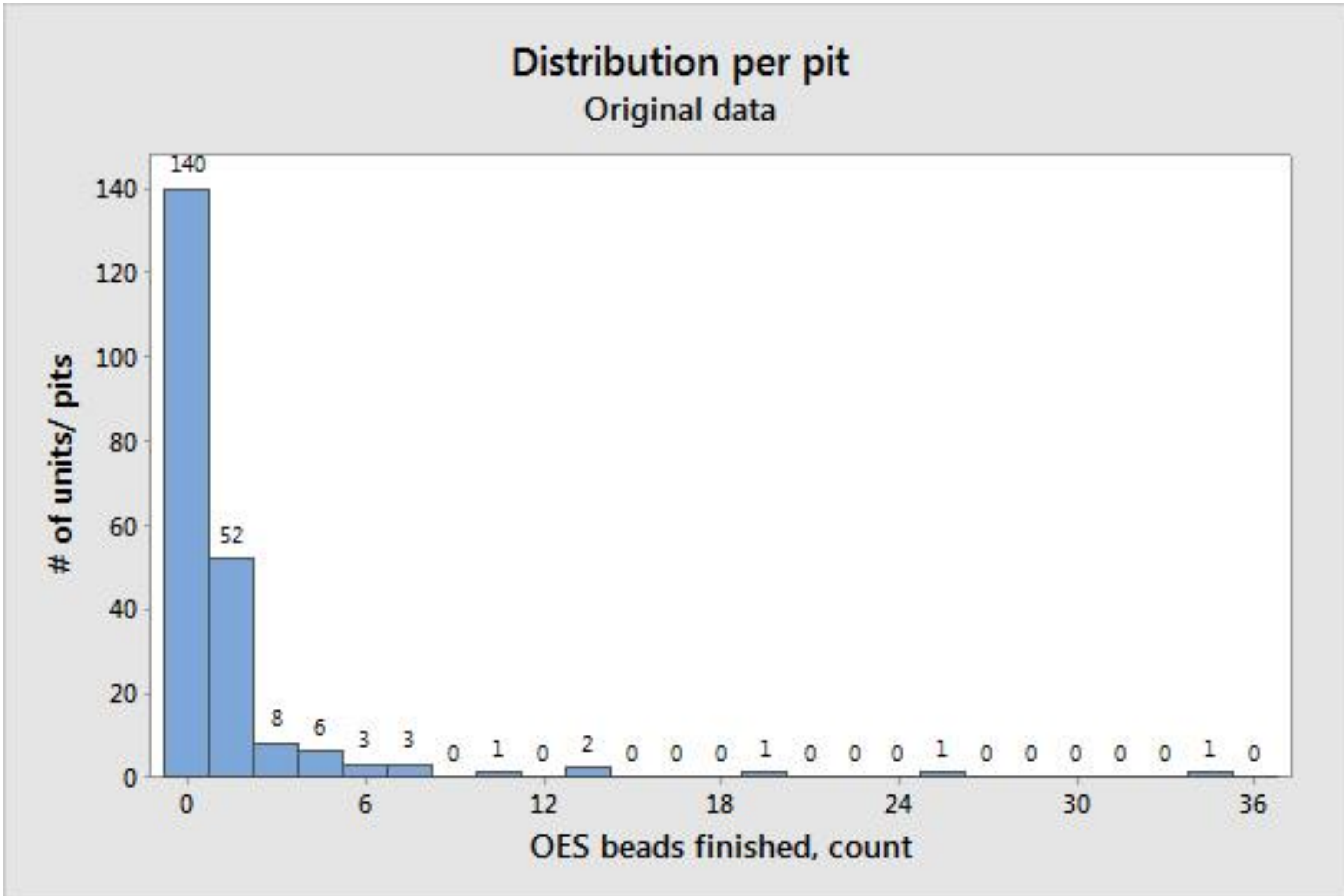

Figure 80 OES beads finished, count, per pit

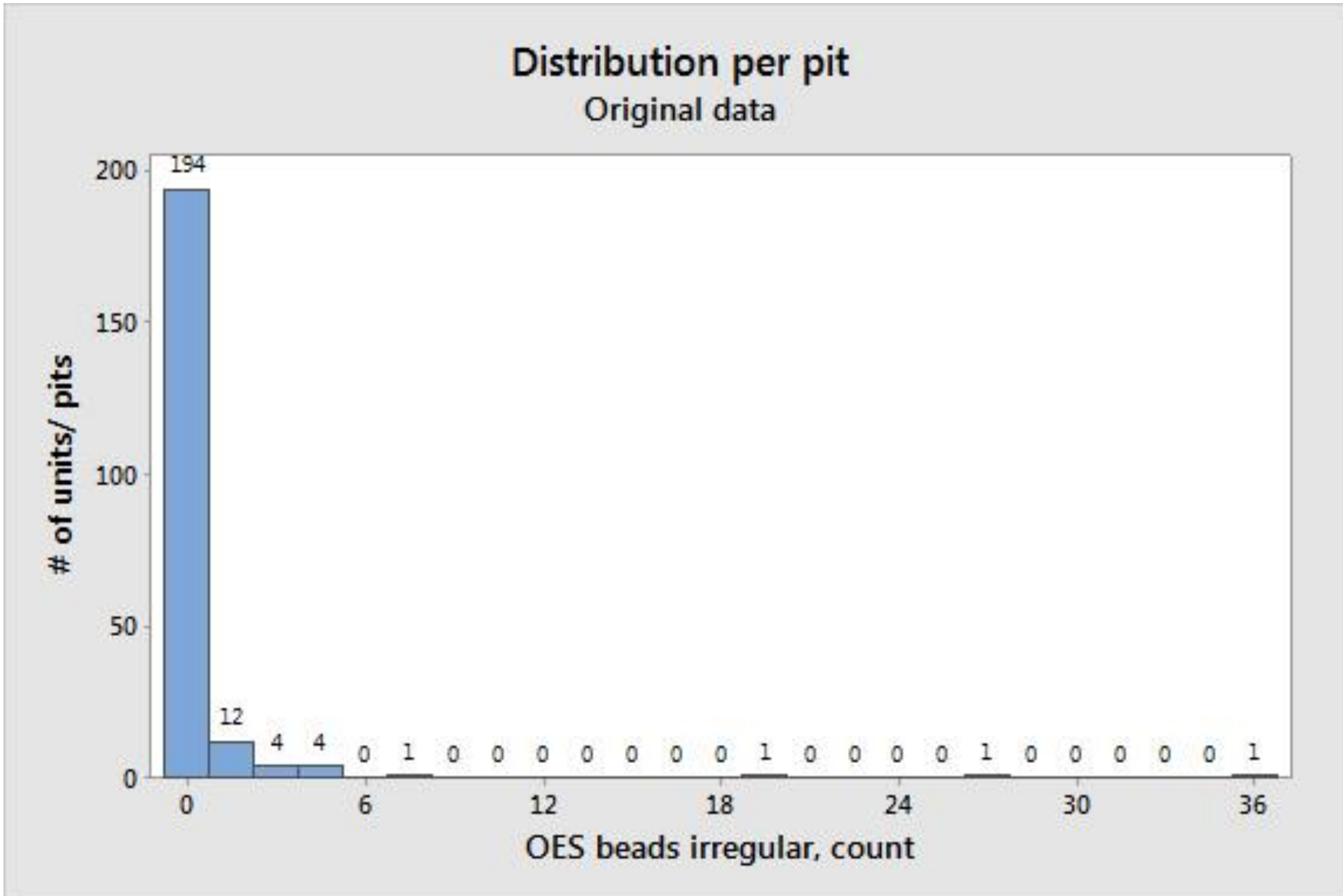

Figure 81 OES beads irregular, count, per pit

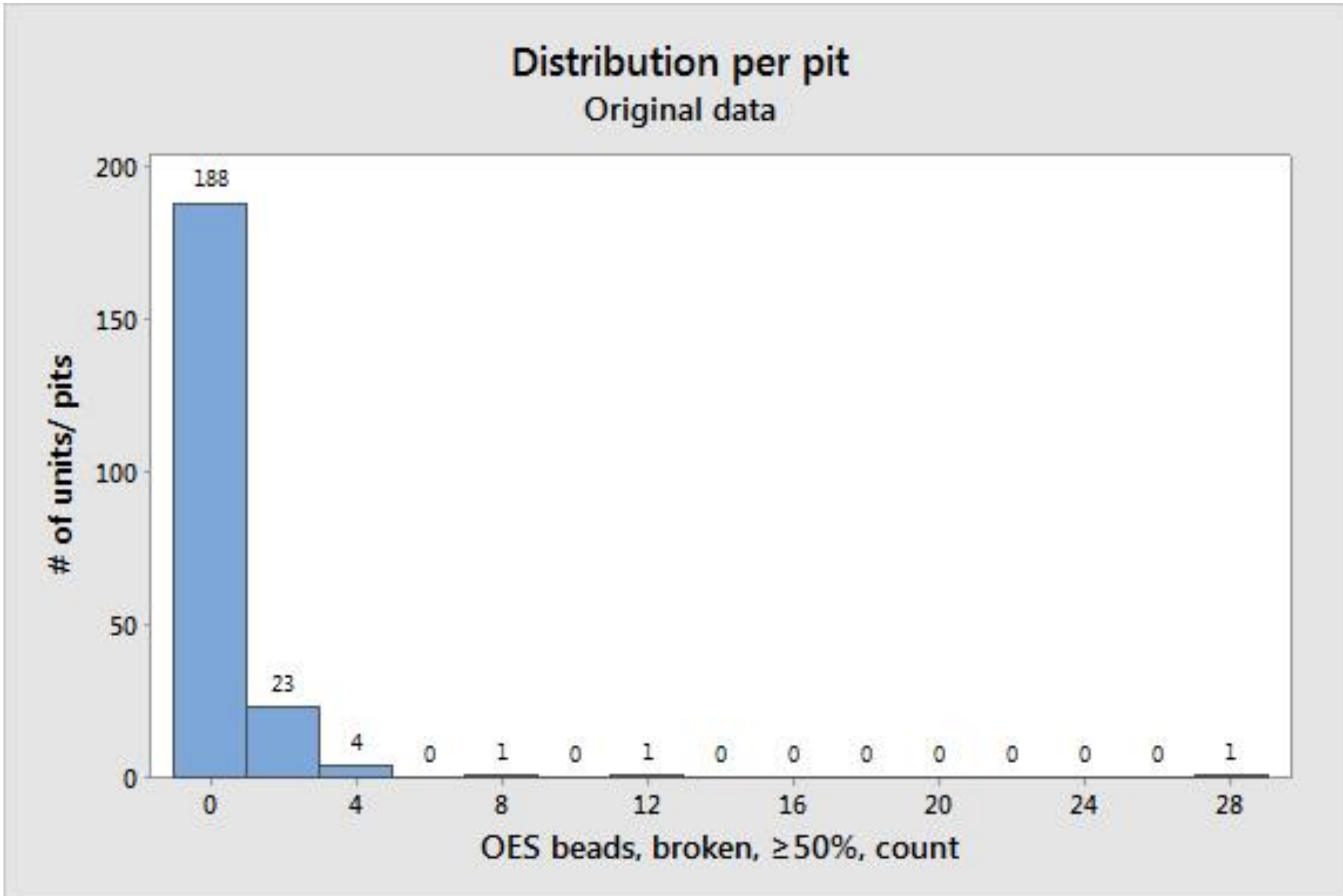

Figure 82 OES beads >50%, count, per pit

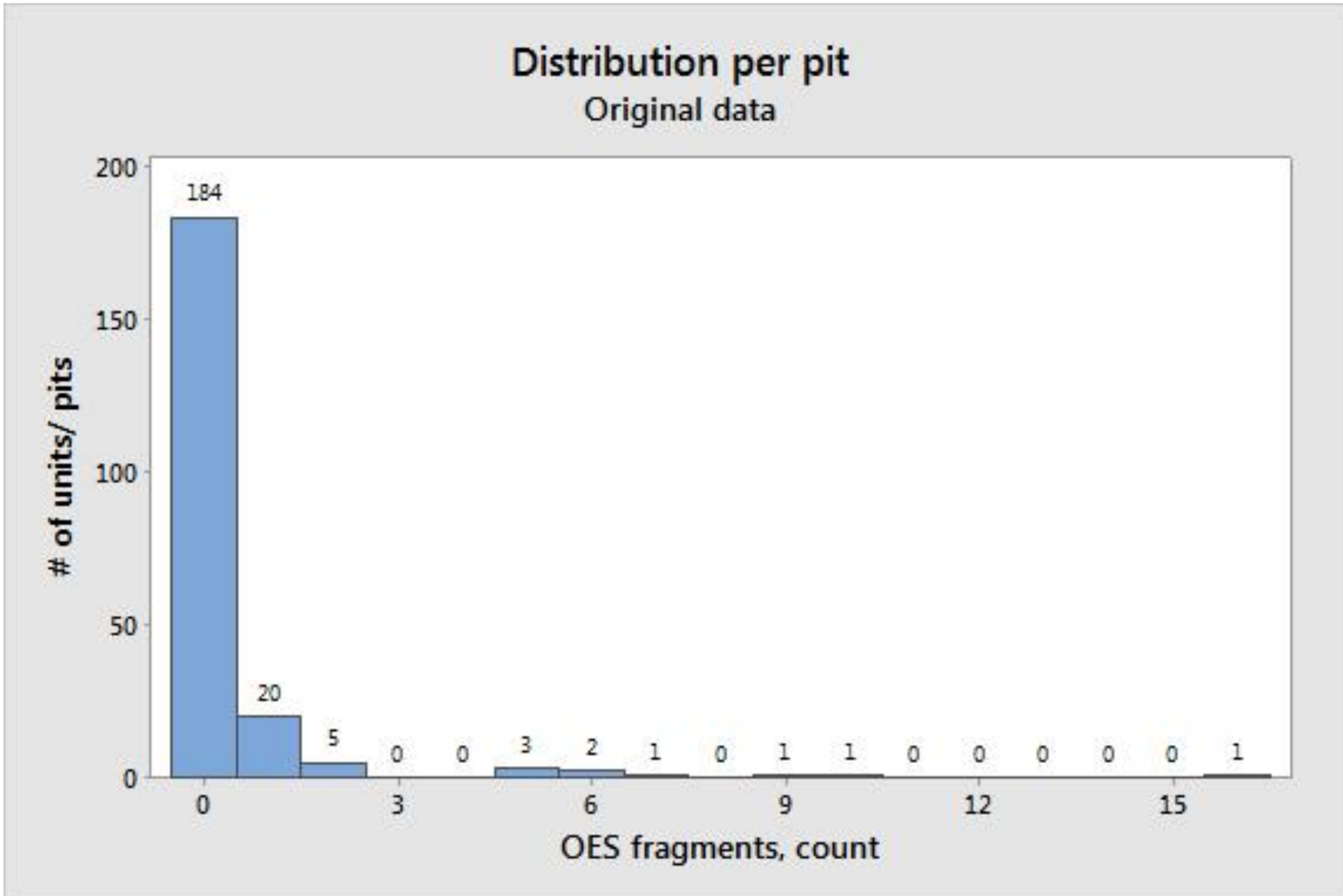

Figure 83 OES fragments, count, per pit

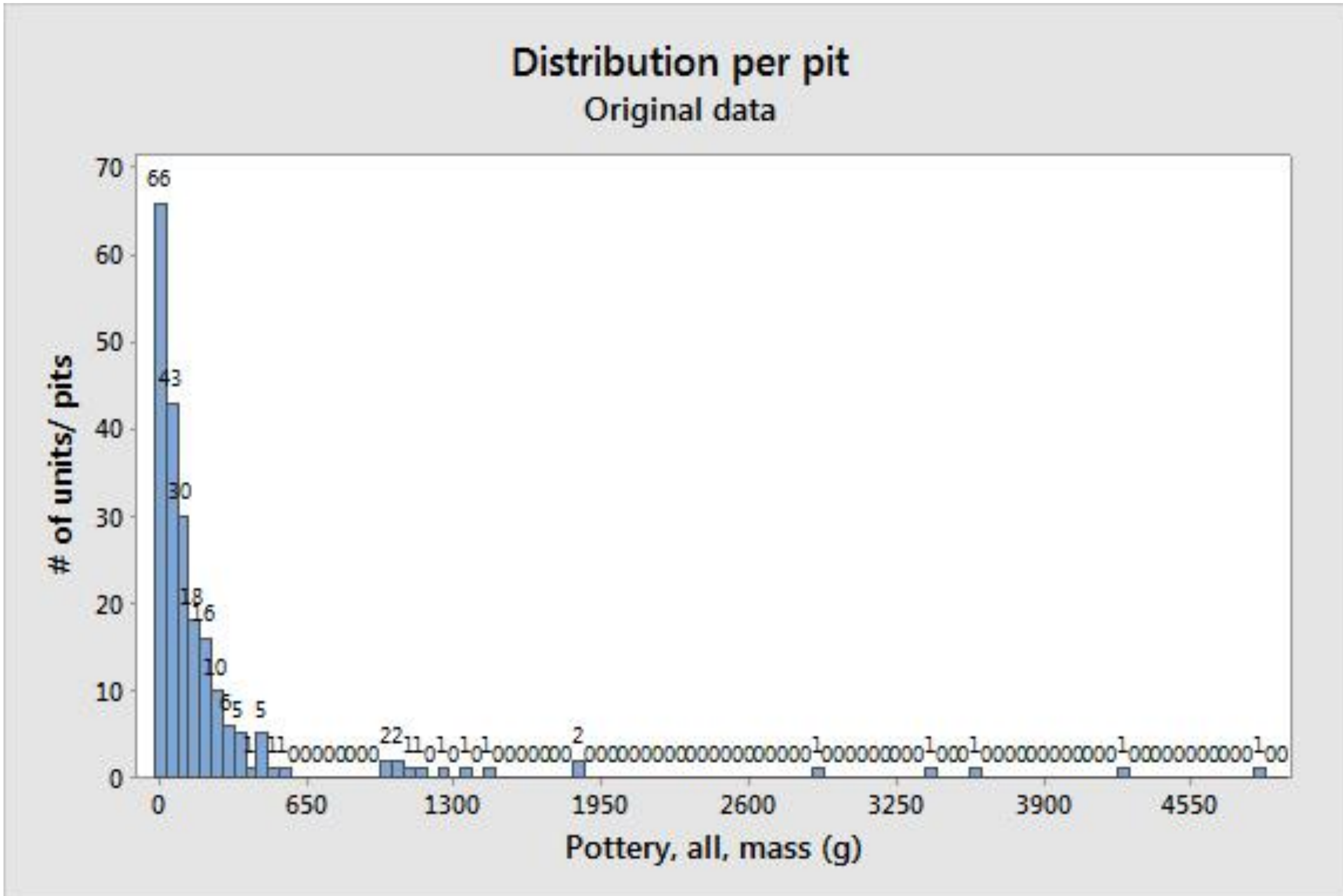

Figure 84 Pottery, mass, per pit

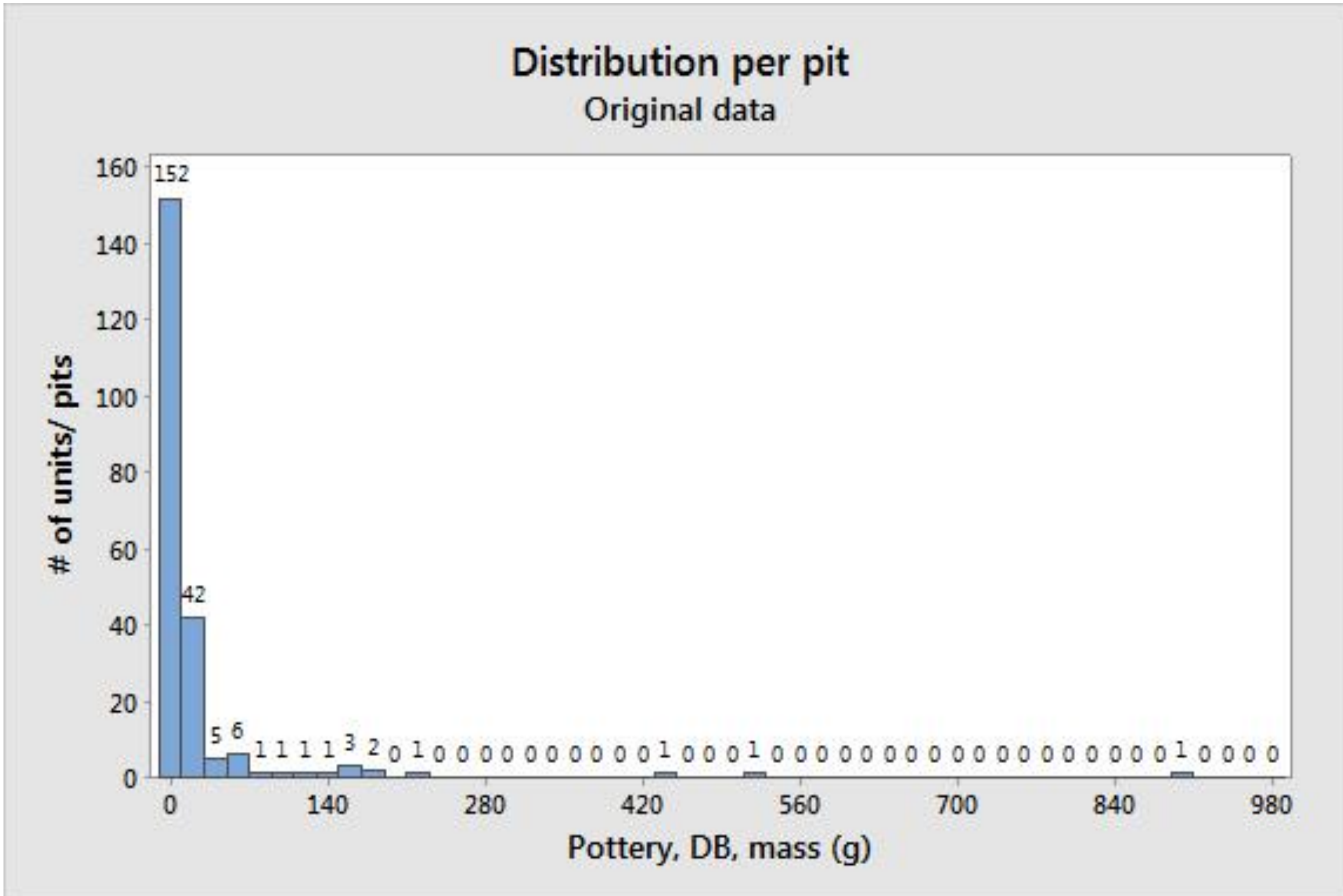

Figure 85 Decorated body sherds, mass, per pit

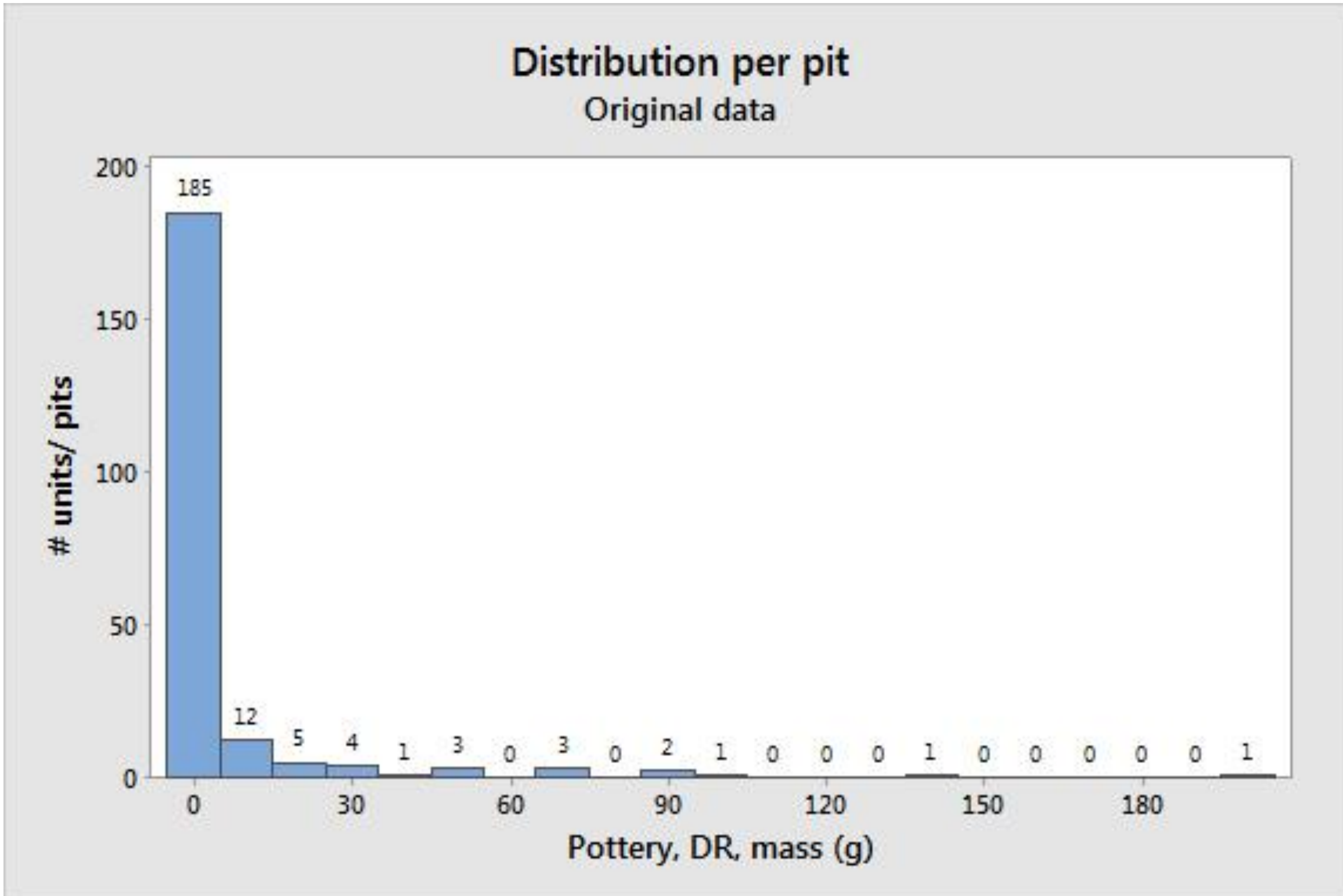

