# THE SALT OF BALENI:
# AN ARCHAEOLOGICAL INVESTIGATION INTO THE ORGANIZATION OF PRODUCTION DURING THE EARLY IRON AGE OF SOUTH AFRICA

Alexander Antonites

A Dissertation submitted to the Faculty of Humanities, University of Pretoria,
for the degree of Magister Artium (Archaeology)

Pretoria 2005

ABSTRACT

The study elucidates the character of salt production during the Early Iron Age of South Africa in terms of the context, concentration and intensity of production. The focus is on the organization of production activities at the Baleni geothermal spring by communities associated with the Kwale ceramic tradition.

Ethnographic, archaeological and historical accounts of salt production activities in Africa provide a comparative body of knowledge to weigh against the archaeological data from Baleni.

Archaeological salt production activities at Baleni is concentrated around the Baleni spring and associated swamp. Prehistoric salt production is characterised by artificial earthen mounds that contain production debris. Excavations of these mounds uncovered evidence comparable to the ethnographic and historical accounts. Salt producers at Baleni collected the salt crust around the swamp after which it was placed in a basket type filter and leached with water to produce brine. The last production step was to reduce brine over an open fire at the saltworking site.

Surveys around the swamp identified two Early Iron Age settlements. These sites were atypical and did not contain features normally associated with Early Iron Age settlements. Excavations indicate that they were temporary encampments within which salt production took place.

Salt production ceramic assemblages are characterised by the limited use of vessel types and a high variability in vessel sizes. The majority of pots also display signs of interior pitting due to the caustic nature of the brine. The Baleni assemblages are very similar to assemblages from contemporary Early Iron Age settlements. The data suggests that salt production during the Early Iron Age did not make use of specialised tools.

The unspecialised production tools, small groups of producers and the seemingly small scale of production indicate a general theme of low capital investment, which is consistent with salt being produced by independent specialists. EIA salt producers at Baleni were not concentrated within a single community, but spread throughout the immediate consumer population. The inexpensive methods of salt production lend support to a view of salt production as a low intensity and part-time or seasonal activity.

**Keywords:**

Baleni, salt, production, organization of production, Early Iron Age, Mzonjani, Kwale, ceramic, use-wear, independent producers, Lowveld, South Africa, archaeology

# OPSOMMING

Die studie analiseer sout produksie gedurende die Vroeë Yster Tydperk van Suid Afrika in terme van die konteks, konsentrasie en intensitiet van produksie. Die fokus is op die organiseering van produksie aktiwiteite rondom die Baleni warmwaterbron deur gemeenskappe wat geassosieer word met die Kwale potwerk tradisie.

Etnografiese, argeologiese en historiese bronne wat sout produksie in Afrika beskryf, word gebruik as vergelykende gegewens om die argeologiese data van Baleni te interpreteer.

Argeologiese sout produksie aktiwiteite by Baleni is gekonsentreerd rondom die warmwater fontein en die vlei waarin dit vloei. Prehistoriese sout produksie word gekenmerk deur mens gemaakte grondhope. Opgrawings van die hope bewys dat argeologiese sout produksie metodes, vereglyk kan word met historiese en etnografiese beskrywings van soortgelyke prosesse. Soutmakers by Baleni het die sout kors wat rondon die waterlyn van die vlei vorm bymekaar gemaak. Die kors is daarna in 'n mandjie-tipe filtreerder geplaas en gedelg met water om soutwater te maak. Die laaste stap was om die soutwater tot sout te reduseer in 'n kleipot oor 'n oop vuur.

Verkenning rondom die vlei het twee Vroeë Yster Tydperk nedersettings geïdentifiseer. Die terreine het geen van die kenmerke wat gewoonlik met kontemporêre nedersettings van hierdie tydperk geassosieer word, getoon nie. Opgrawings toon dat beide terreine tydelike nedersettings was waarin sout produksie plaasgevinde het.

Die Baleni kleipot versamelings wat geasosieer word met sout produksie, word gekenmerk deur die beperkte gebruik van pot vorms en 'n groot variasie in pot groottes. Die meerderheid potte se binnekante is ook geërodeer as gevolg van kontak met gekonsentreerde soutwater. Die pot versameling stem grootliks ooreen met diè van kontemporere Vroeë Yster Tydperk nedersettings. Die resultate impliseer dat sout produksie gedurende die Vroeë Yster Tydperk nie gebruik gemaak het van gespesialiseerde produksie tegnologie nie.

Die ongespesialiseerde produksie metodes, die klein groepe produsente en die klein produksie uitset, dui aan dat sout produksie 'n lae kapitale inset aktiwiteit was. Dit dui aan dat onafhanklike produsente sout gemaak het. Vroeë Yster Tydperk sout produksie was ook nie

gekonsentreerd in een gemeenskap nie, maar verspreid oor die verbruiker populasie. Die goedkoop soutmaak metodes impliseer dat produksie 'n tydelike of seisoenale, lae intesiteit aktiwiteit was.

**Sleutelwoorde:**

Baleni, sout, produksie, organsering van produksie, Vroeë Yster Tydperk, Mzonjani, Kwale, potwerk, gebruiksmerk analise, Laeveld, Suid Afrika, argeologie

ACKNOWLEDGEMENTS

This dissertation started off in the office of Professor Chris Boonzaaier who suggested that I visit Baleni, since he felt that the area had archaeological potential. After a subsequent visit to the site, the project was born. I am, therefore, indebted to professor Boonzaaier who first introduced me to Baleni and its salt, and all the assistance received from him.

During the first year of research in 2003, I was actively involved in fieldwork at Baleni and the Giyani area. During this period Petra Terblanche from the Tsonga Kraal Museum, provided me with accommodation and helped in formulating the research. Her intimate knowledge of Baleni and her relationship with modern day saltmakers were always of great help and interest to me. I also appreciate the help Mr. Solomon Machaba who acted as translator. During this fieldwork period in the Lowveld, two people in particular were very influential in my research: I am deeply grateful to Doctor Harold Braack and Ruth McGuire, for sharing their wealth of knowledge with me. I also value the friendship of Judy Groenewald with whom I explored the Lowveld during this period.

I have a deep appreciation towards *hosi* Aaron Mahumani and the people of the Mahumani Traditional Authority. They were always keen for the research to take place, and without their help, this study would never have taken place.

During the periods of excavations and surveys at Baleni, I had the privilege to stay at the Baleni Ivory Route Camp. I am thankful to Claas Boonzaaier who allowed me to make use of the camp, as well as the camp staff, January, Lazarus, Peterson and Annetjie who were always helpful.

During the fieldwork I was assisted by many people. Joost Esterhuizen helped with the theodelite and site surveying. Frans Roodt acted as principle investigator for the excavations, and I benefited immensely from his acute archaeological knowledge. I am especially grateful to the students from the University of Pretoria who helped with the excavations. In the absence of available research funds, the students were always willing to contribute towards the fieldwork projects. Their friendship and help is deeply appreciated.

I received help from Doctor Stephan Woodbourne and Marc Pienaar from the CSIR who dated the radiocarbon samples, and Professor Tom Huffman from the University of the Witwatersrand, who took time to help me with the ceramics and discuss the research project. Mr Joost Esterhuizen helped with the initial cartographic survey of the swamp and mounds. I also deeply appreciate the help I received from Doctor Natalie Swanepoel, who, on very short notice, acted as a proof reader and gave some crucial last minute comments.