Figure 86 Decorated rim sherds, mass, per pit

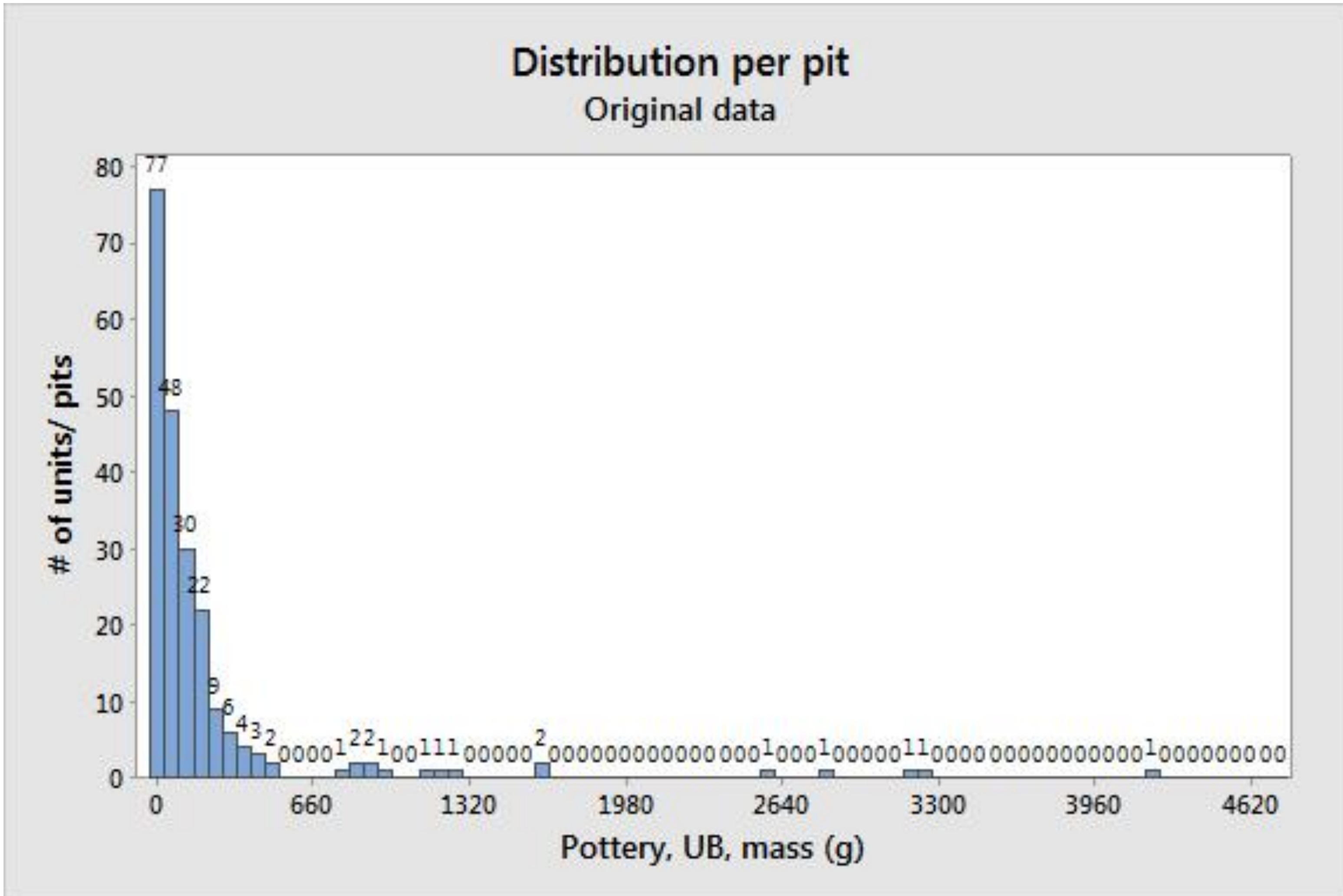

Figure 87 Undecorated body sherds, mass, per pit

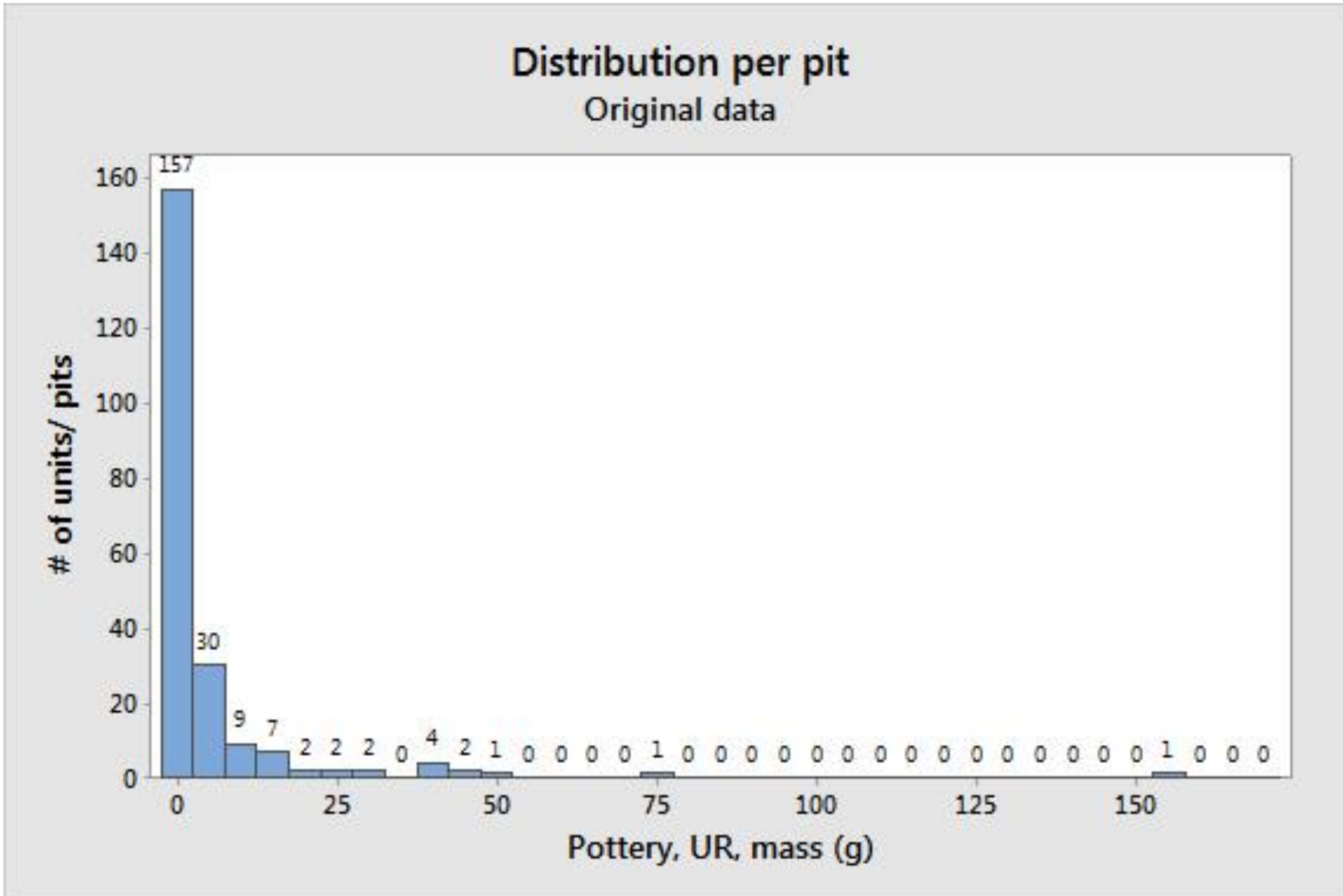

Figure 88 Undecorated rim sherds, mass, per pit

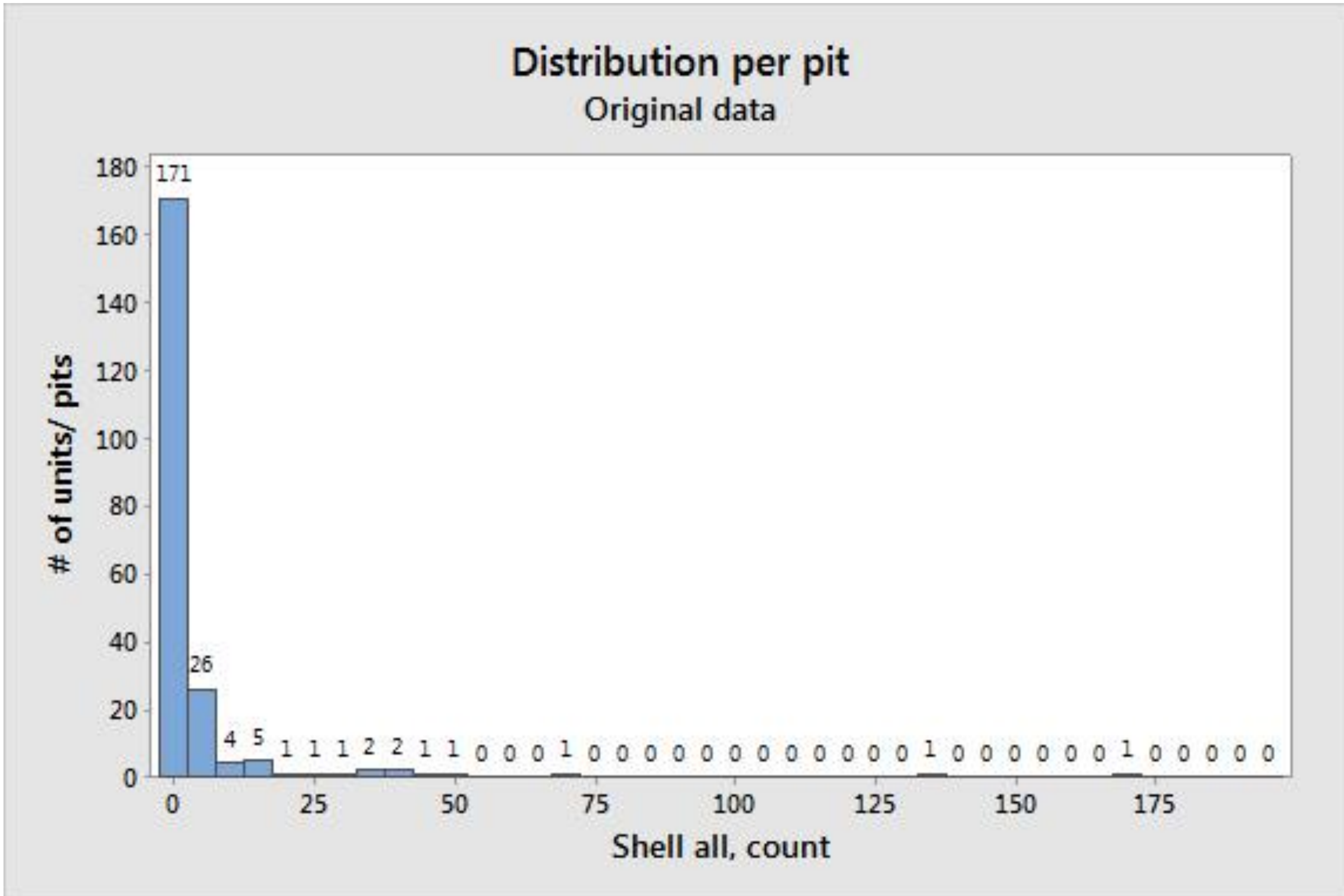

Figure 89 Shell items, count, per pit

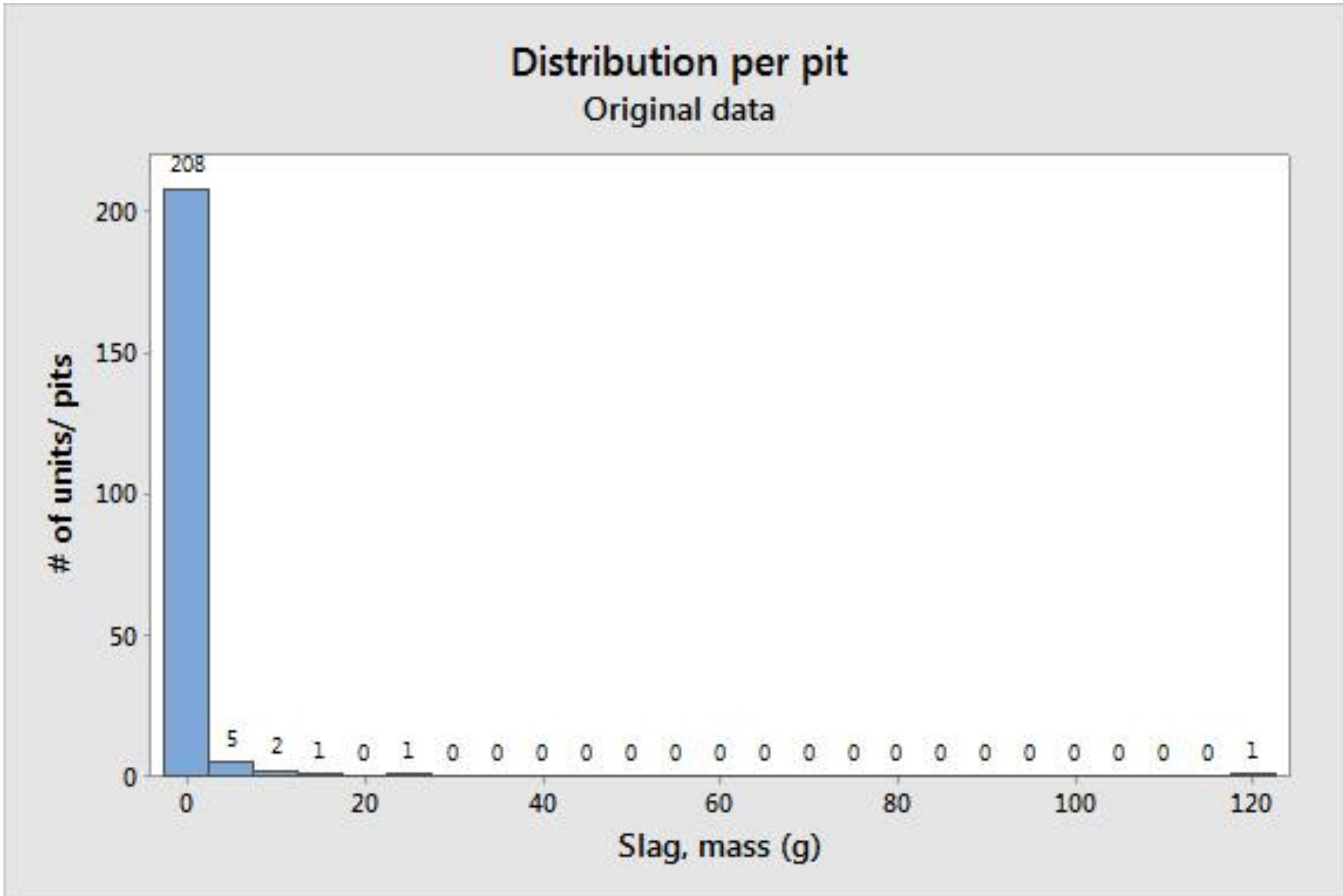

Figure 90 Slag, mass, per pit

APPENDIX G

MATERIAL DISTRIBUTION FOR STANDARDIZED DATA

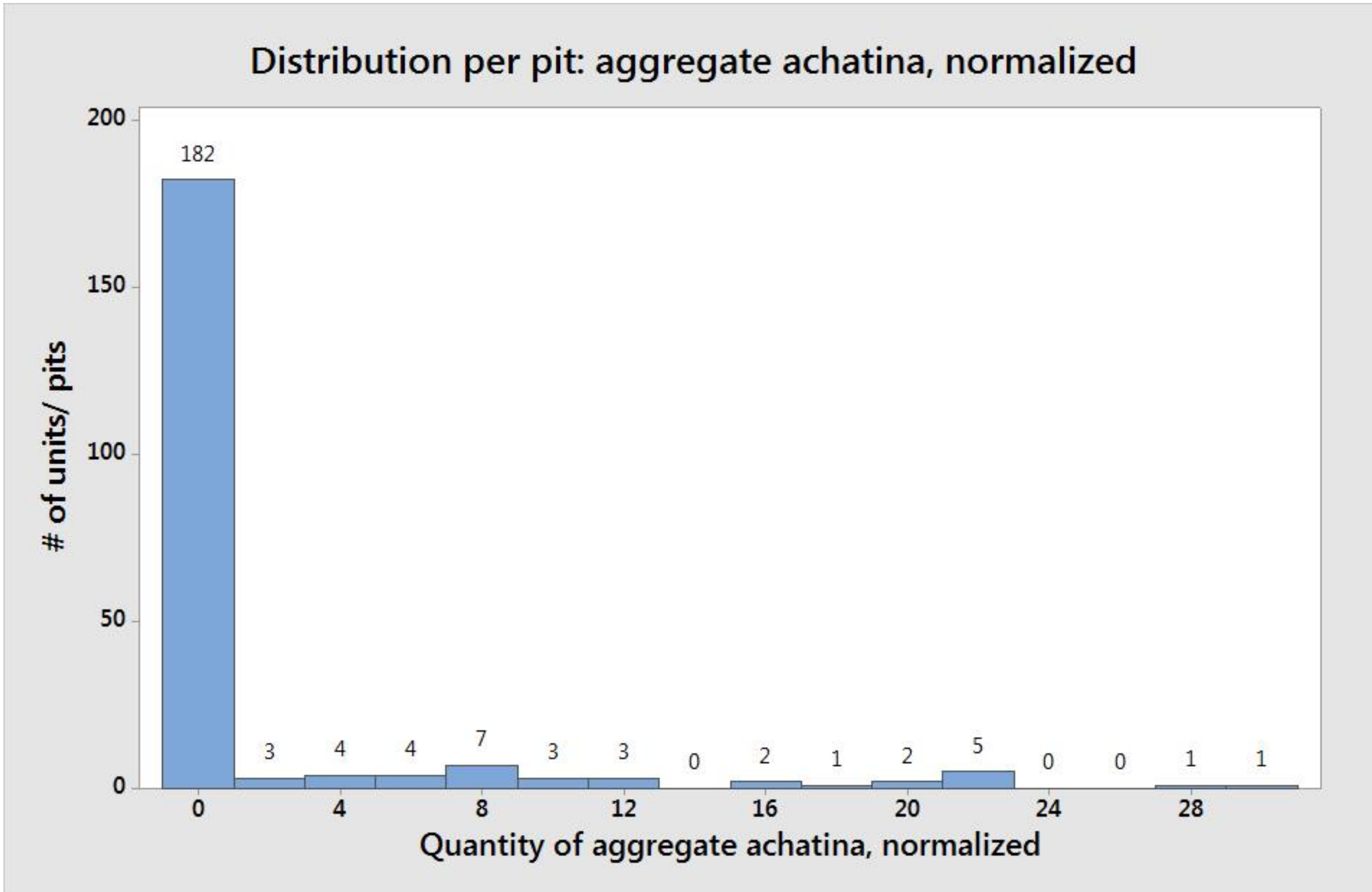

Figure 91 Achatina per pit, count, standardized