I am grateful to my promoter Doctor Rod McIntosh for his guidance. I also benefited from discussions with Doctor Dores Cruz, she was especially influential in steering the research in the right direction.

The patience, encouragement and support from my family: Marna, Jomanie, Andreas, Liezl, Evan, my Mother and Father, made the whole process possible.

Finally, three people in particular, helped me more than anybody else. Firstly, Doctor Katherine Mathers. She was an indispensable source of knowledge and as a friend, gave me the necessary encouragement at a time when I needed it most. Neels Kruger, his help with the excavations, surveys, equipment, analyses and sketches is much appreciated. I will always value his friendship and help. And lastly, Annie Raath. Her love, companionship, assistance and patience made it all worthwhile.

CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

CHAPTER I

# BALENI AND EARLY IRON AGE SALT PRODUCTION

*Modern Westerners are accustomed to cheap and easily available salt, so plentiful and most omnipresent that much of its consumption goes virtually unnoticed; it is one of the plentiful and most utilitarian materials in our lives. It is difficult for us to appreciate how scarce, highly valued, and eagerly sought-after salt has been in so many premodern societies, ranging from isolated tribal groups …to highly centralised states…*

(Parsons 2001: 3)

As the quote by Jeffrey Parsons above indicates, salt was often a highly valued commodity in prehistory. The varying degrees of physical, economic and social values attributed to salt, means that the archaeological study of salt production offers an exciting window onto the socio-economic world of the past.

## Introduction

Salt production, exchange and use, have been the subject of academic attention for a very long time. Pliny the Elder made a comprehensive statement about the production, exchange and use of salt in the Classical world, while Tacitus, another Roman scholar, gave accounts concerning the violence that could erupt from competition over salt sources in the Roman provinces (Parsons 2001:1-3). In more recent times, salt and salt production have been the focus of numerous archaeological studies (e.g. Alexander 1997; Briggs 2003; Connah 1991, 1996; Davison 1993; De Brisay and Evans 1975; Evers 1974, 1981; Fagan and Yellen 1968; Flad *et al.* 2005; Muller 1986; Parsons 2001; Sutton 1983; Williams 1999; Young 1977). In this dissertation, I explore Early Iron Age (EIA) salt production at the Baleni (sometimes referred to as Sautini) geothermal spring. The specific aim is to determine how early farming communities in southern Africa organized salt production. I intend to argue that the context, concentration and intensity of salt production during the EIA is consistent with patterns of seasonal, small-scale production aimed at local consumption.

At the base of any archaeological enquiry into aspects of production, consumption and trade, are the values attributed to salt. Common "salt" (the combination of sodium and chloride ions to form NaCl), is essential for human health and the average adult body contains approximately 250g of sodium. Salt is especially plentiful in body fluids ranging from blood, sweat, tears, semen and urine (Harvard Medical School 2003: 1). Sodium regulates the exchange of water between cells and the surrounding fluid that carries food in and takes out waste (Young 1977: 381). A lack of sodium ultimately causes dehydration, low blood pressure and eventually death (Harvard Medical School 2003: 1). The estimated normal salt intake per day is 5 – 20g with a more or less equivalent loss, mostly in the form of urine (Carter 1975: 13). Medical studies indicate that when dietary salt is in low supply, the body can conserve sodium, drastically reducing the amount excreted in sweat and urine (Harvard Medical School 2003: 1). To avoid sodium deficiency, humans need at least 2g of salt per day (Alexander 1993: 652). Although sufficient levels of salt can be acquired through meat, blood and urine, communities with predominantly cereal diets need a supplementary intake of salt (Alexander 1997). Domesticated animals also need additional salt in their diet. In central Niger salty earth that forms through the evaporation of brine on clayey soils, is sometimes collected and given to animals providing them with additional salt (Gouletquer 1975: 47). Sometimes metaphysical qualities are also attributed to salt. In West Africa, for example, certain fashionable, social and religious observances require particular kinds of salt to be obtained either as a condiment or for offerings (Alexander 1997: 535-537).

## Salt Production at Baleni

Almost four decades of research on the Early Iron Age (EIA) in South Africa have led to the development of a relatively well understood culture historical sequence. With the emphasis on prying out the development and migration of communities, questions still surround the social, political and economic aspects of this period. Arguably, archaeologists can better study aspects of prehistoric economic systems by focusing on sites of production, than by producing large scale regional syntheses (Costin 1991: 1). This dissertation aims to expand research on these aspects of EIA society, by investigating salt production during the EIA. The study focuses on the Baleni Saltworks, located in the South African Lowveld. Baleni is one of the last remaining brine sources in the Lowveld with its archaeological record of salt production activities still intact.

The Baleni geothermal spring has long been recognised by archaeologists as a site of prehistoric salt production (cf. Evers 1974, 1981). Today, salt is still produced on a small scale by the local population. Brine springs like Baleni, form one of the primary sources where salt can be produced. Salt can also be obtained from secondary sources such as ashes from certain plants species (Alexander 1997; Davison 1993: 10-16; Gouletquer 1975: 51; Parsons 2001: 222-227). Extraction from plants, however, is usually a laborious process and the resultant salt is potassium rich and therefore bitter tasting (Gouletquer 1975: 51). As a result, salt from mineral sources such as brine springs, where large quantities of pure salt can be extracted, are usually preferred (Alexander 1997: 536). Due to the general demand for salt, and the localised nature of salt sources, it was frequently traded via local and long distance exchange networks (e.g. Alexander 1993, 1997; Bower 1993; Briggs 2003; Kopaka and Chaniotakis 2003; Meier 2004). Its role as a trade item is in part facilitated by the ease with which salt can be transported and divided into smaller packages of durable, standardized units (Parsons 2001: 221).

The role that salt played as a trade item in southern Africa during the sixteenth to nineteenth centuries has often been emphasised in historical literature (De Vaal 1984, 1985; Harries 1978, 1994; Newitt 1995). These sources indicate that salt produced at Baleni and other Lowveld sources, formed part of a group of trade items, including gold, ivory, beads, cloth, slaves, iron and copper, all of which were largely interchangeable with each other (De Vaal 1984, 1985; Harries 1978; Mutoro 1998; Pwiti 2005). This long-distance trade led to the development of specialised producer communities in the Lowveld and adjacent regions. The most prominent of these specialist communities were the iron producers of Phalaborwa. Plug and Pistorius (1999: 177-182) interpret the specialist iron production by these communities as being part of a system whereby producers traded iron for essential foodstuffs to combat inequalities brought on by the arid Lowveld climate.

Some authors (e.g. Hall 1987b: 65-66; Mitchell 2002: 279) hypothesise that salt functioned in similar exchange transactions during the early first millennium. They believe that salt, extracted from Baleni and other Lowveld sources, was used to combat environmental constraints during the early first millennium AD. This implies a degree of producer specialisation since "some communities were making a living by bartering with other villages"(Hall 1987b: 65). Rice (1981: 219-220) views this adaptive process in the "dynamic interrelationship between nonindustrialized society and its environment" as one of the defining characteristics of specialised production. Such a model of EIA salt production, however, first needs to be tested against the available archaeological data. Any argument for specialist production must show that "simpler, domestic production systems are inadequate to account for the observed archaeological data" (Muller 1986: 406). As a result, production must first be analysed in terms of the organising principles that situate it in time and in physical and social space. This forms the main thrust behind the research at Baleni. For this study, I analyse the temporal patterns of production to relate production to the daily and seasonal scheduling of work and issues of part- as opposed to full-time production. From the spatial loci of production, I infer aspects of the general organization of work and the relative concentration or dispersal of manufacturing activities. These are important factors since they affect how producers interact with consumers and how consumers acquire goods (Costin 2004: 191). How these aspects define the production of salt during the EIA at Baleni forms the aims of this dissertation. By analysing the context, concentration and intensity of production, I argue that salt production during the EIA of South Africa, was a part-time, seasonal activity, practised on a small scale by independent producers for local consumption.

## The Organization of Early Salt Production at Baleni

Costin (1991: 3) defines production as "the transformation of raw materials and or/components into usable objects". Archaeologists generally view production either as domestic or specialised. Both states are seen as a reflection of the underlying principles by which production is organized.

In addressing archaeological approaches to the organization of salt production, Muller (1984) makes the important distinction between site specialization and producer specialization. Site specialization is defined as when a single, short term activity is carried out by an entire social group (Muller 1984: 490-491). Limited activity does not, however, directly imply producer specialization. To argue for specialisation the evidence should indicate that the producers' economic base lies in the activity in question (Muller 1984, 1986). Jon Muller (1984; 1986) showed that at the Great Salt Spring in the Ohio Valley (USA), activities were limited to salt production, possibly indicating site specialization. The great uniformity of craft tools used in the production process did not, however, match the levels of standardization expected to be characteristic of full-time specialization. The evidence thus suggests that although the Great Salt Spring was a limited activity site (i.e. exhibited site specialization), producer or craft specialization did not take place.

Costin (1991: 4) defines producer specialization as the "institutionalized production system in which the producers depend on extra-household exchange relationships at least in part for their livelihood, and consumers depend on the acquisition of goods they do not produce themselves". Producer specialization is therefore a state whereby individuals gain part of their income through participation in a specialist activity (Costin 1991: 4-9; Muller 1984: 490-493; Muller 1986: 407). This implies that specialization is restricted to a specific subset of society and the production of commodities for exchange. Central to this statement is the understanding that specialist producers do not produce all the goods they consume, and that the production activities are regularised and predictable (Costin 1991: 4-9). This means that this production activity is the central and critical economic function for the producer. The exchange of salt for vital foodstuffs during the EIA, as proposed by Hall (1987b: 65-66), would therefore be characterised by specialist production, since producers were dependent on the surplus production of salt.

In developing a working model for the organization of production, Costin (1991) created a synthesis of variants and their possible archaeological manifestations. In the process, she identified a set of parameters that can best explain the organization of production. By investigating the organization of production, I aim to move beyond minimal references to the absence or presence of craft specialization at Baleni. I employ Costin's parameters of context, concentration and intensity as heuristic devices to discuss the character of salt production at Baleni during the EIA of South Africa.

**Context of Production**

The context of production reflects the nature of the demand that exists for a particular good. We can distinguish between attached and independent context production (Brumfiel and Earle 1987). This division determines whether the mode of production was for special high-value goods for elite consumption (attached), or whether it was for the production of utilitarian goods for broad unspecified demand (independent). In the absence of a highly stratified society during the EIA, it is expected that salt production was by independent producers. It is, however, necessary to determine whether production at Baleni is consistent with patterns expected for independent production by looking at the demand for salt, and the technology employed in salt making activities at the site.

### Concentration of Production

Concentration essentially describes the spatial relationship between producers and consumers. The spatial context of production forms the primary data to reconstruct the "social context of production" (Costin 2000: 384). The level of concentration describes whether producers are uniformly dispersed throughout the consuming population, or nucleated within a single production location, as well as the degree to which the subsequent products are transferred between the producer and consumer communities (Costin 1991: 27-29). Nucleated production is usually associated with more specialised or full-time production. The localization of production centres can be caused by many factors. For example, non-specialist production can be localized at concentrations of natural resources such as brine springs (Muller 1984, 1986), and do not necessarily reflect the presence of full time producers, but rather domestic production levels.

### Intensity of Production

Intensity describes the amount of time producers spend on craft activities relative to other economic activities. This reflects whether production was part-time or fulltime, and is approached as a continuum rather than a dichotomy (Costin 2000: 378). Muller (1984: 490-491) emphasises the amount of time devoted to the activity and its interference with other subsistence activities. Fulltime production efforts are usually taken to indicate high levels of specialization. Costin (1991: 18) points out that independent producers are less likely than attached producers to be full-time. Likewise, technologically less expensive industries are more likely to be part-time than technologically expensive ones. If production at Baleni was a part-time activity, producers would combine salt making with agricultural production. This "semi-generalized strategy", however, can only be practised when the technology is "simple or inexpensive" (Costin 1991: 17).

### The Technology of Salt Production

The approach to production at Baleni will draw heavily on the technology of salt production during the EIA. This is necessitated by the fact that salt itself leaves no archaeological trace, since it is usually consumed, and even when it is deposited, it quickly dissolves. Despite the absence of salt in the archaeological record, production debris provides contextual evidence for salt production. This approach reflects the increased archaeological interest in technological studies as sources of inference for both analytical and theoretical research (cf. Stark 1998: 5).

The approach to production technology has always mirrored trends in general archaeological theory. As is widely known, studies in material culture formed the foundation of early anthropological and Americanist archaeological research (Pfaffenberger 1992: 491-493). As the goals of anthropology changed after the 1920's, most cultural anthropologists lost interest in studies of technology and material culture. Archaeologists on the other hand retained this interest, since this topic formed the basis of the construction of culture histories and regional chronologies (Stark 1998: 3). Archaeological research on material culture faded after the introduction of Processual Archaeology in the 1960's. Material culture was rejected as a valid research topic since it was generally associated with narrow description and a lack of an appropriate theoretical framework (e.g. Longacre 1975). One area of archaeological research in which production technology received explicit attention during this period, was "middle-range" or "actualistic" research (Binford 1983). The result was that traditional technology was subordinate to research that provided models of spatial variability or tests of social inferences (e.g. Gould 1980). One direct result of the New Archaeology's approach to material culture was the division of technology, function and style. Technology was defined as raw materials and production steps, while function became associated with utilitarian purposes. The study of technology remained without any explicit theory primarily because it was viewed as an "extrasomatic means of adaptation" (Binford 1965: 205).

Archaeological approaches to technology began to change when ethnoarchaeological studies showed that the makers and users of material culture routinely blur the distinction between technology, function and style (e.g. Hodder 1982). Technology is no longer seen as simply governed by environmental pressures, but also as reflecting aspects of social and economic behaviour (Costin 2000: 382-383; Stark 1998: 4-5). Archaeologists increasingly use a holistic framework that examines both technical (i.e. ecological and economic factors, as well as the mechanical and functional properties of artefacts), and cultural factors (historical, political and social). Torrence (1986) for example, develops models from diverse ethnographic descriptions of production lithic tools. This she combines with descriptive statistics of the standardization and specialization of production debris on Melos Island in the Aegean. The lack of standardization of obsidian artefacts on Melos, she argues, indicates little control in the production process. This implies that production was carried out opportunistically by many different craftsmen. Similar analyses have been applied to the study of ceramic production. Rice (1981), argues that the variation in technological characteristics such as paste, temper and firing, indicates the relative number of hands at work. Other important studies include the work by Costin (1991, 2000, 2004) and Hagstrum (Costin and Hagstrum 1995) who make use of ethnographic models to investigate the nature and the organization of production and exchange in ceramics, following Inca imperial conquest of the Andean central highlands.