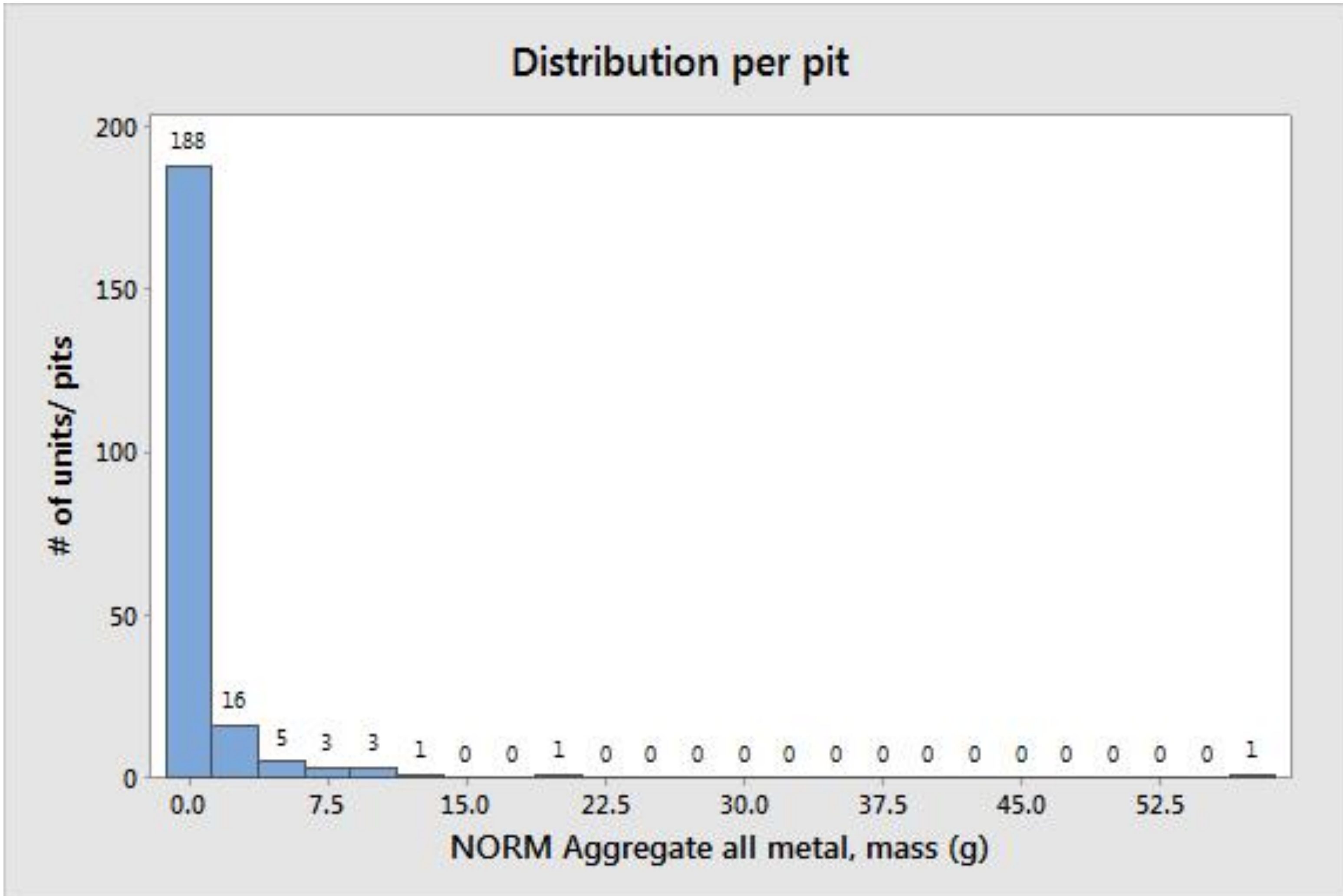

Figure 92 Metal per pit, mass, standardized

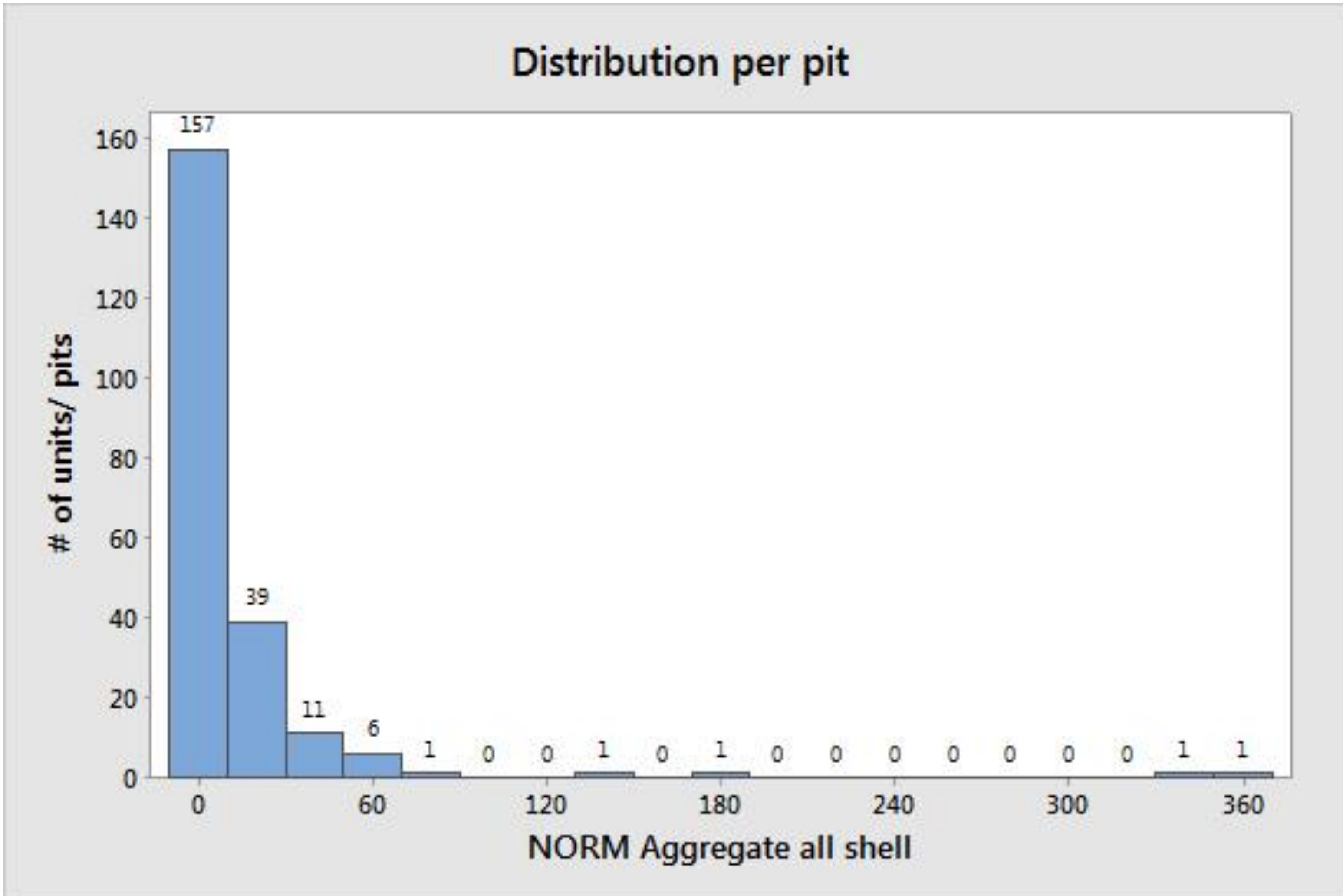

Figure 93 Shell per pit, count, standardized

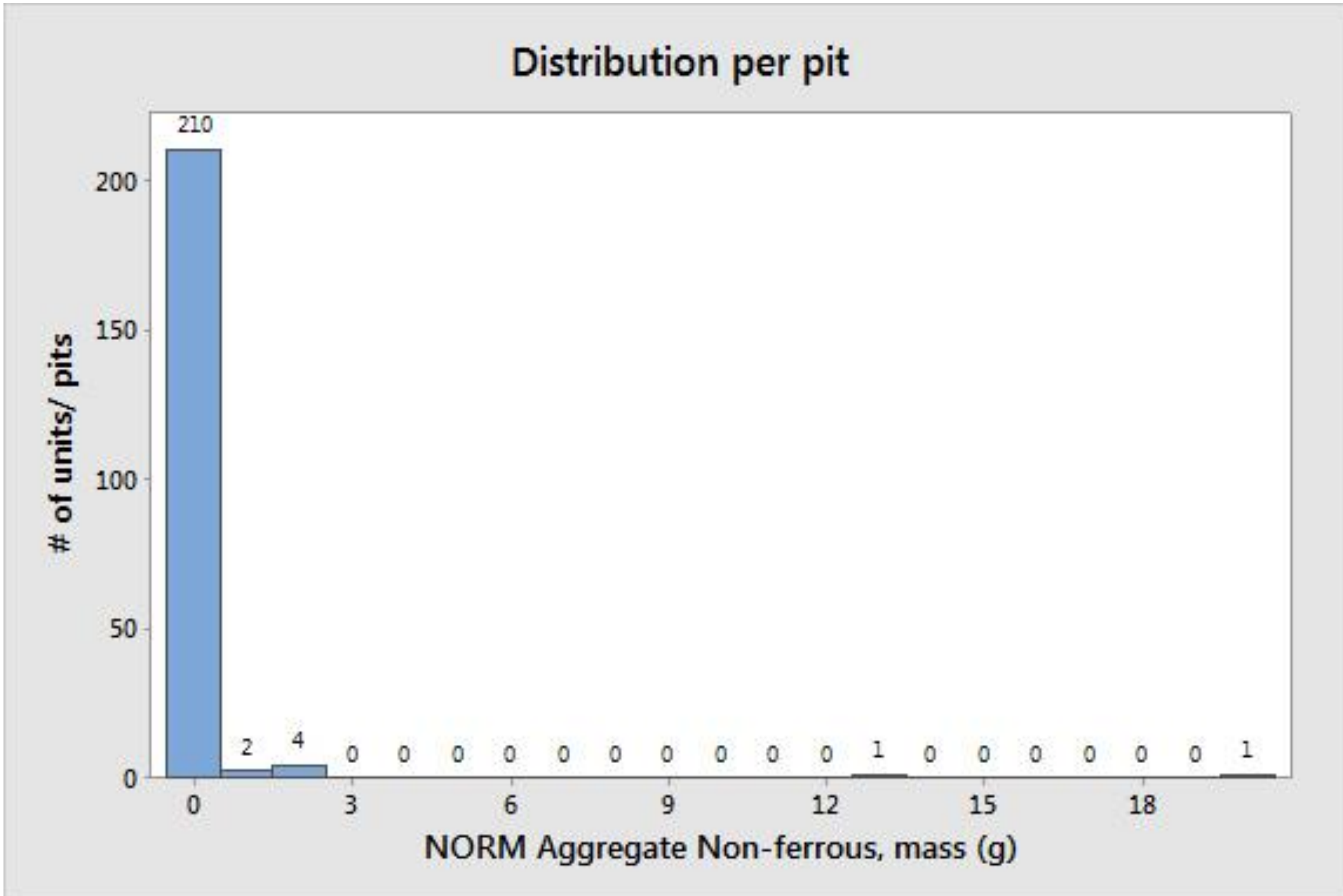

Figure 94 Non-ferrous items per pit, mass, standardized

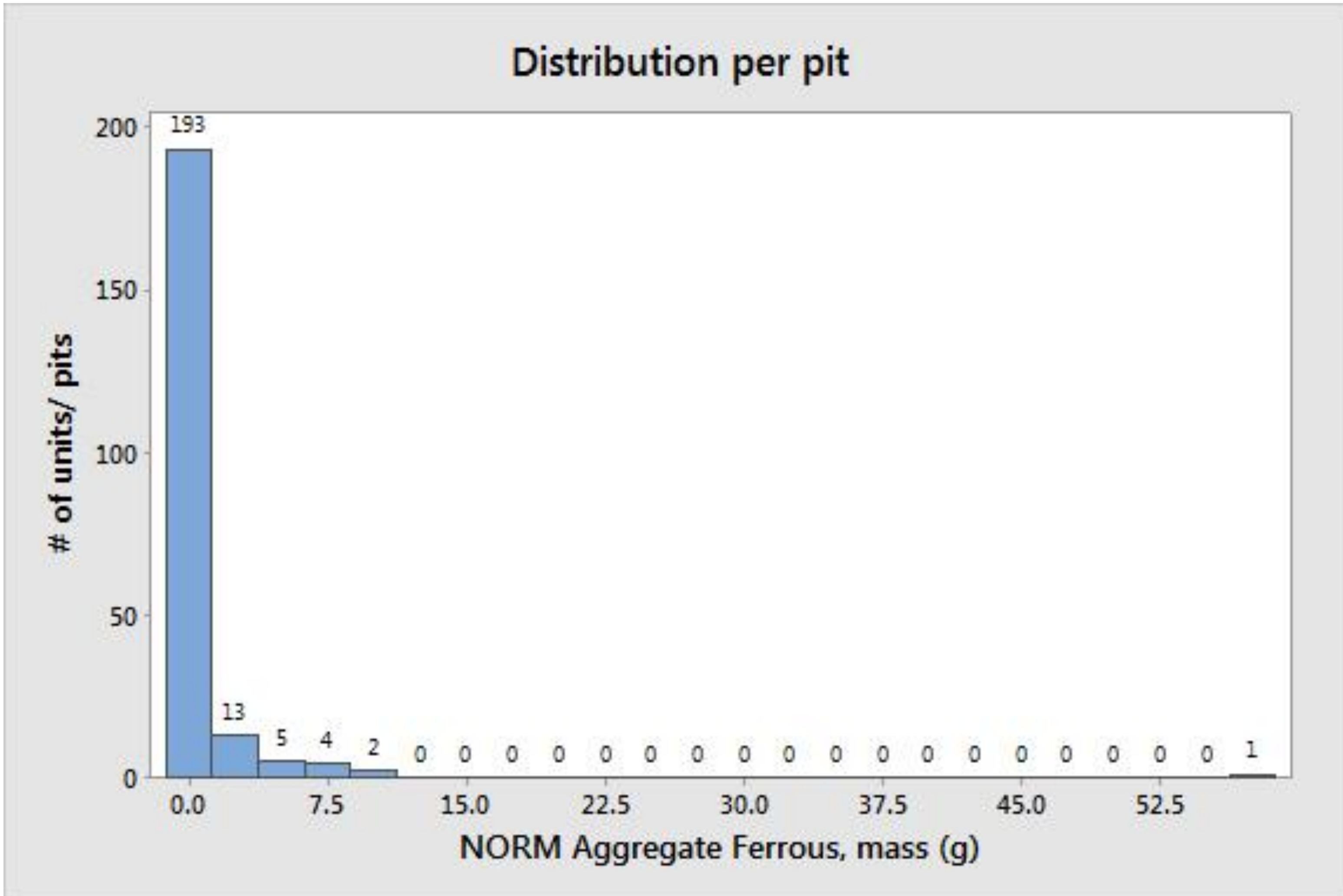

Figure 95 Ferrous items per pit, mass, standardized

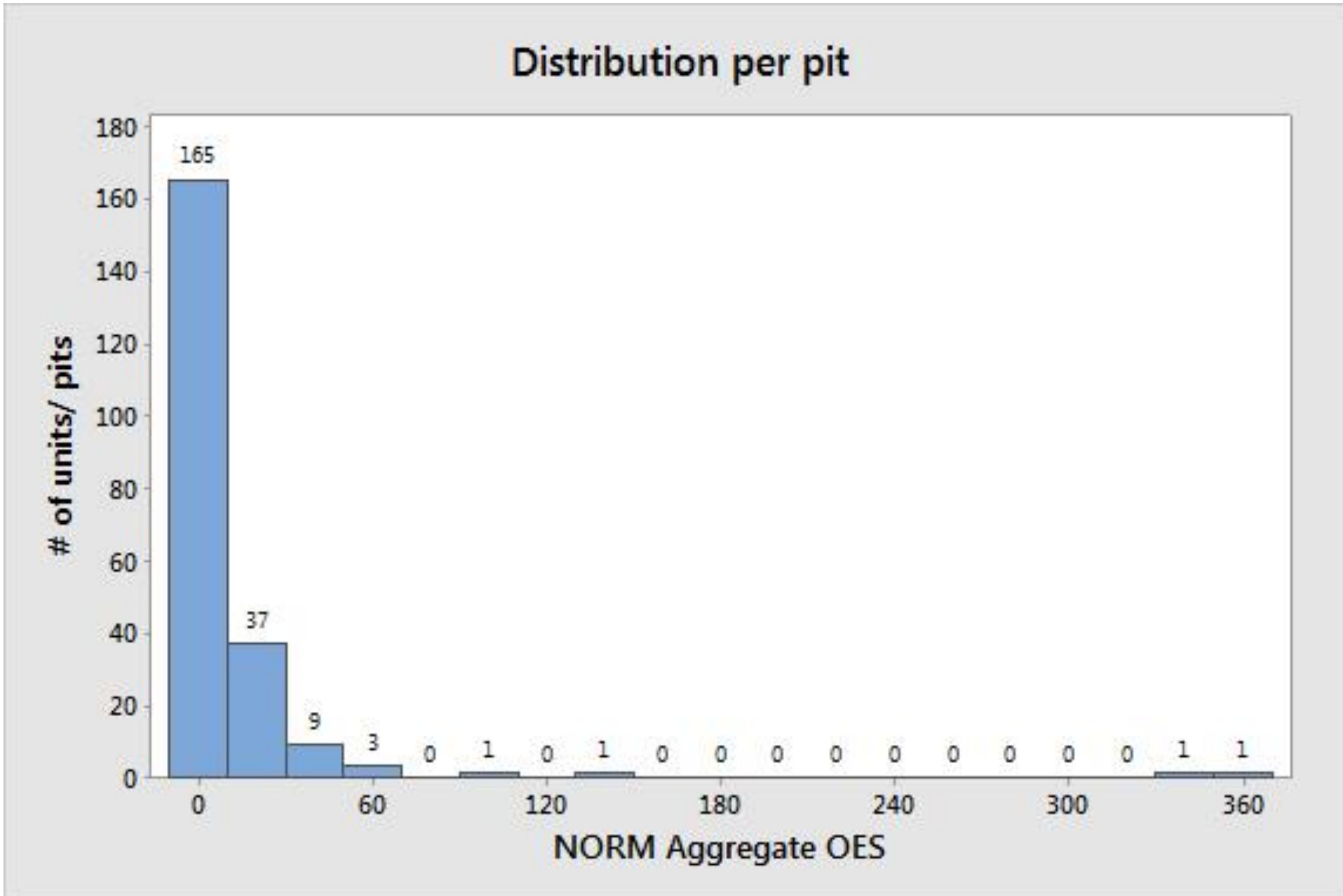

Figure 96 OES per pit, count, standardized

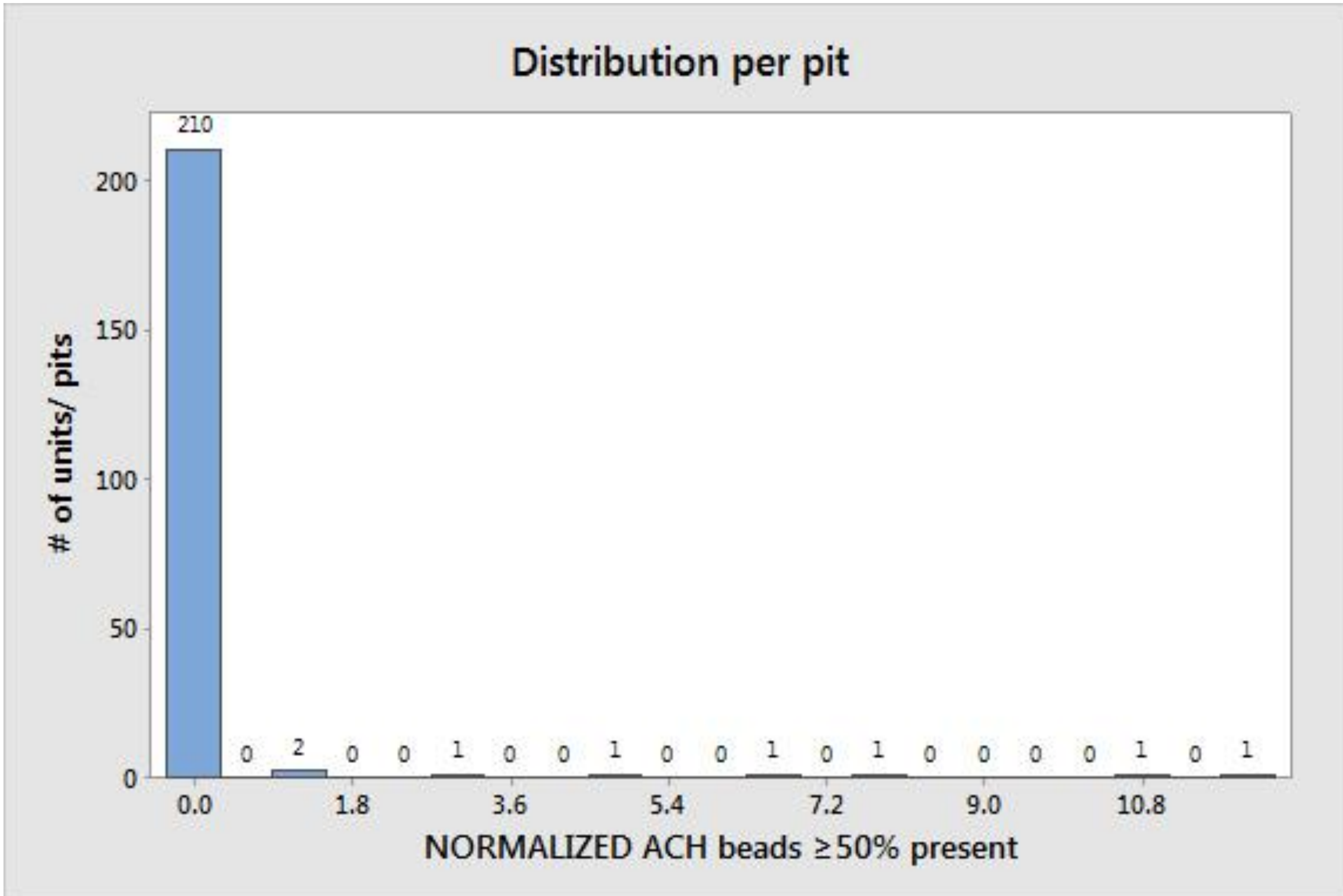

Figure 97 Achatina >50% per pit, count, standardized