The approach to constructing an ethnographic analogy of salt production in this dissertation, closely follows these examples, which are sometimes referred to as "neoprocessual ethnoarchaeology" (cf. Stark 2003: 201). In formulating general hypotheses, to explain the archaeological record, I draw on the archaeological evidence of salt production as well as ethnographic and historic accounts that inform the archaeological data. Salt production methods from Baleni and other salt production areas in Africa provide a large body of comparative data (discussed in Chapter III). These are used to create a formal analogy, strengthened by the similarities in environment (i.e. salt springs), cross cultural uniformity (by drawing on examples from across Africa) and the physical and archaeologically observable traces left by salt production (cf. Lane 1994/1995). I draw on this wide body of data not only to pick up trends in salt production, but also to avoid the problems generally associated with extrapolating ethnographic data back in time. The analogy serves as a tool for understanding the organizational system of salt production at Baleni during the EIA, and explains the formation of the archaeological record (cf. Stark 2003: 201-202).

**Identifying Context, Concentration and Intensity**

The principal archaeological artefacts associated with salt production are ceramics vessels. The assemblages from Baleni therefore represent an opportunity to characterise production during the EIA in terms of production technology. In Chapter VI, ceramic assemblages from salt production contexts are analysed in terms of vessel morphology in order to ascertain the variation in production tools. I focus on vessel attributes of size, as this may reflect functional aspects of salt production. A statistical approach is used to analyse the variability of the ceramic assemblage in terms of orifice diameter, inflection and maximum diameter. Coefficients of Variation, as the standard statistic in studies of variance, identify the levels of standardization present in the ceramic assemblage. The emphasis falls on the identification of special purpose production "tool-kits". The presence of such evidence suggests efforts to maximize production (Torrence 1986: 43). The results from Baleni will indicate the degree to which the ceramic vessels, as production tools, were standardised or special salt production vessels. Through comparisons with contemporary EIA settlements, the analysis will show whether these production vessels constitute specialised tools or ordinary, "everyday" vessels. For production at Baleni to be independent, the archaeological data should reflect production by small groups of producers using basic technology, not aimed at mass production (Costin 1991: 25-27). This is contextualised by the comparative body of data and should show up in the archaeological record in a lack of evidence for maximising efforts, and unspecialised production tools with low levels of standardisation.

At Baleni, the concentration of salt production will be measured by the permanence of the communities exploiting the salt resource. The absence of a permanent producing community will indicate a scenario where more than one group visited Baleni to harvest salt during the same general period. Comparative data suggests that, in similar scenarios, nearby communities often made longer (monthly/seasonal) visits to the natural source to fulfil their own demands (cf. Burton 1984; Sutton and Roberts 1968; White and Pigott 1996). With this in mind, I formulated a research strategy (presented in Chapter V) to investigate the possibility of exploitation by a permanent community, as well as temporary exploitation of varying lengths of time.

Intensity is difficult to determine directly from the archaeological record. Inferences tend to be indirect and reliant on ethnographic analogy (White and Pigott 1996: 159). To measure the intensity of salt production at Baleni I turn to the observed salt production methods presented in Chapter IV, and discuss it in terms of the seasonality of production, and how it relates to the subsistence strategies of EIA communities.

## Frameworks

The immediate spatial frame for this study is the Baleni spring and the area within a radius of 1,5km from the spring centre. It is within this area that salt production at Baleni is concentrated.

Chronological and spatial divisions in the southern African Iron Age are primarily established through ceramic and radiocarbon methods. The research question and discussion presented in this dissertation, focus on salt production by the Early Farming Communities identified with the Urewe ceramic tradition's Kwale branch. This ceramic tradition is associated with the earliest expansion of farming communities along the eastern half of southern Africa. In southern Africa, Kwale is characterised by two ceramic phases, Silver Leaves and Mzonjani. The Silver Leaves ceramic phase is generally seen as ancestral to Mzonjani and is distinguished from it by minor typological differences in assemblages (Klapwijk and Huffman 1996: 90-91). The close relationship between the phases is emphasised by the fact that until recently, they were regarded as one entity, and referred to as Matola (e.g. Maggs 1980a, 1984b; Whitelaw and Moon 1996). The distinction between Silver Leaves and Mzonjani refers to small scale temporal differences and do not reflect social and economic differentiation. Since this dissertation aims to characterise salt production by early farming communities, the timeframe under study covers the Mzonjani and Silver Leaves ceramic phases and therefore roughly the period between the first and sixth centuries AD.

Briefly stated, the archaeological framework of this dissertation covers salt production activities during the early first millennium AD at the Baleni salt geothermal spring. I intend to clarify the character and organization of salt production during the EIA at Baleni through a discussion of the parameters of context, concentration and intensity. The discussion will draw on ethnographic and archaeological literature, as well as primary empirical research conducted at Baleni. Additionally I will also provide the cultural historical sequence of salt production and related activities at Baleni that was uncovered in the course of the research. This is the first study in South African archaeology concerned with the organization of salt production by communities from this period. I will review the spatial and archaeological frameworks of the research in the following two chapters.

# CHAPTER II

# THE STUDY AREA

The salt production activities which form the focus of this study centre around the Baleni geothermal spring. In this Chapter, I describe the natural landscapes in which Baleni is situated, and within which prehistoric salt production took place.

## The Study Area

The name Baleni refers to a mineral hot spring located at S23°25'07.50", E30°54'54.36" and 380m above sea level. The Baleni research area covers the entire area around the salt spring up to a radius of 1,5km measured from the spring's centre. The spring is located approximately 20km south-east from the town of Giyani, and falls within the borders of the Giyani Municipal District (Figure 1). Situated in the Limpopo Province, the district is bordered in the east by the Kruger National Park, in the south by the Groot Letaba River and in the north by the Shingwidzi River. This area forms part of the South African Lowveld (Figure 2) - the area geographically defined as the low-lying areas east of the South African escarpment  and west of the Lebombo Mountains on the Mozambique border (Onderstal 1984: 17).


Figure 1: The location of Baleni within the Giyani Municipal District, as well as adjacent municipal areas and major rivers.