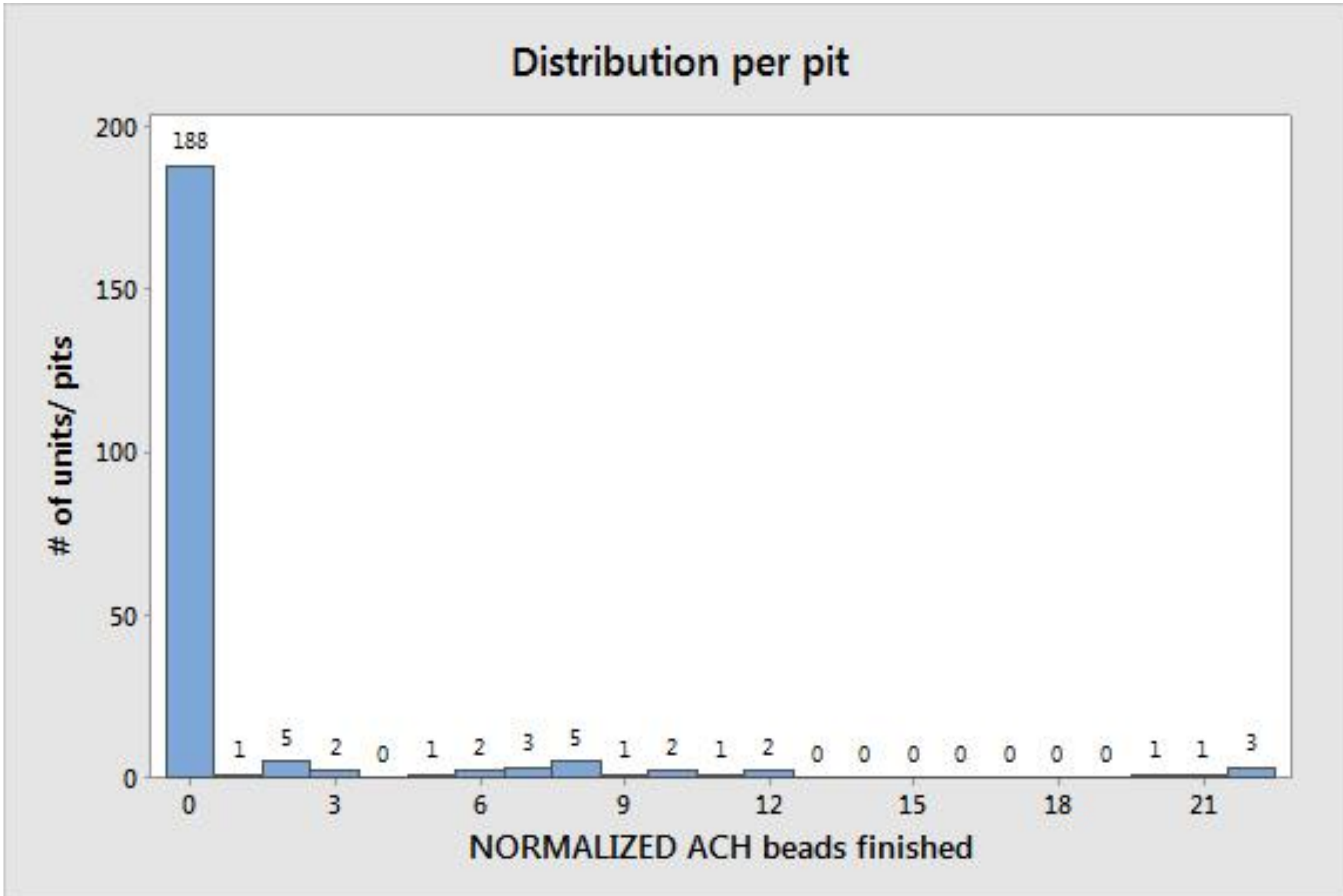

Figure 98 Achatina finished per pit, count, standardized

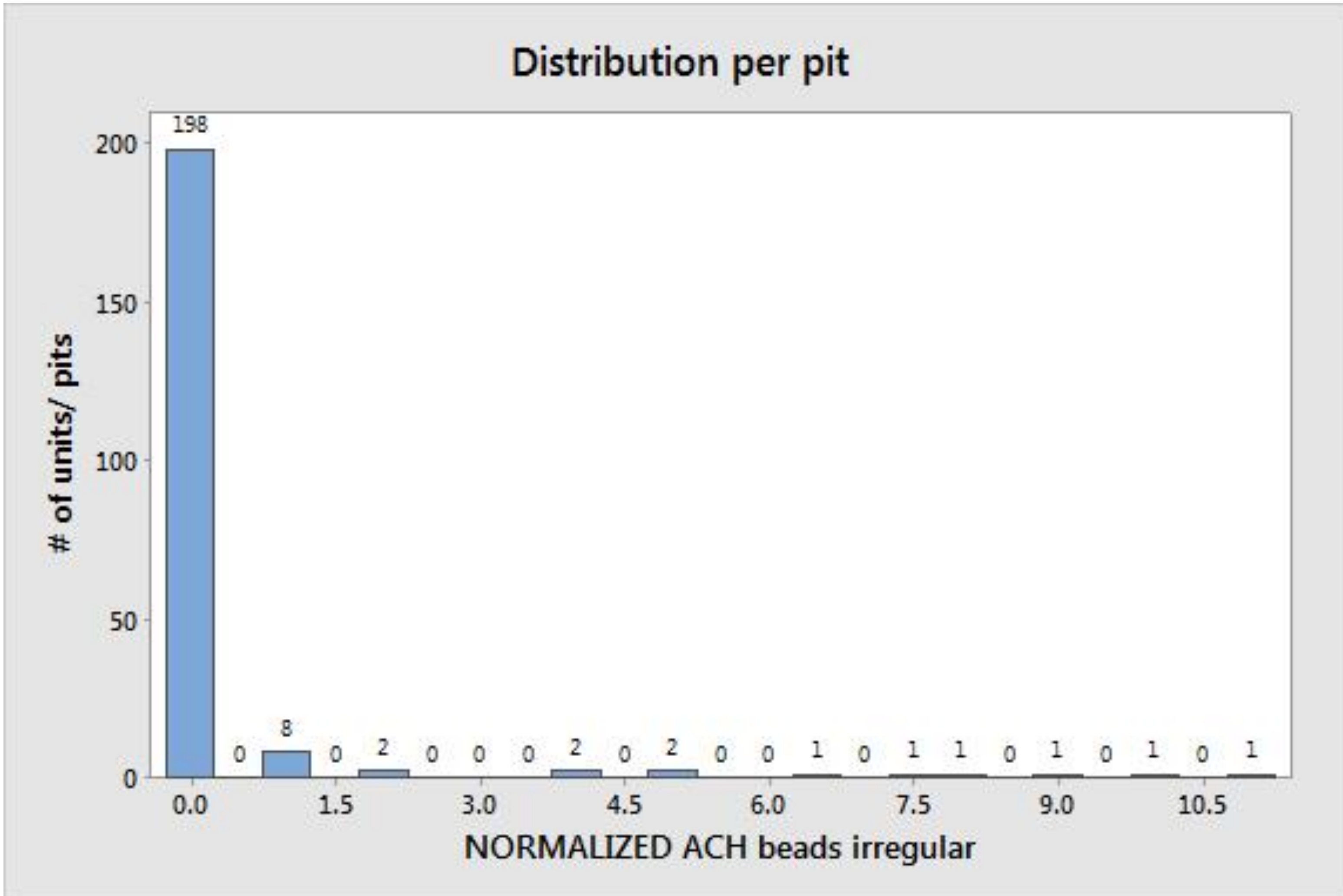

Figure 99 Achatina irregular per pit, count, standardized

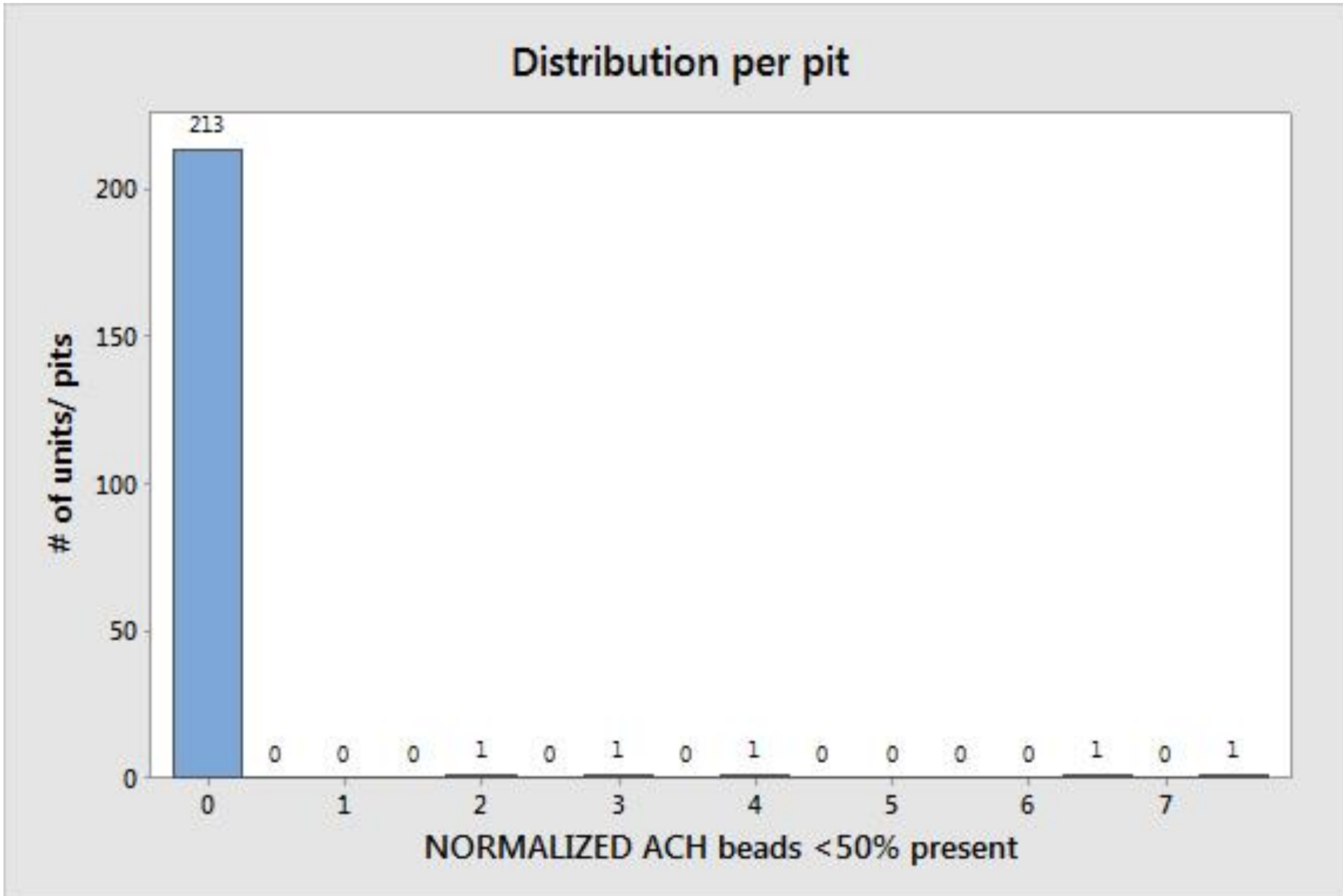

Figure 100 Achatina <50% per pit, count, standardized

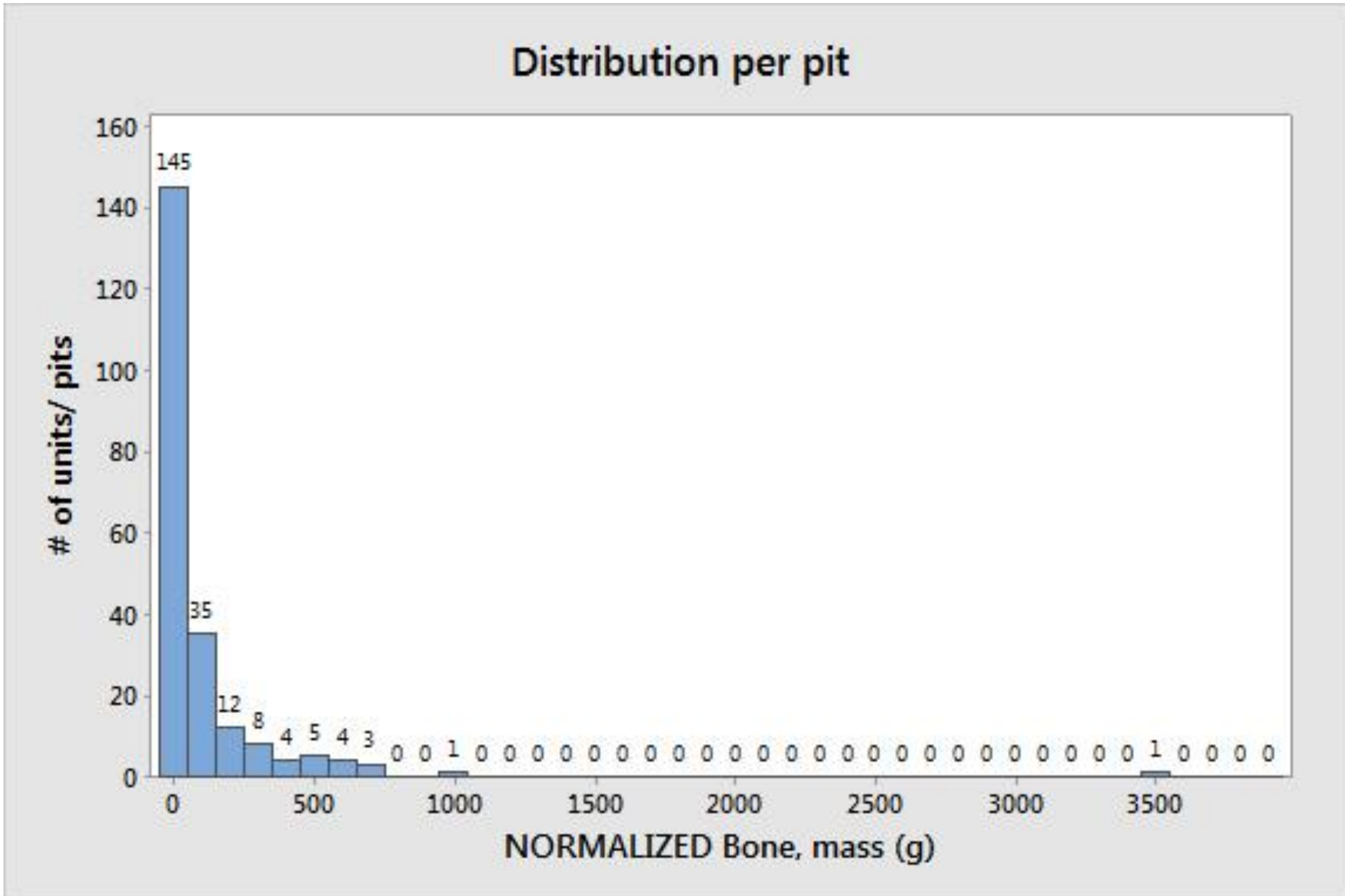

Figure 101 Bone per pit, mass, standardized

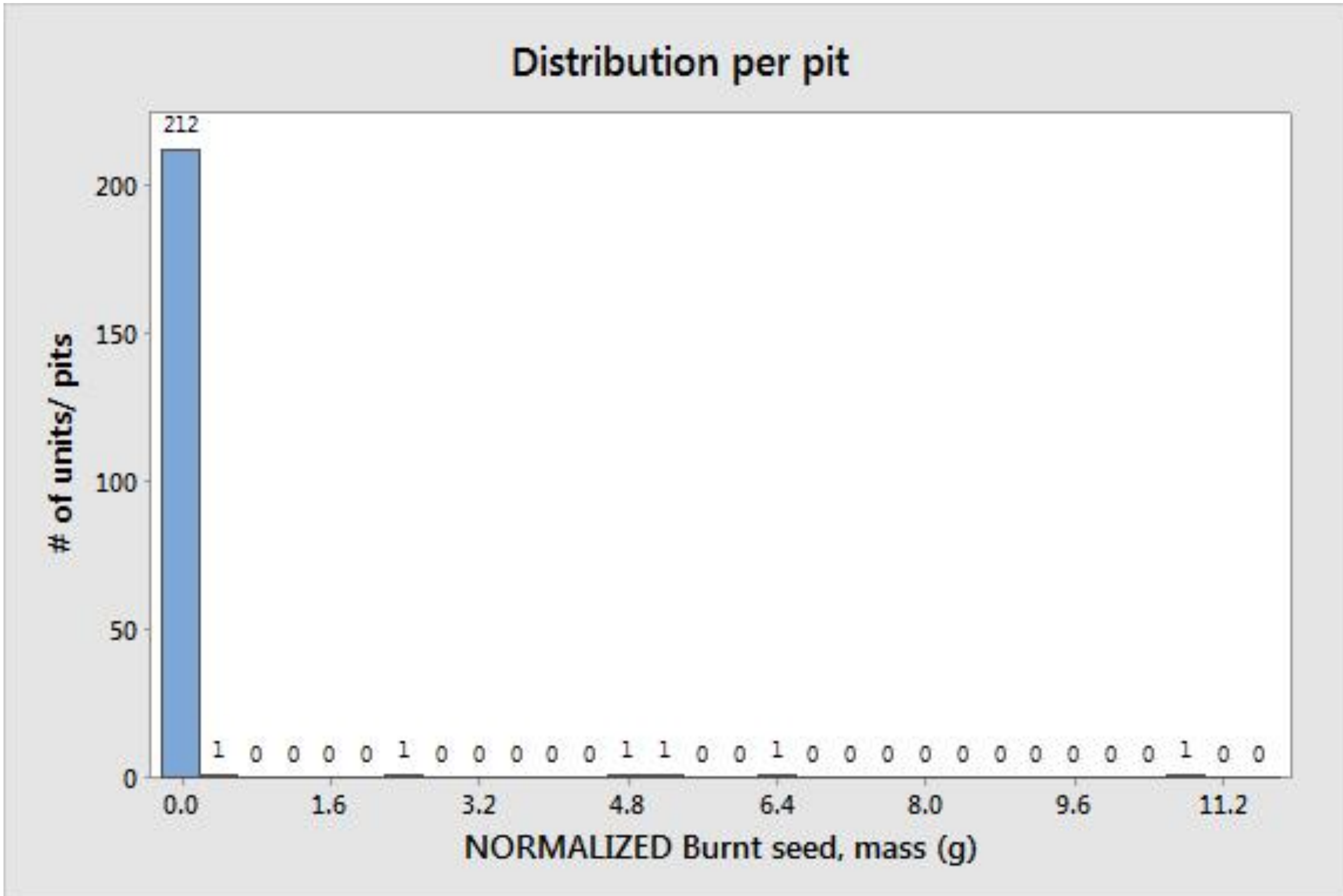

Figure 102 Burnt seed per pit, mass, standardized

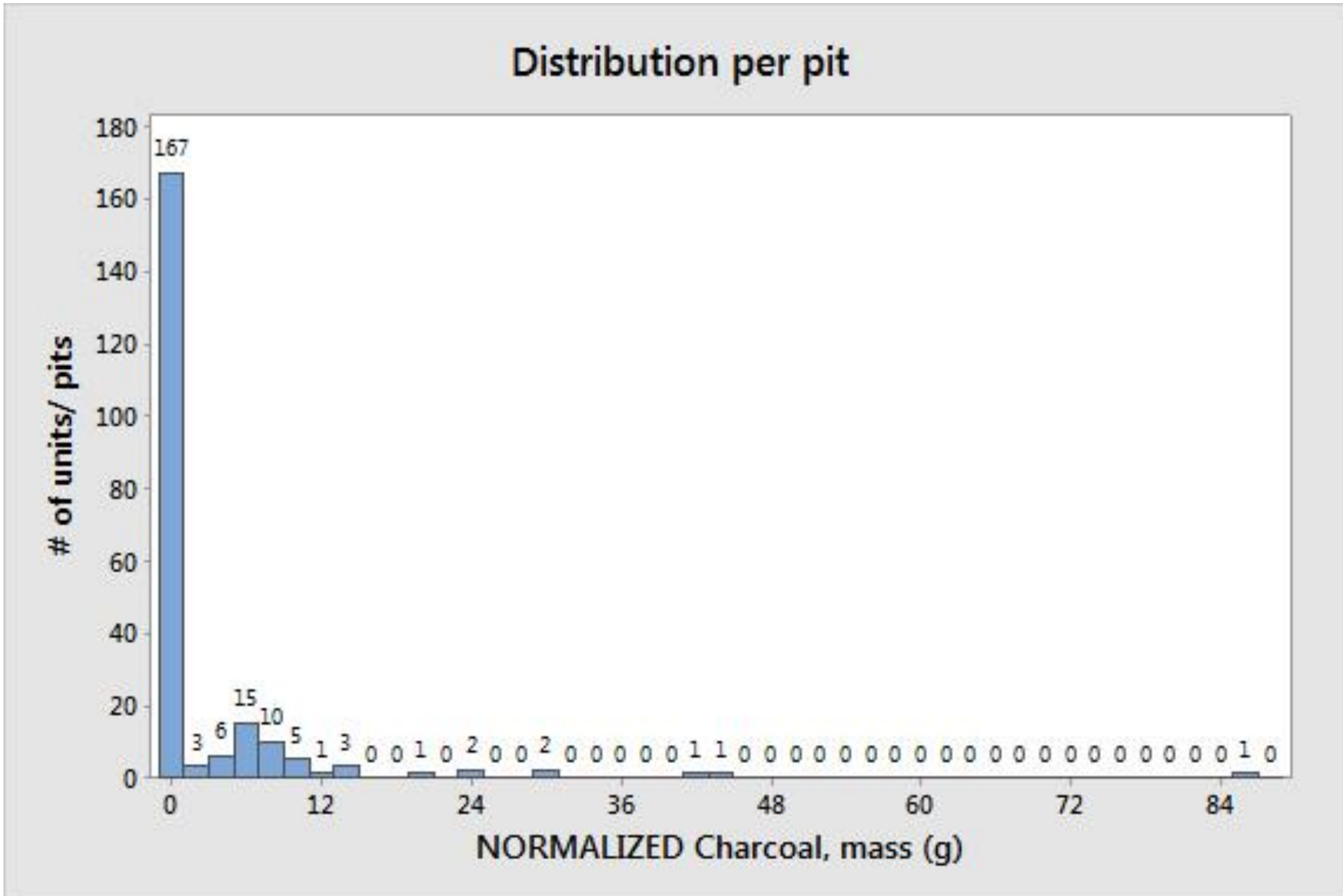

Figure 103 Charcoal per pit, mass, standardized

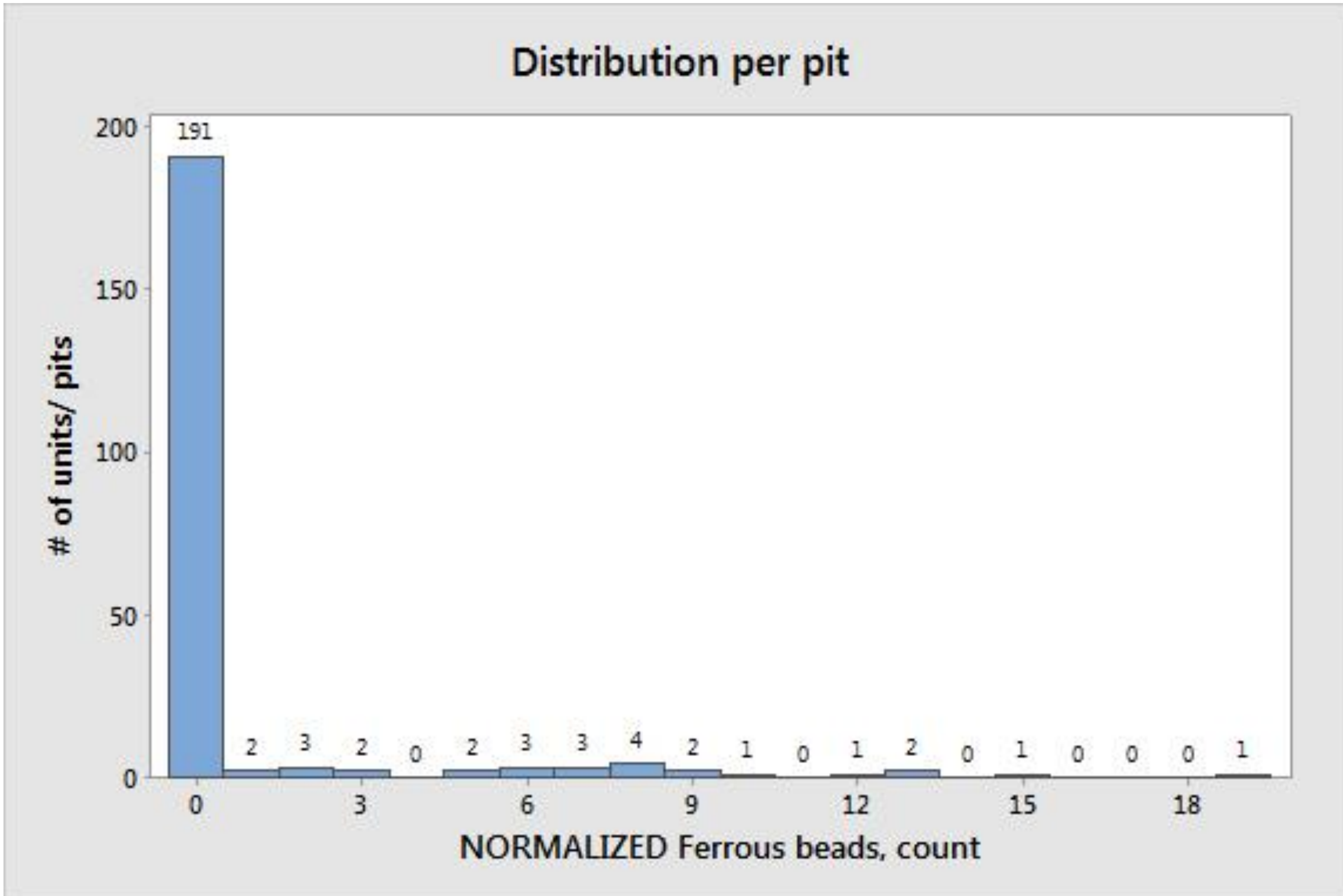

Figure 104 Ferrous beads per pit, count, standardized

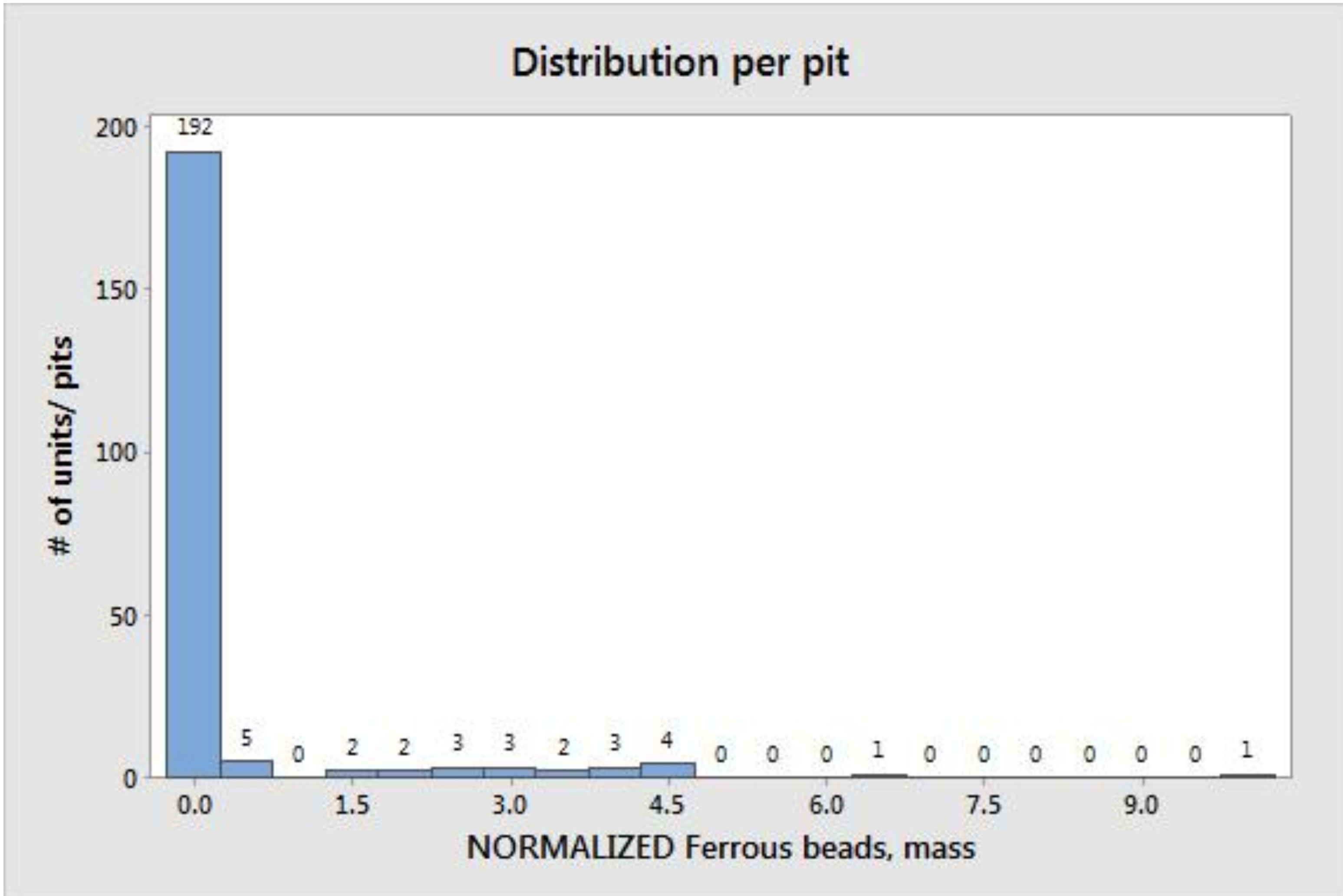

Figure 105 Ferrous beads per pit, mass, standardized

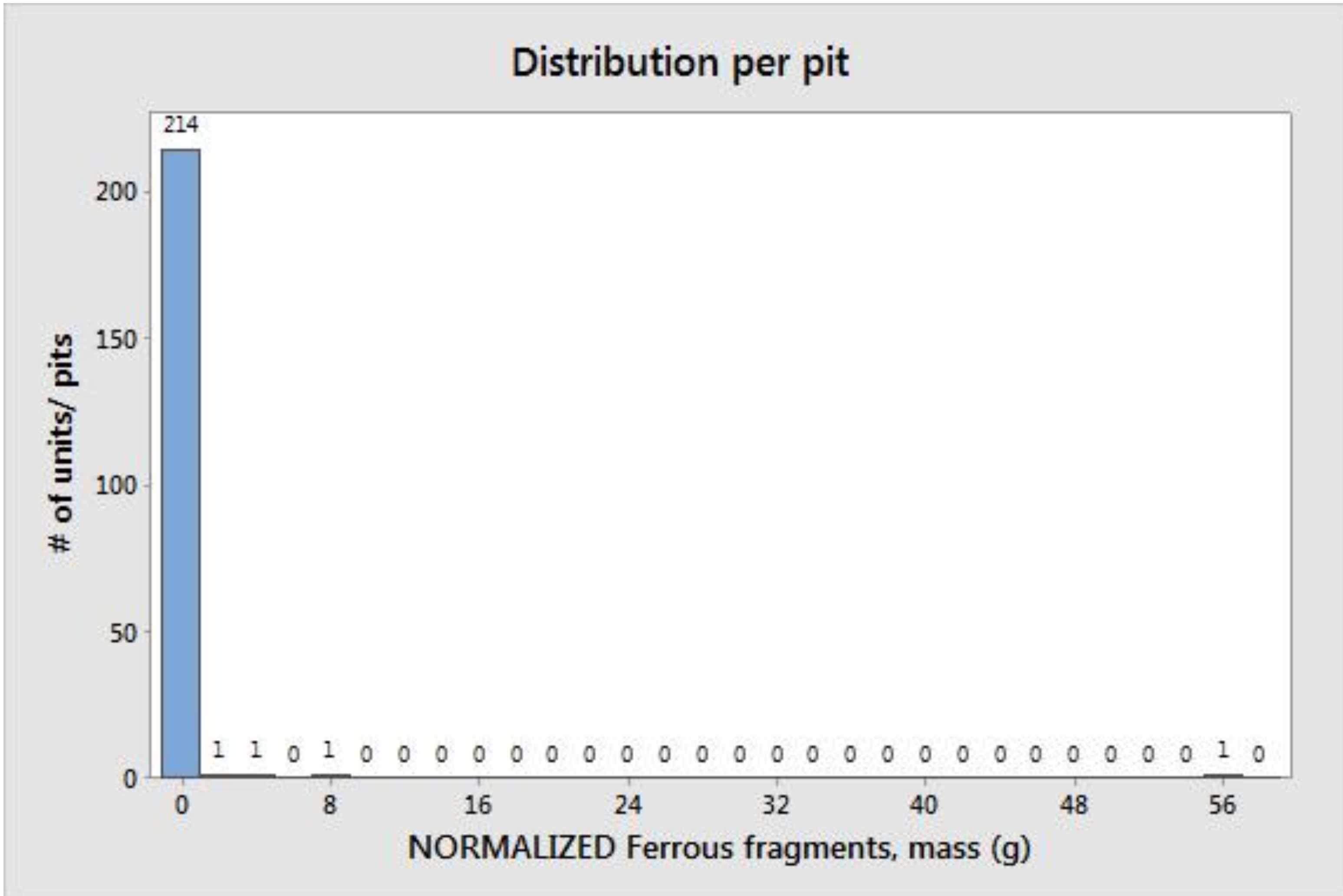

Figure 106 Ferrous fragments per pit, mass, standardized

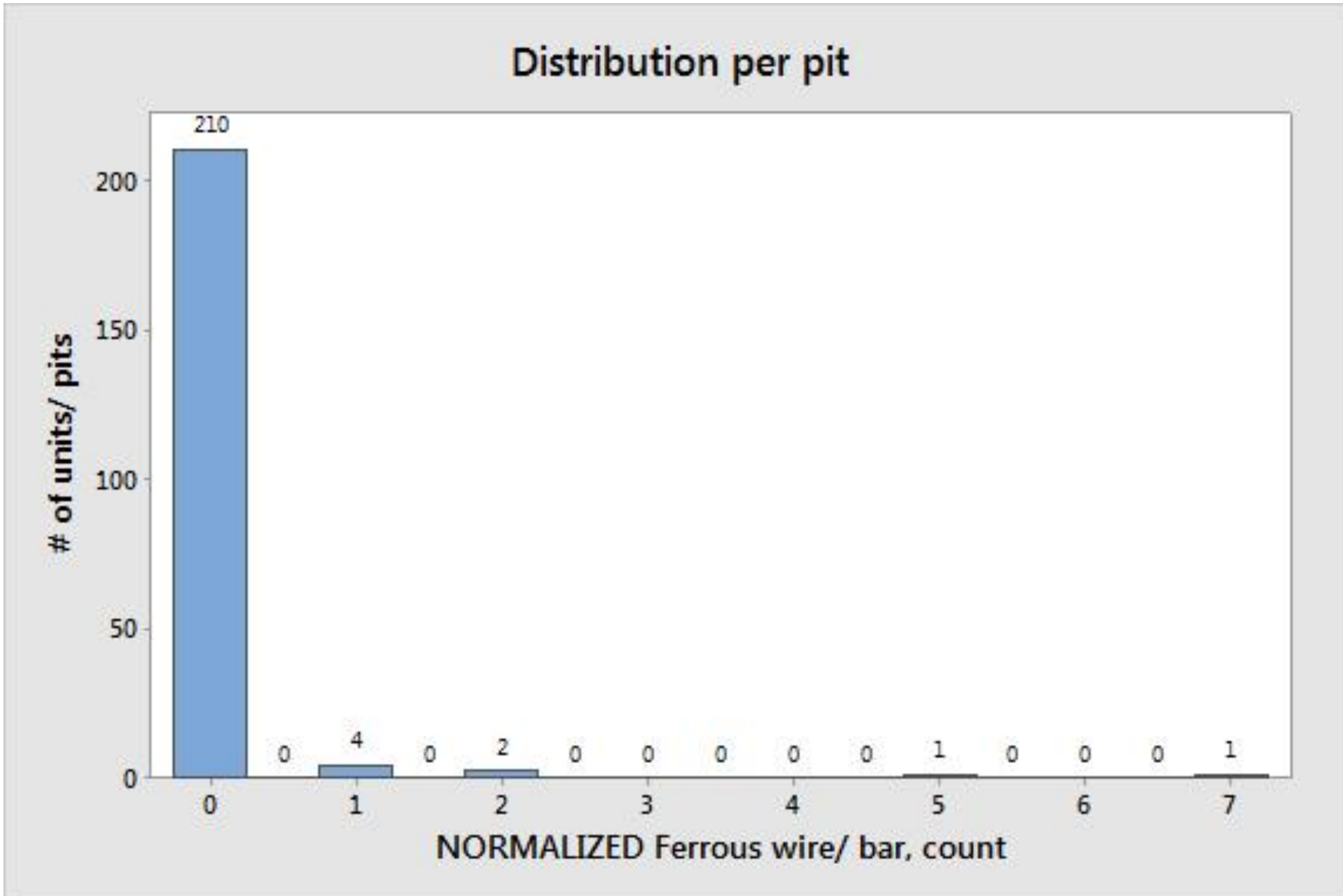

Figure 107 Ferrous wire per pit, count, standardized

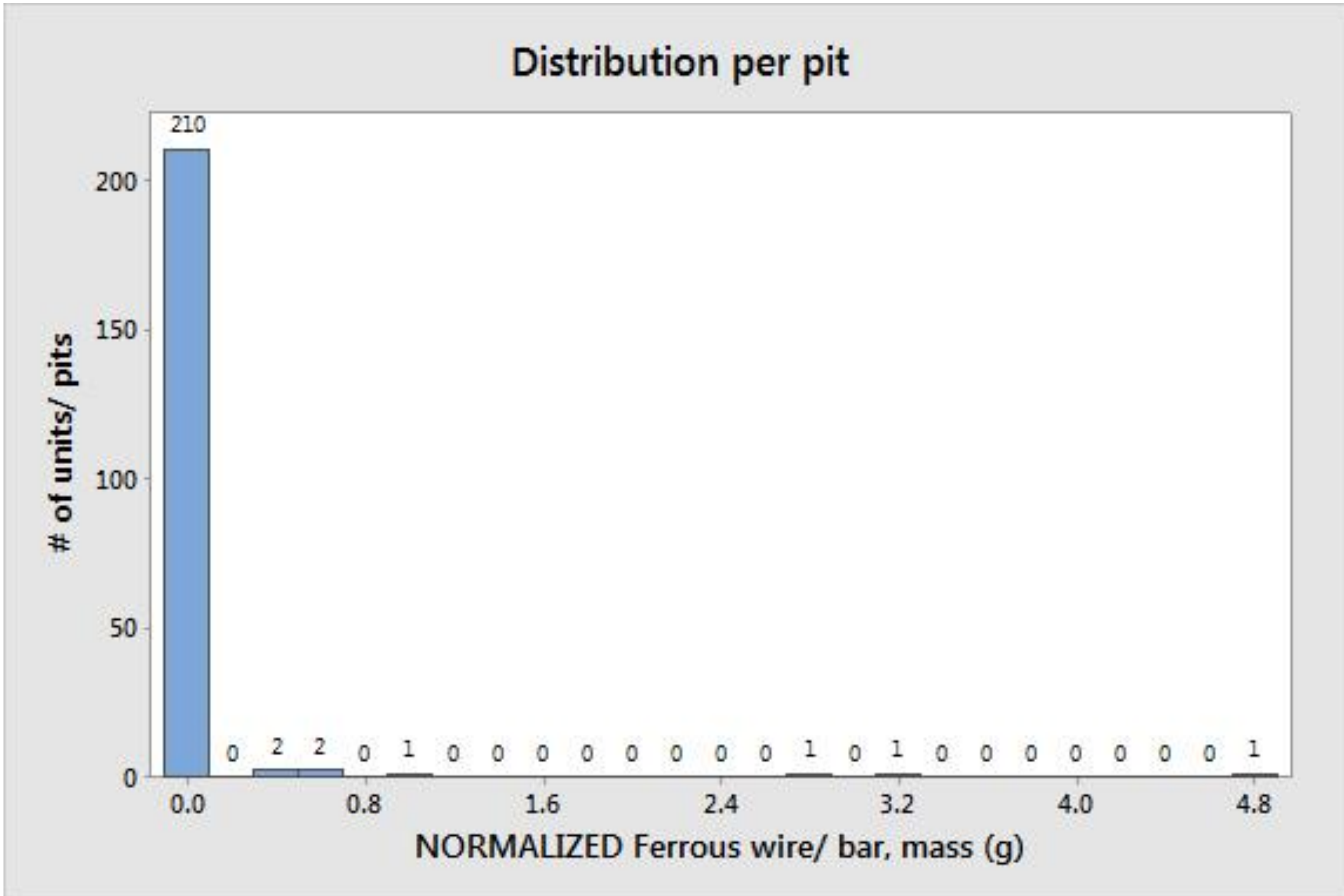

Figure 108 Ferrous wire per pit, mass, standardized