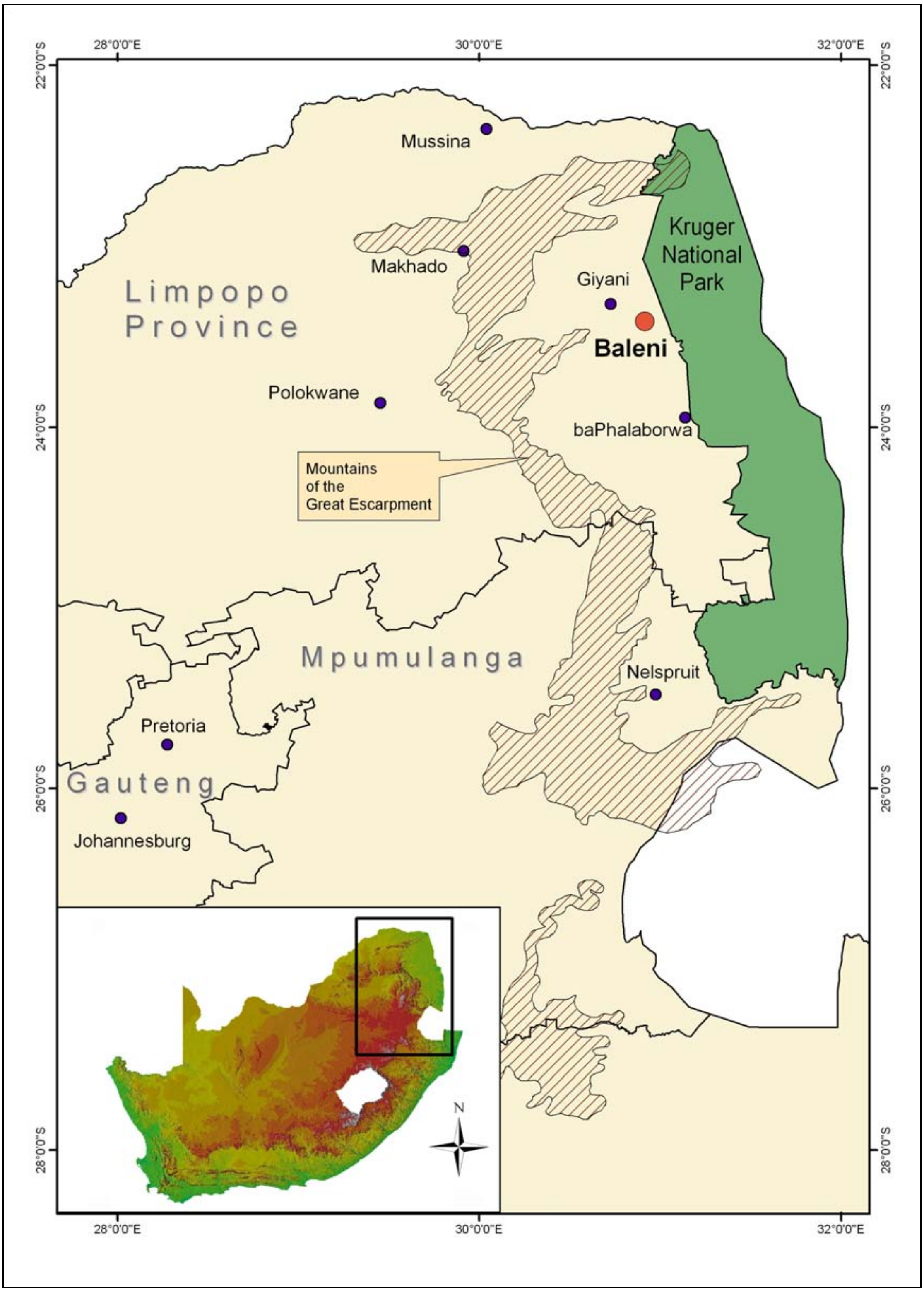



Figure 2: Baleni in regional context

**Biome**

Baleni is situated within the Savannah Biome, which is characterized by grassy ground cover and an upper layer of trees and shrubs. The grass layer in savannah areas is mostly dominated by C4 –type grasses (Van Rooyen and Bredenkamp 1996: 20).

**Climate and Rainfall**

The Lowveld is primarily a summer rainfall area. The average precipitation for the Giyani district is 600mm per annum, mostly in the form of thunderstorms. On average 90% of the annual rainfall occurs during the period between October and March. Summer temperatures for the Giyani District vary between 18ºC to 43ºC while winter temperatures range between 8ºC to 23ºC (Hartman and Kriel 1991).

**Topography, Geology and Soils**

The average elevation of the northern Lowveld ranges between 600m in the west and 300m in the east. The gentle undulating landscape is broken at places by conspicuous ridges and hills like the Murchinson Range, Mangombe Hills, and the Black Hills which rise up to 400m above the surrounding landscape. In the east where the Lowveld meets the escarpment, the landscape rises sharply to an altitude of almost 2 000m (Brandl 1987: 3).

The landscape around Baleni is set on archaean gneiss from the Goudplaats Gneiss formation. The gneiss varies in colour between light and dark grey (Brandl 1987: 3-6). The rocks are generally poorly exposed with outcrops limited to river channels. In the vicinity of Baleni, the gneiss is medium grained and well-foliated (Brandl 1987: 3; Kent 1986: 145). Small schist lenses and thin pegmatite in bands and segregations have also been observed in the area. The gneiss is cut by many mafic dykes of a north-east tending direction (Kent 1986: 144). The predominant soils are medium and coarse freely drained sandy loams, usually of a reddish-yellow to red colour with a high alkaline content.

**Fauna and Flora**

The predominant vegetation type at Baleni is Mopane Bushveld. It is characterized by fairly dense growth of *Colophospermun mopane* (mopane), and mixtures of *C. mopane* and *Combretum apiculatum* (Red Bushwillow) and is also associated with Knob Thorn (*Acacia nigrescens*), *Comiphora* spp. and *Combretum imberde* (Van Rooyen and Bredenkamp 1996). Areas of Mixed Lowveld Bushveld also occur approximately 1km south of the spring where the elevation rises slightly. Here the vegetation is mostly dominated by Red Bushwillow (*C. apiculatum*), Silver cluster leaf (*Terminalia siricea*), and Knob Thorn (*A. nigrescens*) with concentrated pockets of Sicklebush *Dichrostachys cinerea*. Dense clusters of Magic Guarri (*Euclea divinorum*) occur on the brackish floodplain area around the eastern and northern edges of the saltpan. The area along the Klein Letaba River is typical riverside forest with large examples of Common Cluster Fig (*Ficus sycomores*) and Tamboti (*Spirostachys africana*). In areas along the river, pockets of Mopane Forest also occur. The predominant grass types in the area are all Digitaria species.

At present, the Baleni area is devoid of game. Due to the close proximity of Baleni to the Kruger National Park (its western border being approximately 15km to the east of Baleni), and seeing as the Mopane veldt around Baleni extends into the Park, present-day game profiles from Kruger can be used to give an indication of past profiles for Baleni. At present, Mopane Bushveld in the Kruger Park supports herds of buffalo, waterbuck, zebra, giraffe, impala, white rhinoceros, eland and sable antelope as well as very large herds of elephant (Gertenbach 1983: 50, 52, 60).

**The Baleni Thermal Spring**

The eastern edge of the swamp is situated about 150m from the bank of the Klein Letaba River. The spring flows into a reed covered swamp or pan which is roughly oval in shape, about 415m in length and 150m wide. The swamp drains into the Klein Letaba River by means of a small stream on its eastern edge. At present, the Baleni fountain is the most reliable source of water in the area. Although the water is brackish, cattle from the surrounding area come to the spring to drink during dry spells. In wetter periods other sources of water are preferred.

During the dry season, a white salt crust is formed along the edge of the swamp when the waterline of the swamp recedes. This crust is collected by present-day salt workers at Baleni to produce salt. These processes will be discussed in greater detail in Chapter IV.

South-east from the main spring, there are a number of much smaller springs that flow out into open depressions. These depressions are mostly dry but become swampy in the rainy season. A saline crust also forms in these depressions, however, it is not as concentrated as that around the main spring.

Figure 3: Looking east over the reed covered swamp into which the main spring at Baleni flows. The spring itself is located approximately 15m inward from the waters' edge.