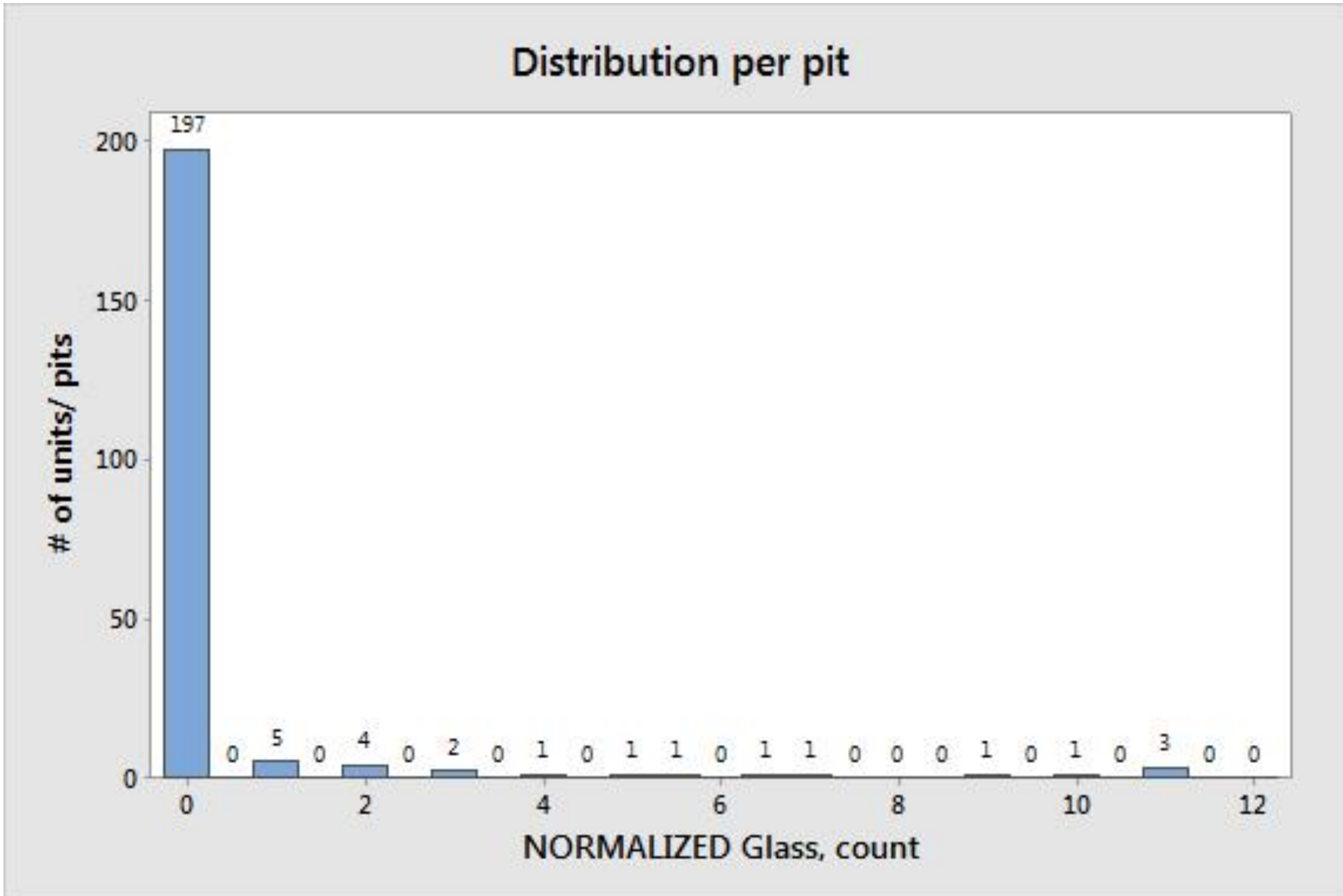

Figure 109 Glass per pit, count, standardized

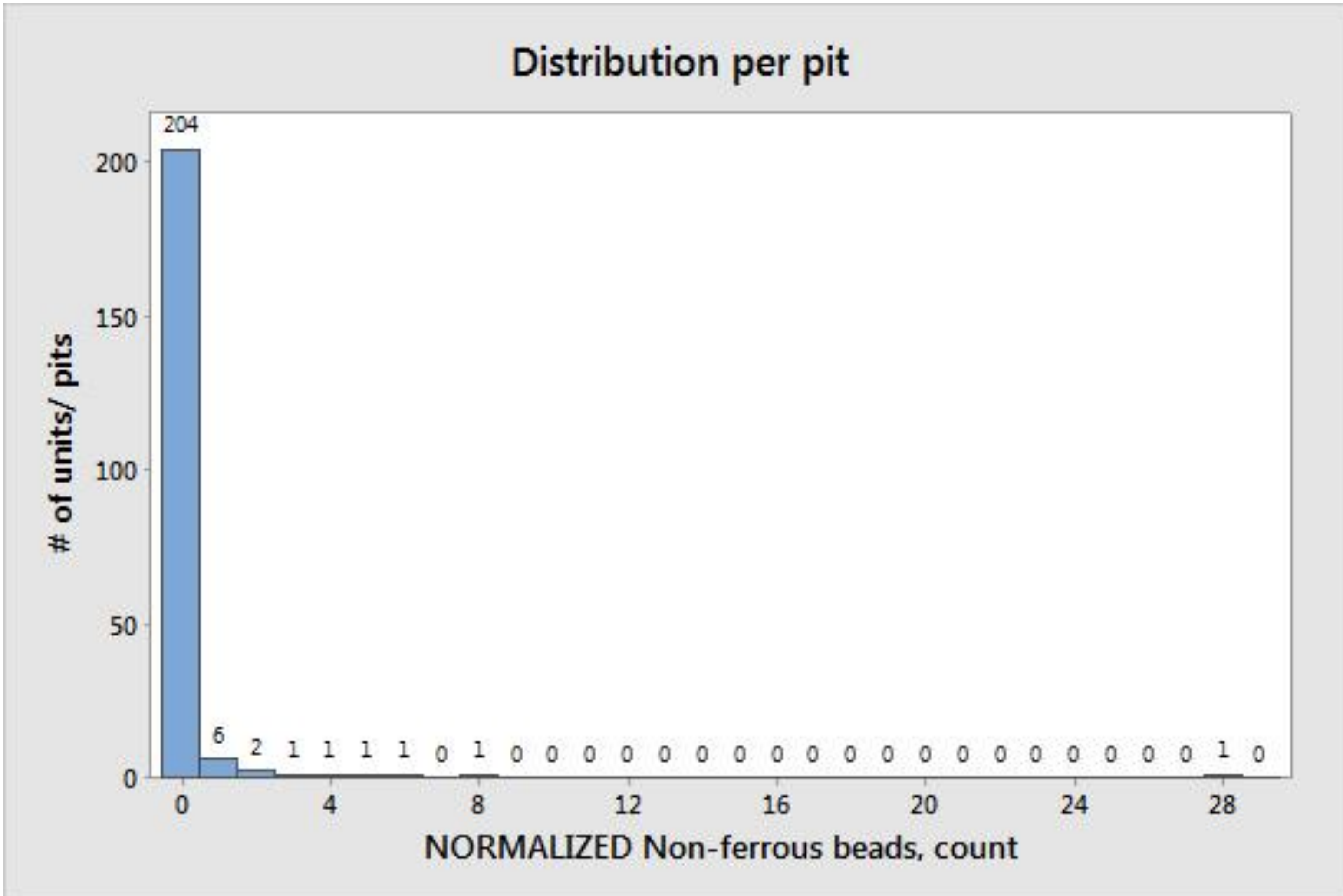

Figure 110 Non-ferrous beads per pit, count, standardized

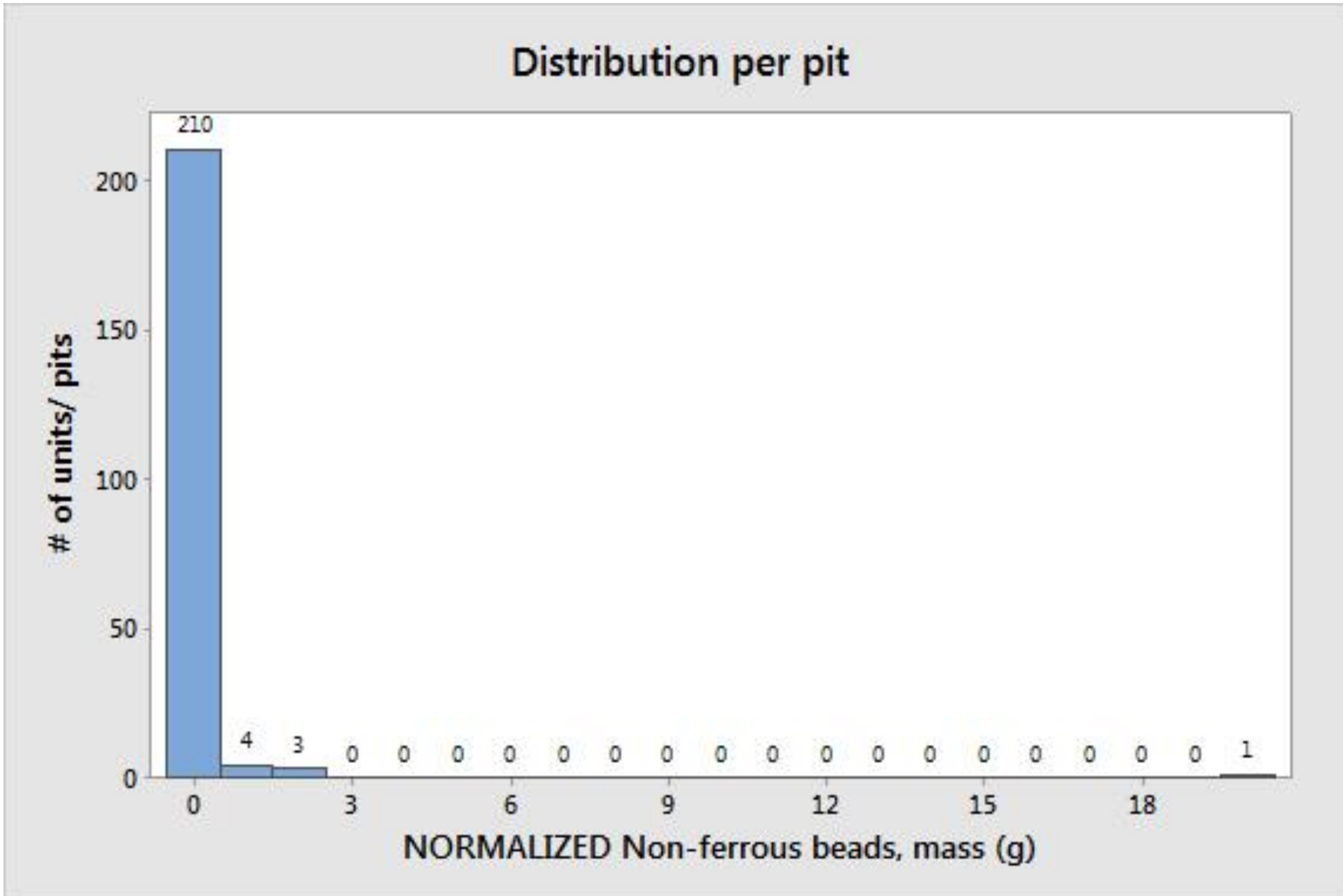

Figure 111 Non-ferrous beads per pit, mass, standardized

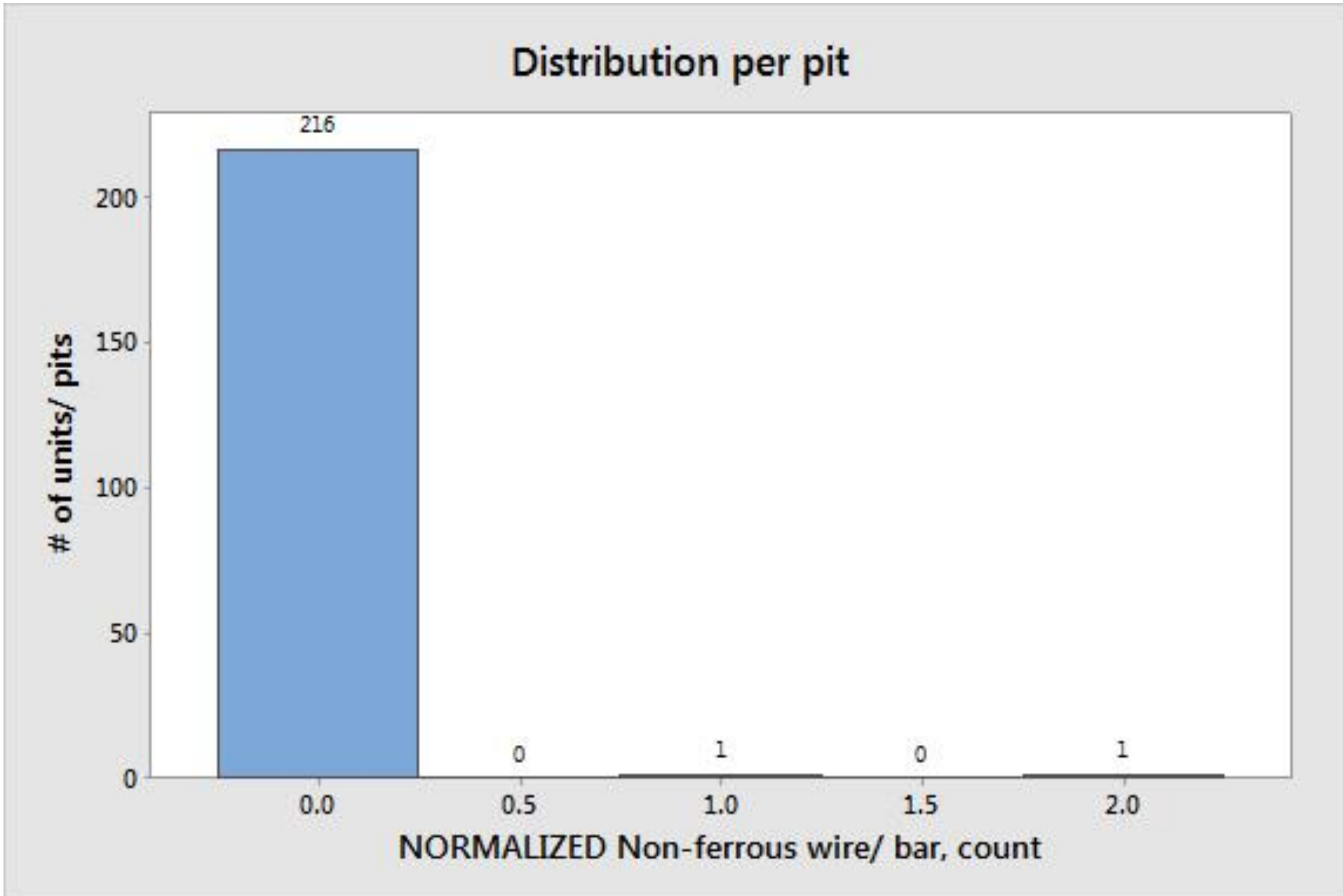

Figure 112 Non-ferrous wire per pit, count, standardized

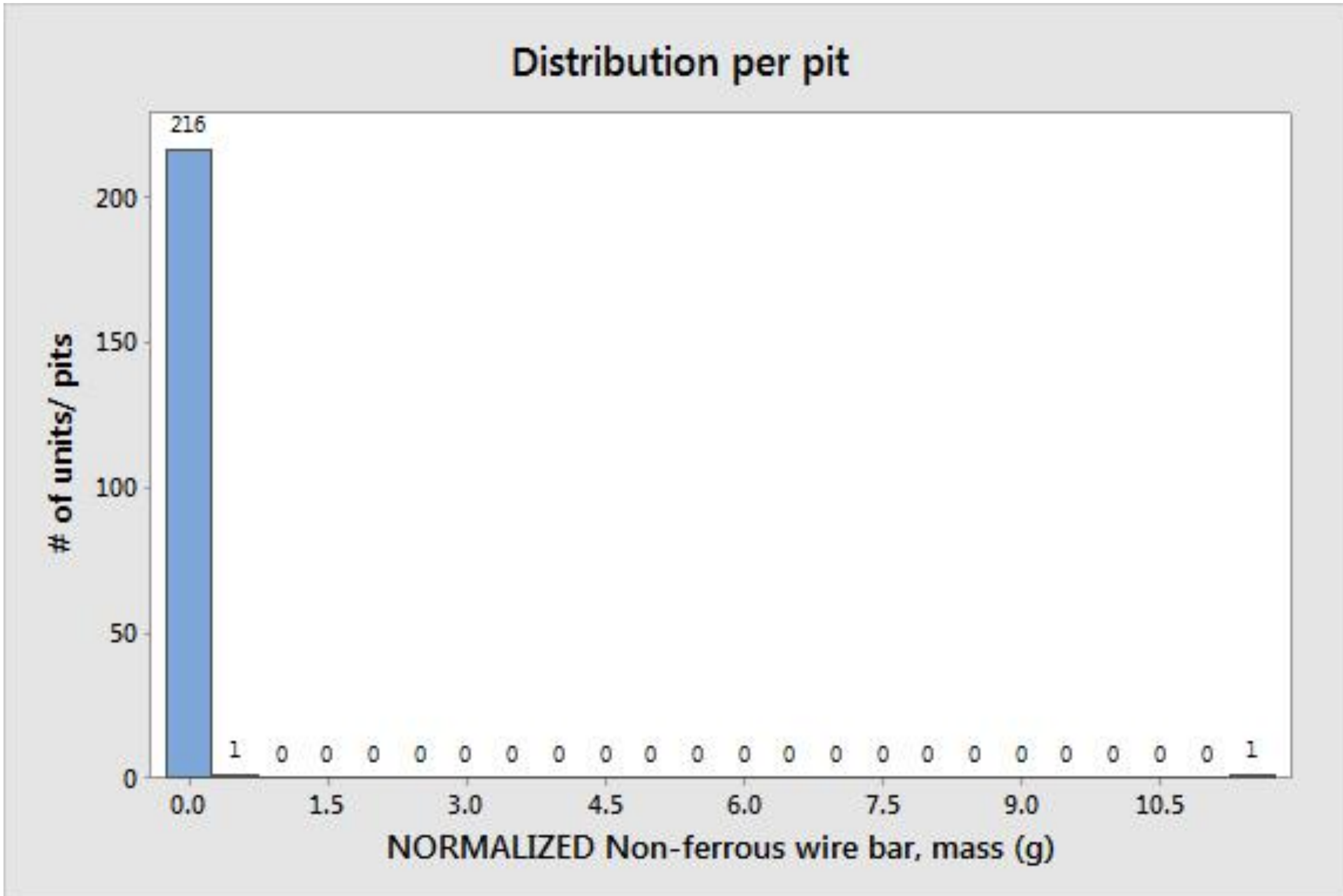

Figure 113 Non-ferrous wire per pit, mass, standardized

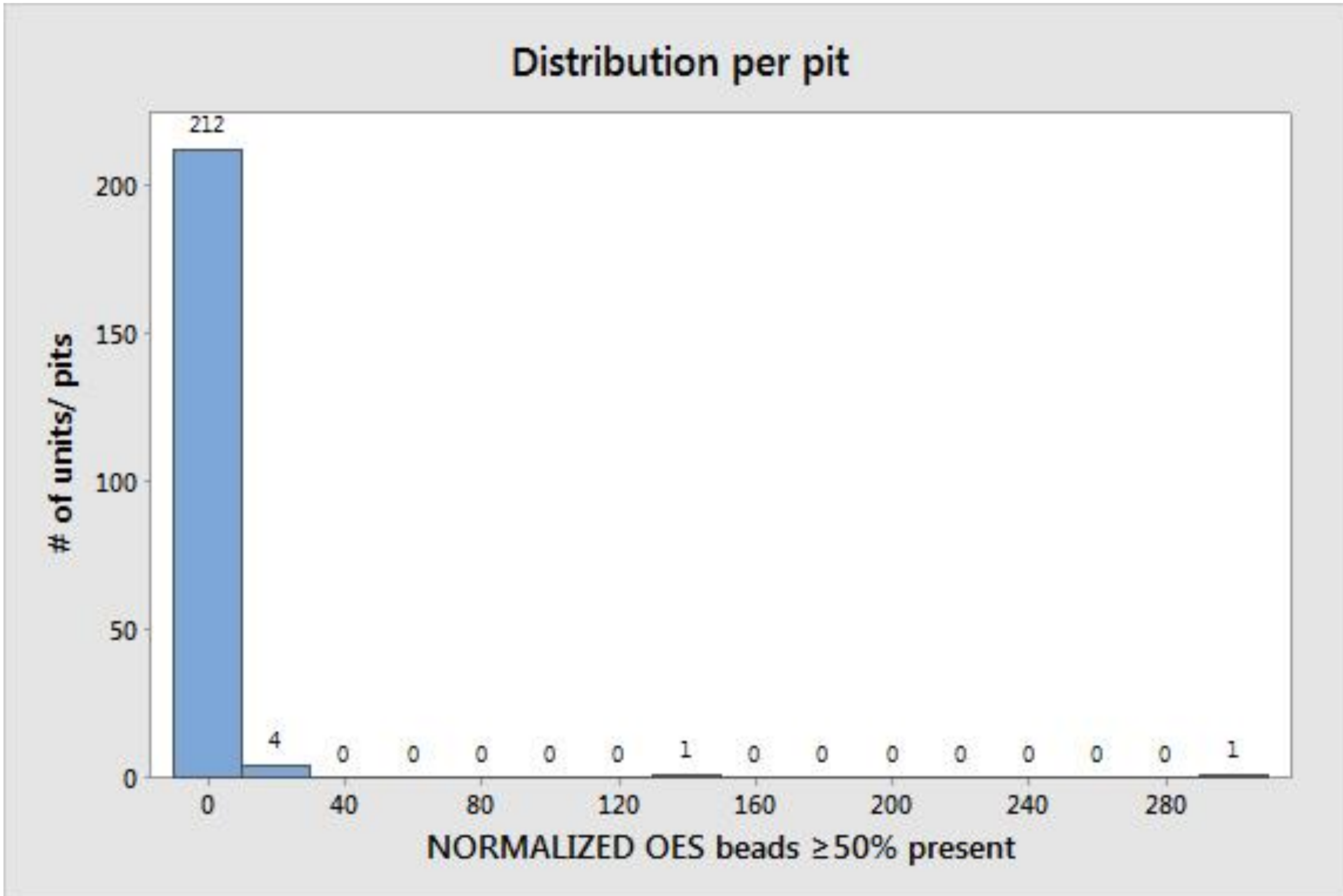