*Origins of the thermal water*

Kent (1986: 4-5), after analyzing air photographs and LANDSAT images, believe that the thermal water at Baleni rises to the surface through a geological fault. Though no faults pass directly through it, the spring is likely part of a fracture that is connected to a prominent east-west tending fault, situated 900m south of the pan. This fault, with its shear-zone and associated fractures, believed to form the main aquifer that feeds the spring. Although it is difficult to determine the hydro chemistry of the spring's water, Kent (1986: 150-152) believes that the high temperatures are due to resurgences of ground water that descends to depths of at least 1000m. At this depth the water takes up heat from the earths' crust and then returns to the surface at a high enough speed so that much of this heat is retained.

Chemical analysis of the spring's water indicates that its mineral content exceeds 1g/*l*, which means that, in addition to being a hot spring, Baleni can also be classified as a mineral spring (Kent 1986: 150). Tests showed that the water is slightly acidic, being saline, with the predominant constituent being NaCl (Table 1). Kent (1986: 152), argues that the water which flows forth at the spring acquires its mineral content in deep aquifers. These aquifers are probably made up out of trapped oceanic water of an unknown age (source of the Na and Cl), recent recharge (accounting for Ca, Mg and HCO in the water) and dynamic underflow (Na and HCO). Reaction between the country rocks and the thermal water is believed to be an additional source of Na, Ca, Mg and other trace elements.

Table 1: Mineral content of the Baleni spring (Kent 1947: 72)

| | |
|---|---|
| **NaCl** | 1270 mgm p/*l* |
| **$CaSO^4$** | 218 mgm p/*l* |
| **$CaCO^3$** | 30 mgm p/*l* |
| **$MgCO^3$** | Trace |

Figure 4: Reeds behind the cows indicate the location of a minor spring located in an open depression.

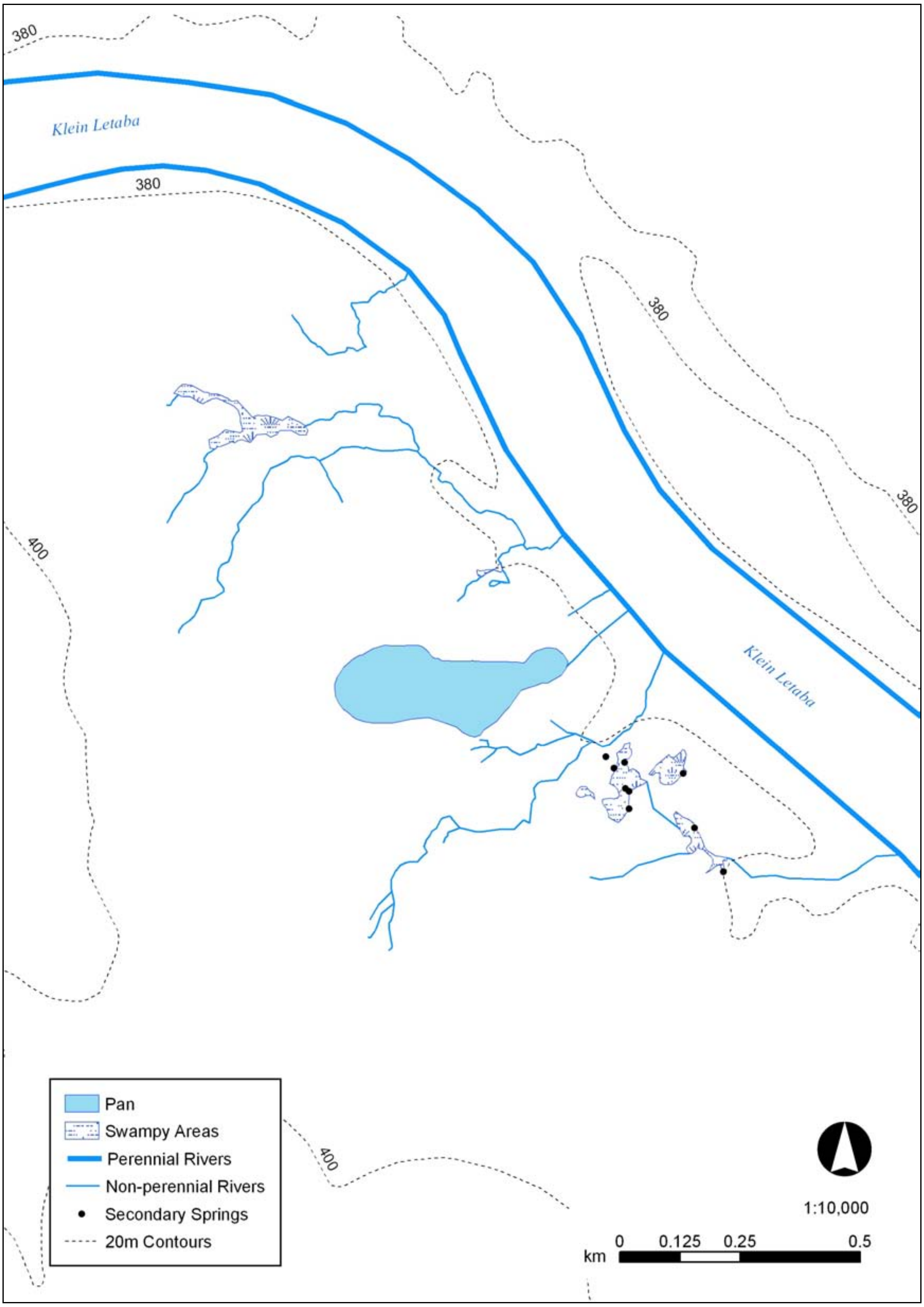



Figure 5: The Baleni spring and associated features

**Other Hydrological Features**

The main hydrological feature in the area is the Klein Letaba River. Approximately 30km downstream, it drains into the Letaba River, which eventually flows into the Olifants River, the main drainage line of the northern Lowveld. The Nsama, a prominent tributary of the Klein Letaba, flows into the latter approximately 8km downriver from Baleni. At present the Klein Letaba only experiences ephemeral flows. This, however, was not the case in the past, since the catchment area has been dramatically modified by human activity (Moon and Heritage 2001: 52-54).

Figure 6: Salt crust formed in basin of non-perennial river near the salt spring.

At Baleni, there are several non-perennial streams around the swamp that all drain into the Klein Letaba. In several places these streams have formed deep dongas or erosion gullies. One large gully, on the south-eastern side of the swamp, has eroded into a deep channel with vertical banks, over four meters deep in places. In several places these small perennial rivers display a tendency to expand horizontally to form open areas, which become swamp-like in the rainy season. When dry, a white salt crust forms on the surface of these open areas. This crust is probably a result of the surrounding saline soils being leached by the streams.