Figure 114 OES beads >50% per pit, count, standardized

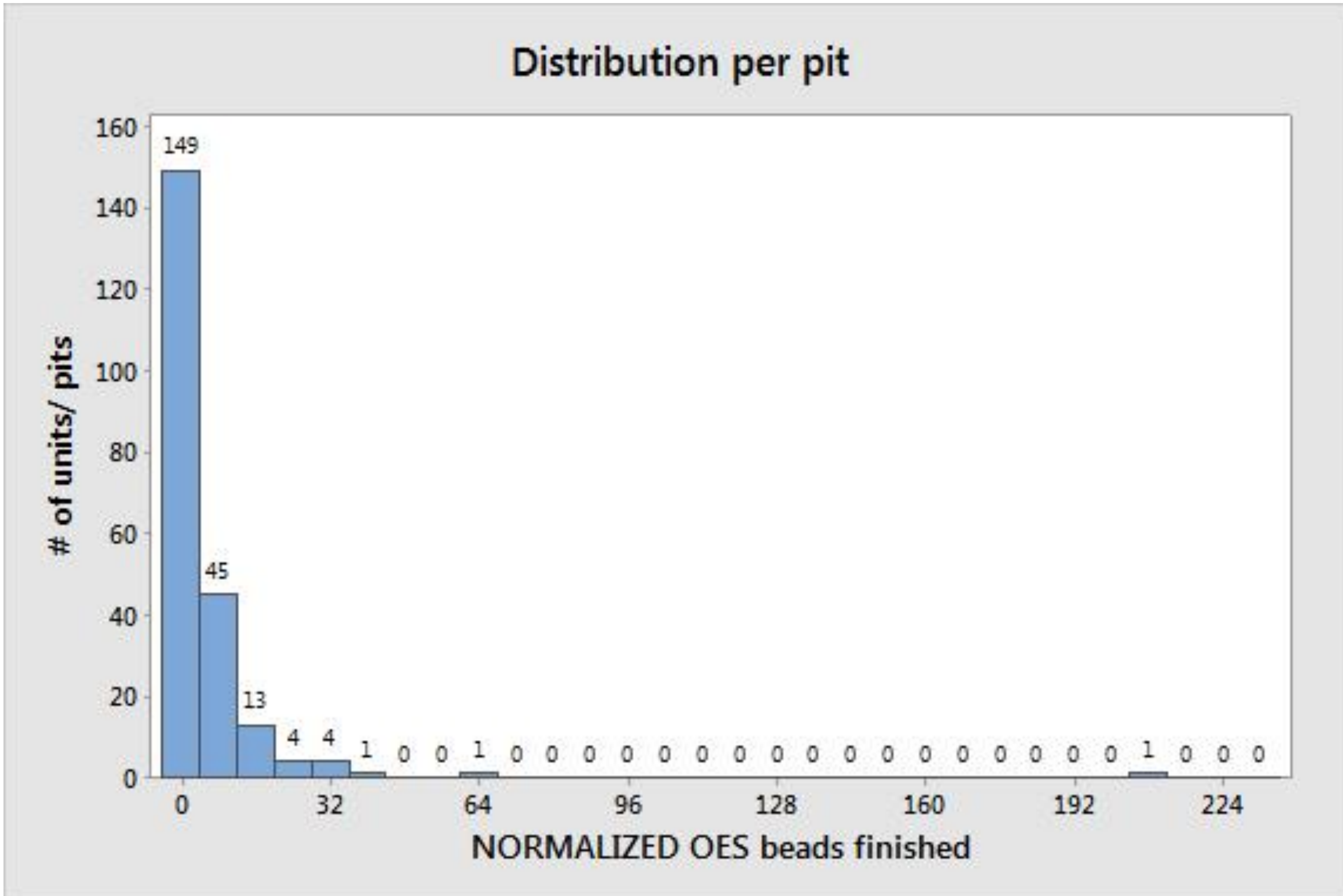

Figure 115 OES beads finished per pit, count, standardized

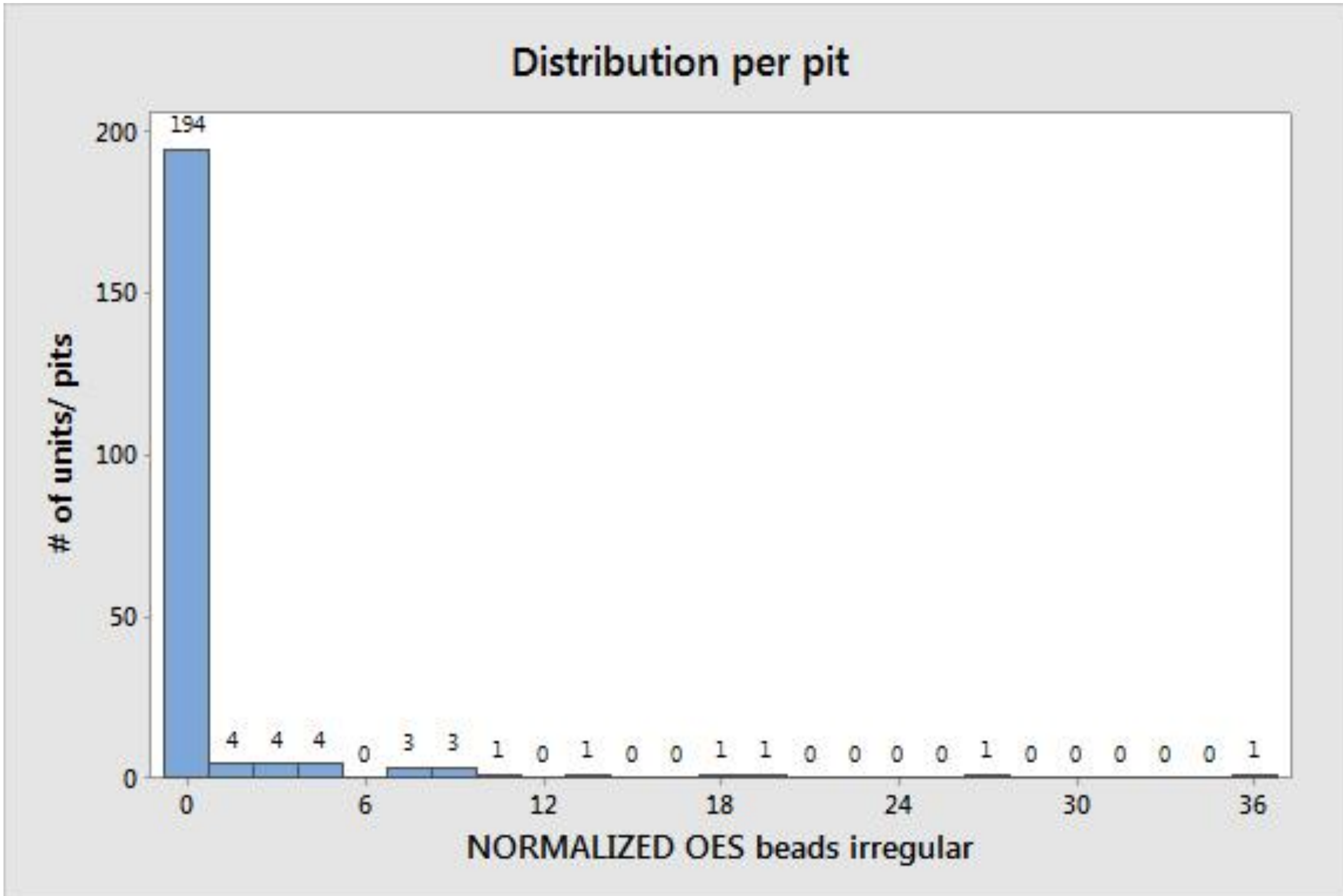

Figure 116 OES beads irregular per pit, count, standardized

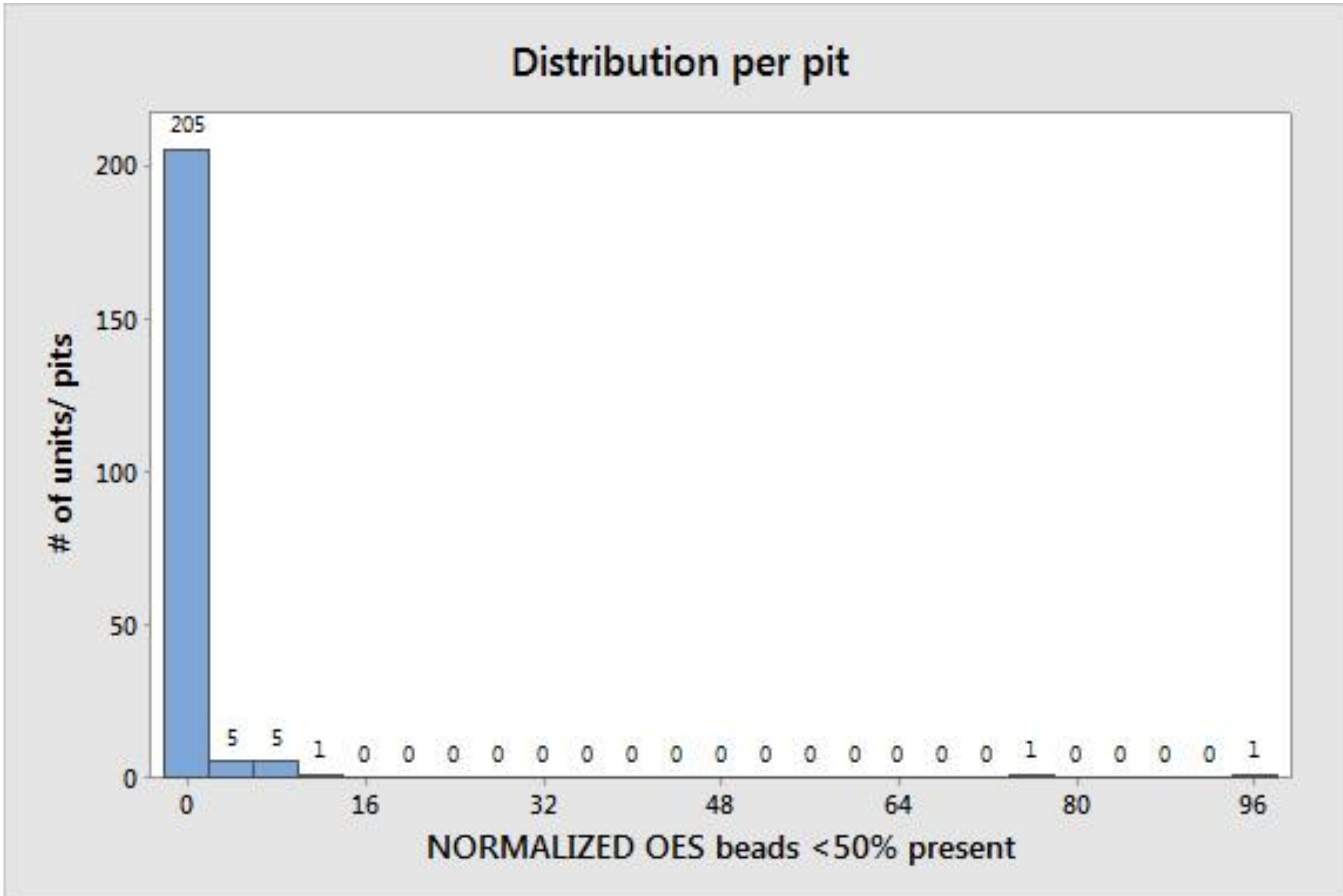

Figure 117 OES beads <50% per pit, standardized

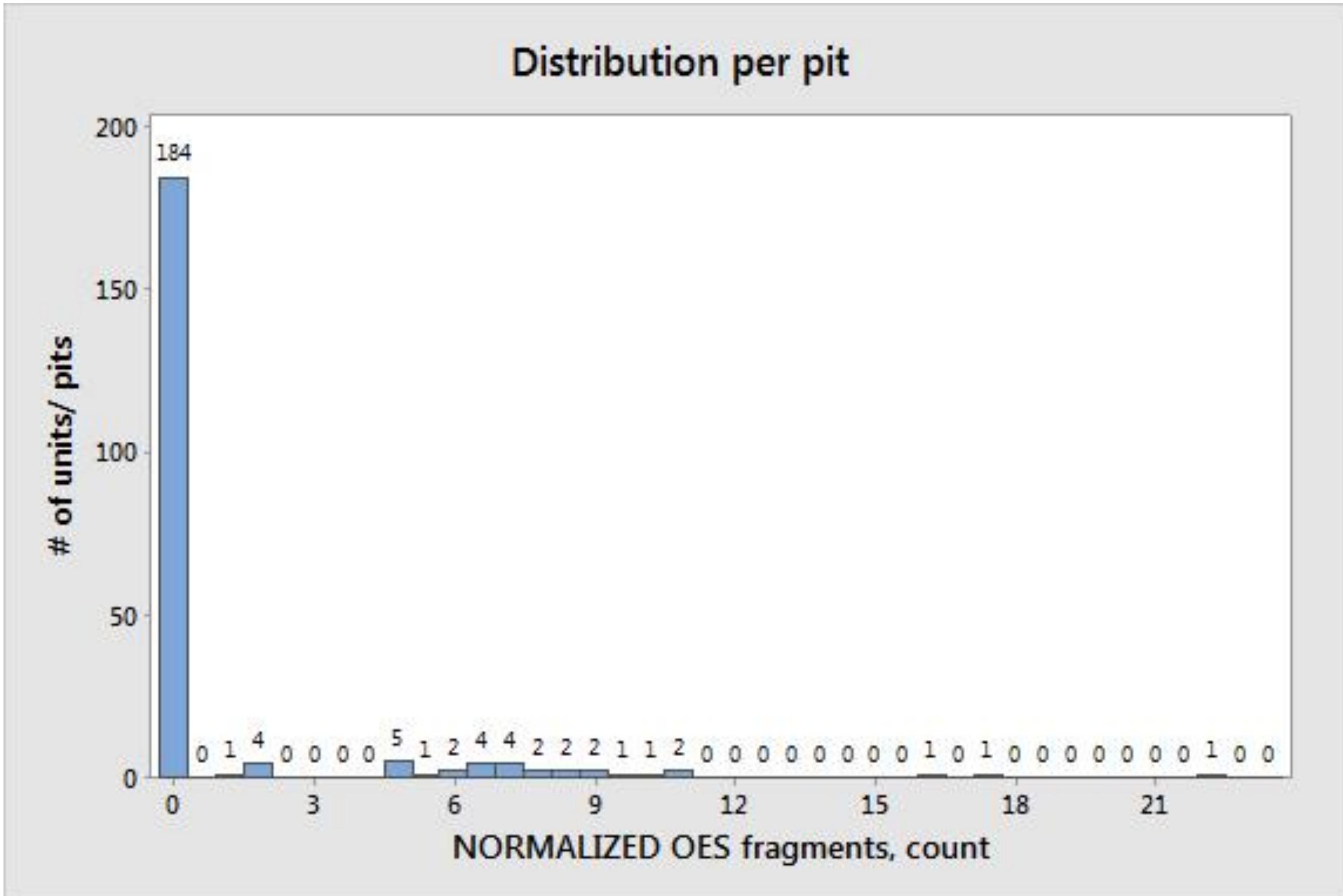

Figure 118 OES fragments per pit, count, standardized

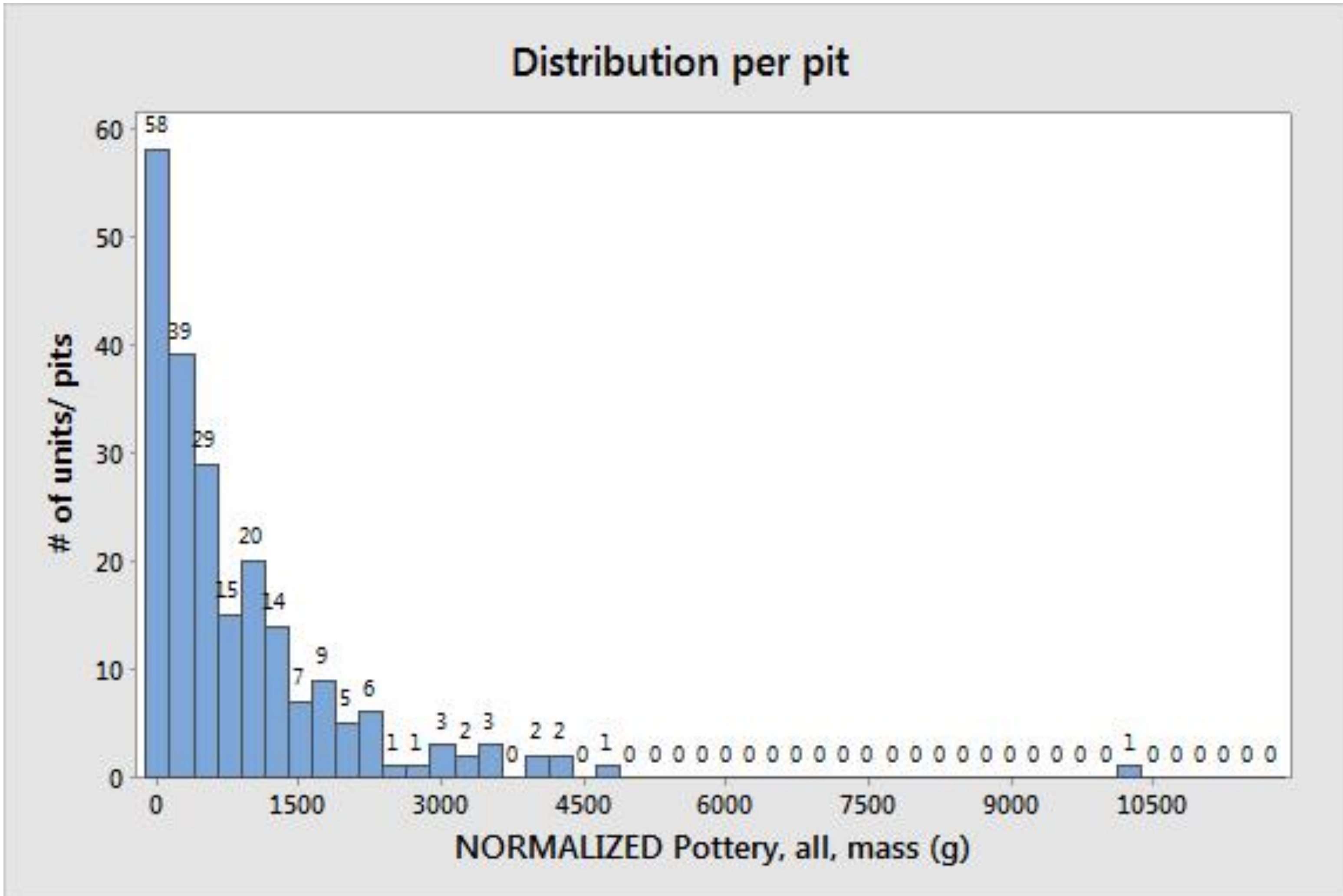

Figure 119 Pottery per pit, mass, standardized

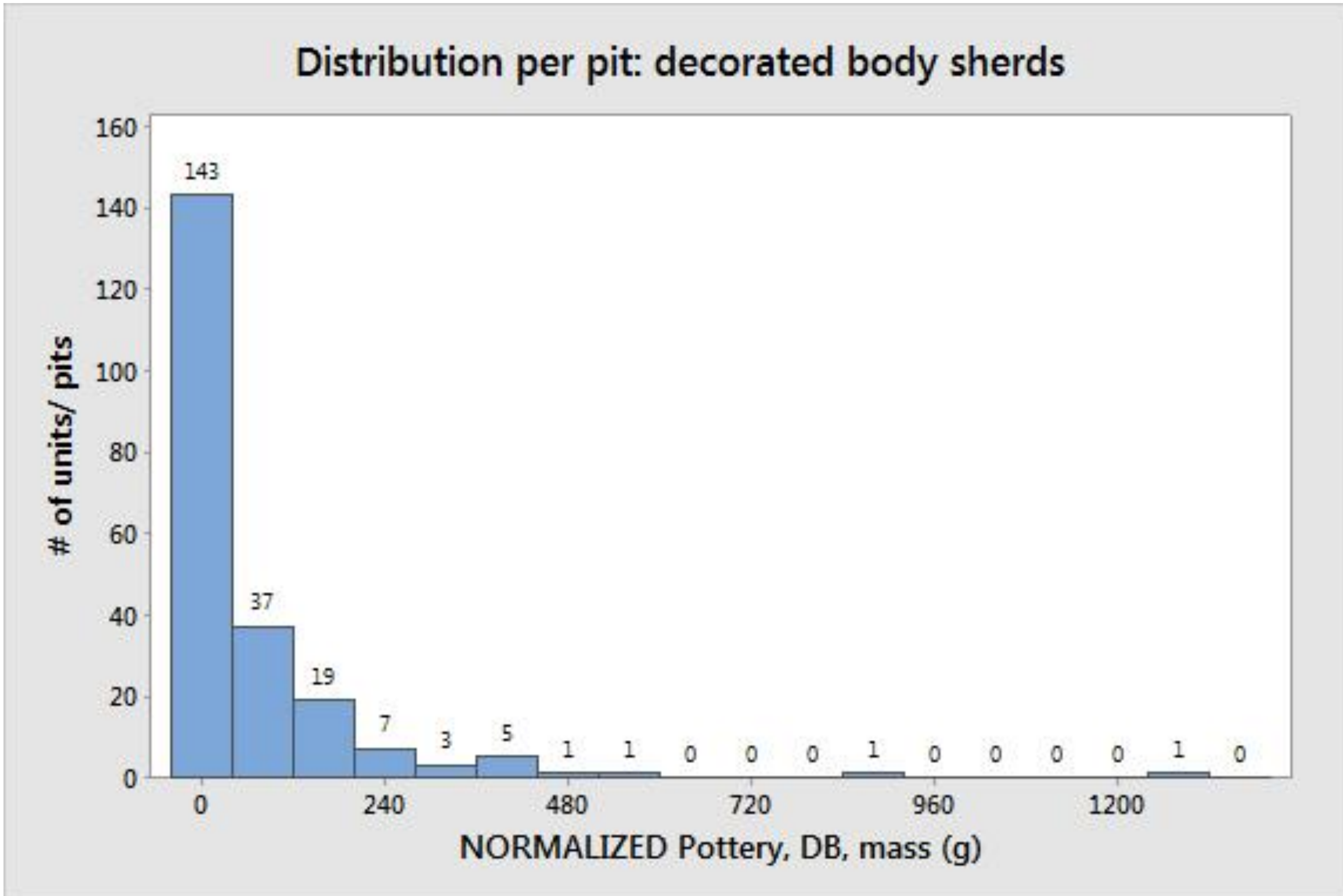

Figure 120 Decorated body sherds per pit, mass, standardized

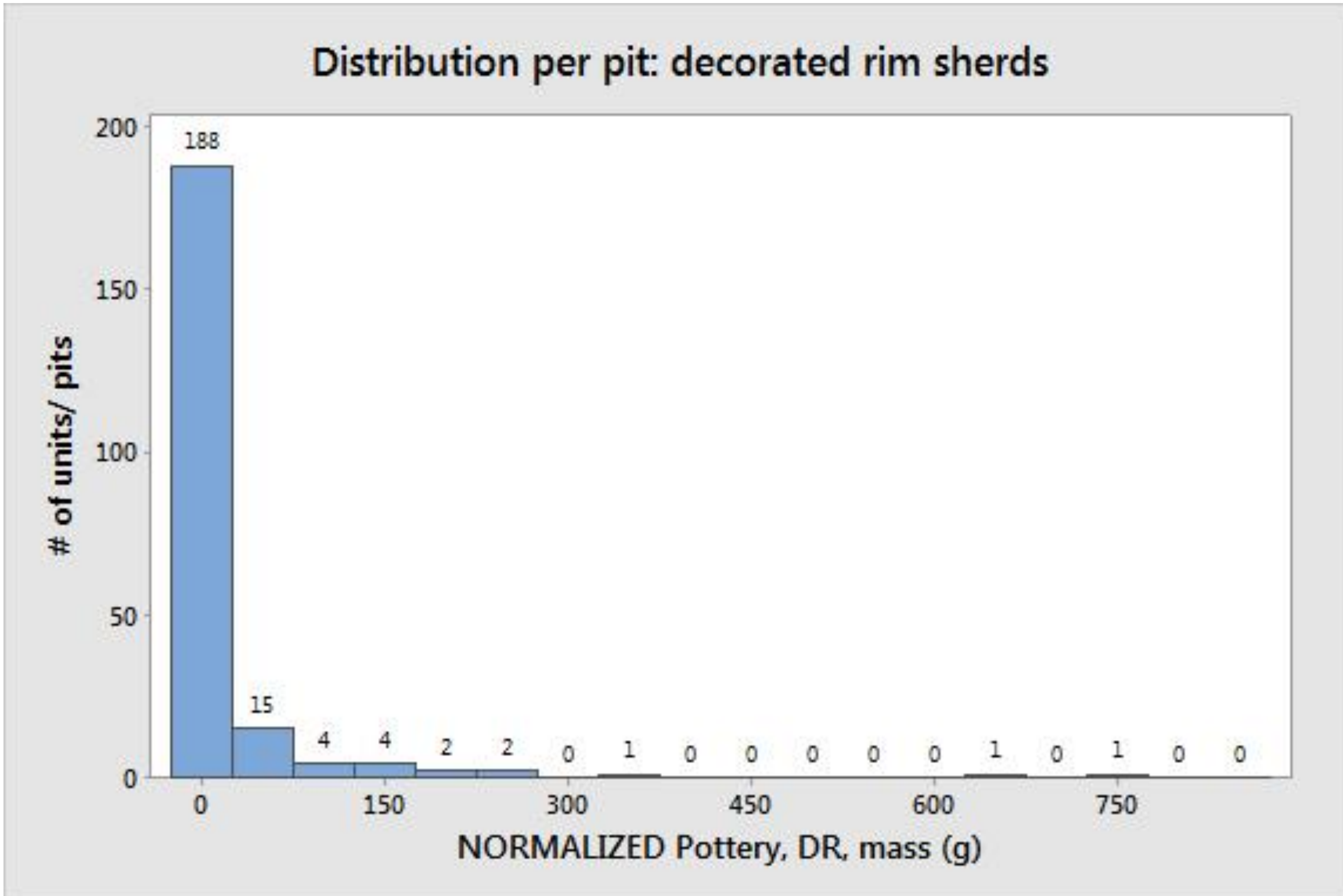

Figure 121 Decorated rim sherds per pit, mass, standardized

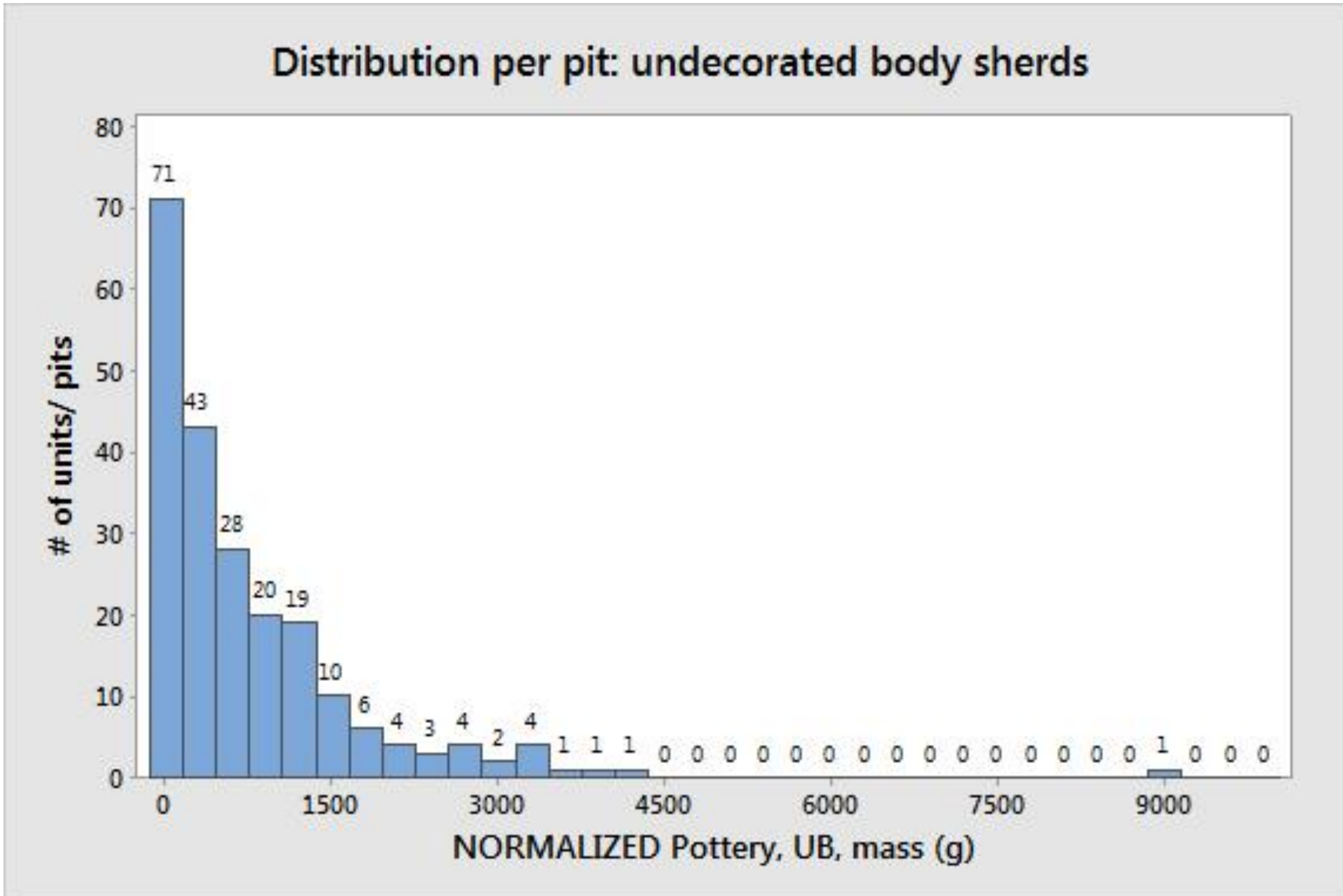

Figure 122 Undecorated body sherds per pit, mass, standardized

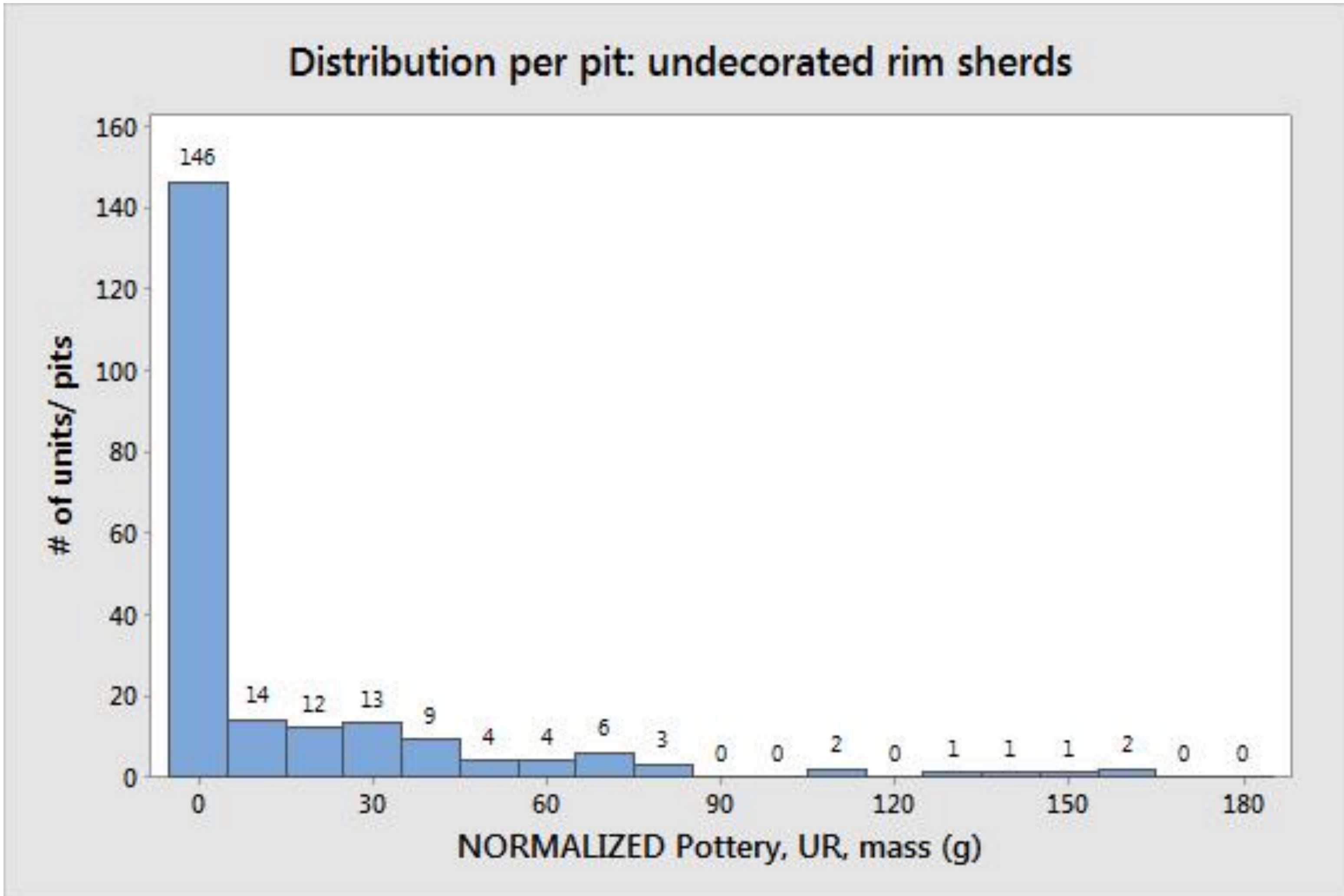

Figure 123 Undecorated rim sherds per pit, mass, standardized

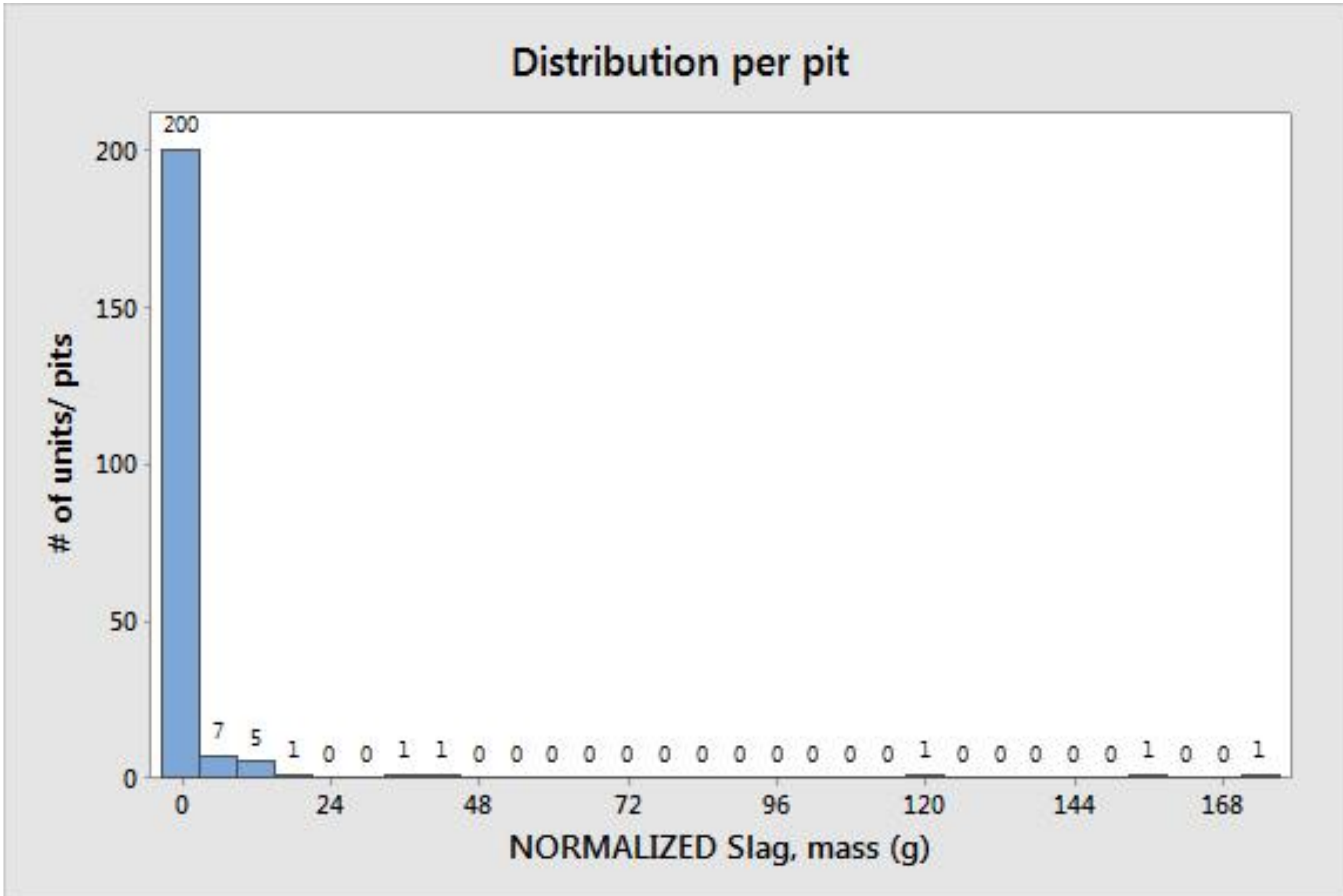

Figure 124 Slag per pit, mass, standardized

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