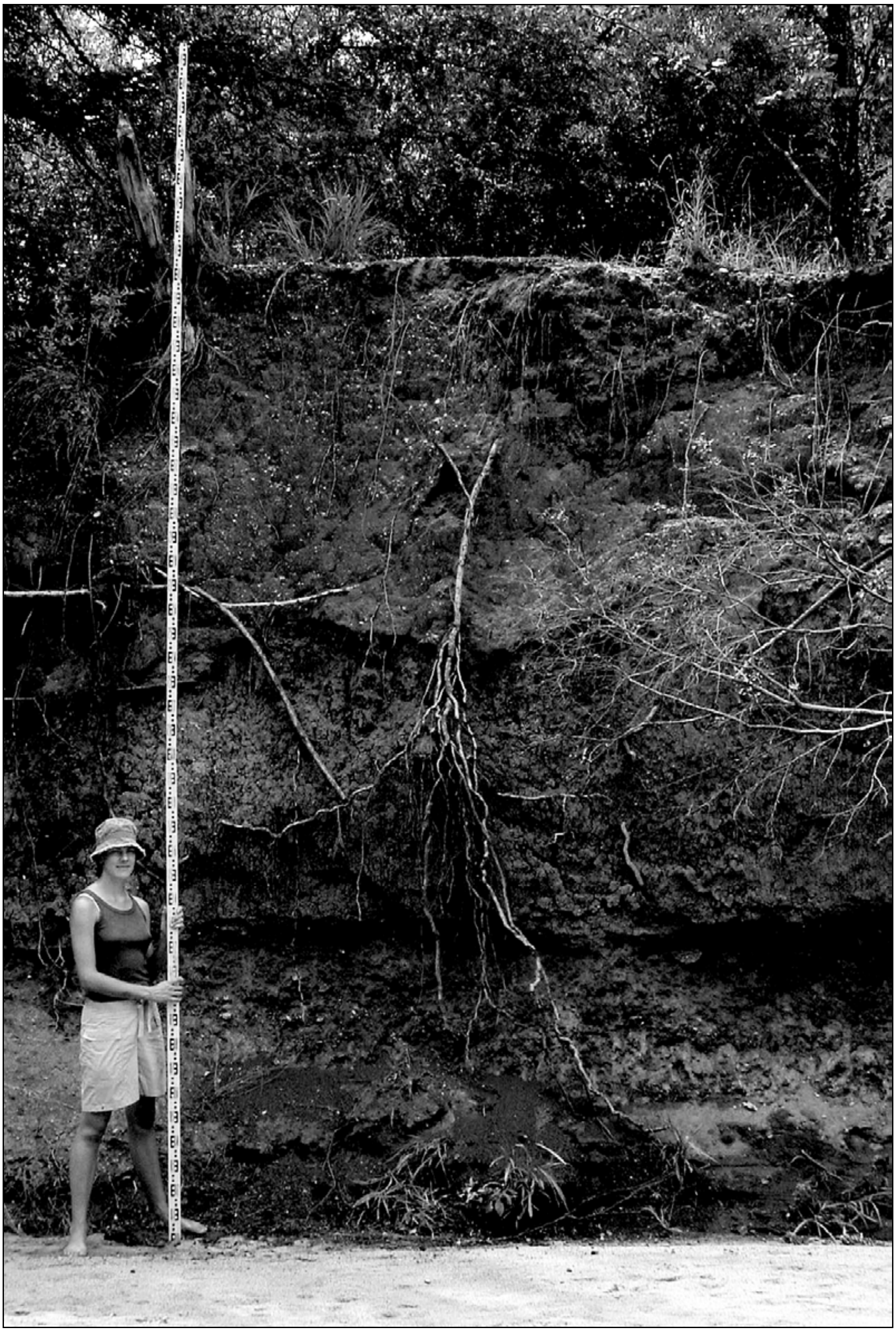


Figure 7: Vertical erosion of stream banks south-east of the swamp, here measured at 4m.

## Implications for Agro-Pastoral Communities of the Iron Age

Although Mopane Bushveld has a low carrying capacity, mopane leaves are nutritional, and provide relatively good fodder for cattle. Bonsma (1976: 8) states that cattle can be successfully raised, provided the animals are adapted to the hot climate and are able to stand the dry conditions. Grazing in Mopane Bushveld should, however, be controlled and well managed to prevent overgrazing and degradation of the veldt (Bonsma 1976: 8-11). Since the indigenous African cattle species are heat tolerant, cattle raising during the Iron Age would not have been a problem in the study area. Evidence of cattle raising in the area during Iron Age periods, is provided by archaeolzoological research in the Kruger National Park (Plug 1988). The presence of domesticate animals during the Iron Age would, however, be constrained by animal diseases endemic to the area. The most important of these were nagana, carried by the tse-tse fly (*Glosina* spp.), malignant catarrhal fever (MCF), foot-and-mouth disease, as well as various tick-borne diseases. These diseases are endemic, and thus non-lethal, to wild animals, but the same cannot be said for domesticated fauna (Fuller 1923; Plug 1988). Although indigenous cattle breeds do have a high tolerance against some of the tick-borne diseases, they have none for nagana. Ovicaprines are more tolerant to nagana, and less sensitive to grazing conditions than cattle. A preference for these species probably existed in areas where cattle keeping was limited by environmental factors (Plug 1988: 315-316).

The staple diet of EIA communities in southern Africa was cereal crops. Seeing as the predominant soil types of the area are relatively low in nutrients and the surrounding clays are poor water retainers, the area is relatively unsuitable for agriculture. EIA communities in the Kruger National Park are all located along the banks of large rivers where deep alluvial soils occur and limited agriculture can take place (Plug 1988: 307).

## Conclusion

The Baleni area would have been a suitable area for EIA communities to settle. Although game would have been plentiful in the region, herding and agriculture could only have been practiced on a limited scale at Baleni during the Iron Age. Ecological factors that would limit the success of these systems would be erratic rainfall, wet/dry cycles, the presence of diseases affecting domestic stock, and the low carrying capacity of the veldt.

The most important aspect of the study area, in relation to the research, is the presence of the Baleni saline spring and the pan into which it flows. The pan's mineral rich waters, with its high NaCl content, allowed Iron Age communities to extract salt. However, the spring and associated pan are not the only available sources of salt at Baleni. Precipitated salt also forms in the dry beds of some of the small rivulets that drain into the Klein Letaba River.

Both of these could have been exploited as sources of salt by prehistoric communities. Unprocessed salt could therefore have been obtained from a variety of different sources at Baleni. This point serves as a good introduction to the next chapter which will review Africanist research on the various sources and methods utilised in traditional salt production.

# CHAPTER III

# DEFINING THE ARCHAEOLOGICAL FRAMEWORK

As has been defined in previous chapters, the salt production at Baleni is analysed within the specific spatio-temporal framework of the South African Early Iron Age (EIA). EIA communities are associated with the introduction of farming, distinctive ceramics, metallurgical knowledge and the period roughly covering the first 1000 years AD. The earliest phases of salt production, which form the focus of this study, are specifically associated with communities that made ceramics from the Urewe tradition. This chapter will define the culture-historical framework of the dissertation and discuss some of the relevant academic discourse on Iron Age studies in South Africa.

## The Early Iron Age of South Africa

The culture historical sequence for the South African Iron Age is primarily based on the association between types of ceramic assemblages and radiocarbon dates. The concern with creating a regional chronology for the Iron Age has over the years led to several competing hypotheses concerning the relationship between the various ceramic groups. One approach has been associated with Gordon Childe's concept of culture (Hall 1990: 70). Childe viewed culture as certain types of remains (such as pots, implements, burial rites, house forms etc.) seen as a package that constantly recurs together. He stressed that each culture had to be delineated individually in terms of constituent artefacts and that cultures could not be defined simply by subdividing ages or epochs either spatially or temporally. Instead the geographical limits of each culture had to be established empirically and individual cultures aligned chronologically by stratigraphy and seriations. South African archaeologists who had their roots in this approach were Mason (1962) and Maggs (1980a, 1980b, 1984b). In contrast to this approach, Huffman (1974, 1979, 1980, 1982, 1989a, 1989b) introduced the concept of the ceramic *tradition* in the 1970's, which was already well established in American archaeology (Hall 1984: 267). This method entails a detailed analysis of ceramic attributes, which are summarized statistically and built into models that trace traditions through space and time. By identifying traditions rather than cultures, Huffman mapped a complex set of ceramic traditions that accounted for the ceramic variability of southern Africa. Huffman and

Evers approach ceramic design as part of a much larger visual code (Evers 1989: 129-130; Evers and Huffman 1988: 740). This means that ceramic design can be used to identify groups of people who share, learn and transmit the same code. The large areas of ceramic uniformity often observed by archaeologists are frequently punctuated by a great change in ceramic style over short distances. Huffman believes this reflects changes in verbal communication (i.e. language). Ceramics can therefore trace the movement of people on the landscape.

A major critique of the view that ceramic style correlates to distinct groups of people sharing a common cultural code, is that it encourages a migrationist view of cultural change and that it de-emphasises internal dynamics. Although such an approach cannot be dismissed out of prejudice, the archaeologist should consider alternative explanations for change and variability in the material culture and also try to explain why movements occurred (Mitchell 2002: 270). Hall (1983) warns that the emphasis on ceramic typologies creates the risk that attention will be drawn away from more historic and anthropological questions. Bearing this in mind, the approach adopted in this study is that ceramic typologies are a useful tool when considering units of space and time (cf. Mitchell 2002: 270), but that it can also address issues wider than mere temporal classification.

**Ceramic Sequences**

Using ceramic traditions, Huffman (1989a) presented an interpretation that grouped all the ceramic assemblages of the Early Iron Age under the Chifumbaze Ceramic Complex. Archaeologists postulate that the distinct traditions within this complex are the result of early farmers migrating from the north in two streams; a western (Kalundu) and an eastern stream (Urewe), the latter containing two separate facies. This model is largely a development of an earlier synthesis by Phillipson (1977, 1985) who placed all the southern African first millennium sites into an eastern stream, of which two facies, a highland and lowland, were represented in South Africa.

The first tradition to reach southern Africa was the Urewe tradition and it is divided into the Kwale and Nkope branches. The Kwale branch extends along the East African coast from Kenya to KwaZulu-Natal. The Nkope branch extends from southern Tanzania through Malawi and eastern Zambia into Zimbabwe. The second tradition, Kalundu, is found from Angola in the west through western Zambia, Botswana and Zimbabwe into South Africa

(Huffman 1989a). At Baleni there is no chronological overlap between the Kwale and Kalundu traditions, therefore, as discussed in Chapter I, this dissertation specifically deals with communities associated with ceramics from the Urewe tradition's Kwale branch.

*The Kwale Tradition*

In South Africa, the Kwale branch can be divided into two phases (Huffman 1989a). The first phase, dated between AD 280 - 420, is termed Silver Leaves, or Matola by Maggs (1980a, 1984b). Silver Leaves sites have been found along the east coast near Maputo (Morais 1988) as well as in the interior at the Silver Leaves name site (Klapwijk 1974), Castle Cavern in Swaziland (Dart and Beaumont 1968), Zimbabwe (Sinclair *et al.* 1993) and at Ma 38 in the Kruger National Park (Meyer 1986). Silver Leaves assemblages have a high proportion of fluted rims on bowls and bevelled rims on jars (Klapwijk and Huffman 1996). The Silver Leaves ceramics are only marginally younger than the closely associated Kwale assemblages from Kenya, which indicates a rapid spread down the east coast, possibly by boat (Klapwijk 1974: 22). During the mid-fifth century AD Silver Leaves gives rise to a new ceramic entity known as Mzonjani. In general, the Mzonjani assemblages display continuity in profile and design layout with Silver Leaves, but lack the distinctive bevels and flutes of the latter. In the northern Lowveld, assemblages have been excavated at Silver Leaves (Klapwijk and Huffman 1996), Eiland (Evers 1981) and the Kruger National Park (Meyer 1986). Most Mzonjani settlements are, however, concentrated along the coastal belt of KwaZulu-Natal (Whitelaw and Moon 1996). Of the six sites associated with Kwale ceramics in the Kruger National Park, Meyer (1986) places three southern sites (Tsh1, Mal10, St6) into a Mutlumuvi Complex and Le7, Ma32 and Mo8 in the north are placed into an Early Eiland Complex. Both phases are seen as northern and southern variants of the same ceramic entity, which Meyer believes to have developed from earlier Silver Leaves. Consequently, Meyer's Early Eiland Industry and Mutlumuvi, are very similar to Mzonjani ceramics, and can be classed as such.

**Economic and Social Aspects of Early Iron Age Society**

Settlements with Urewe ceramics were all located within the savannah eco-zones of southern Africa. Settlements were mostly located on deep arable soil close to rivers or streams. Sites near the coast indicate that marine resources were also exploited. Shell middens identified along the coast served as collection points for villages situated further inland (Horwitz *et al.* 1991; Maggs 1984b). Communities were heavily dependent on domesticated animals for meat. Hunting played a variable role in the subsistence economy. Faunal remains from sites in the Lowveld region indicate that here, hunting fulfilled a major dietary role, more so than in other regions. This could be due to the animal diseases endemic to the area. The most important of these were nagana, carried by the tse-tse fly (*Glosina* spp.), malignant catarrhal fever (MCF), foot-and-mouth disease, as well as various tick-borne diseases (Plug 1988: 313).

Although no dedicated archaeobotanical study has been done for the EIA, indications are that cereals formed the staple diet. Domesticated species that were cultivated include pearl millet (*Pennisetum americanum*), finger millet (*Eleusine coracana*) and sorghum (*Sorgum bicolour*). (Hanisch 1981; Klapwijk 1974; Maggs 1984a; Maggs and Ward 1984). These were likely the principal crops during this early time period.

An analysis of site locations seems to suggest an apparent link between settlements and iron ore bodies. This relationship has led some archaeologists to suggest that ore-procurement strategies were mostly small in scale. This, and the lack of abundant ironworking residue on settlements, suggests that iron production was primarily intended for consumption within the village (Whitelaw and Moon 1996: 70).

Two largely contradictory models are used to explain community organization during the Early Iron Age. Hall interprets EIA society as possessing a Primitive Communist or "domestic" (Hall 1987b:73) mode of production. Villages were bound in a balanced reciprocal relationship without the opportunity to accumulate power. Although EIA communities were economically self sufficient, ecological instability, resource failure and limited storage of resources, necessitated secure reciprocal relations. Thus, economic and social interaction primarily took place within the village while wider ranging connections were called on to supplement resources in times of hardship. These connections were signified by shared codes of ceramic decoration (Hall 1987a: 7-9; Hall 1987b: 73).

In contrast, Huffman (1993), Whitelaw (1994) and others (e.g. Denbow 1983, 1984), drawing on ethnographically derived models first proposed by Kuper (1980), have argued that EIA production was organised around a community-wide mode of production. This thesis revolves around the spatial organization of settlements, generally referred to as the Central Cattle Pattern (CCP). The application of the CCP rests on the premises that (1) human society organizes its environment into discrete physical spaces where only a limited range of activities are permitted, and (2) that spatial locations have social significance and provide the physical setting for a specific set of human activities (Huffman 2001). The fundamental aspect of the CCP is the integrating role that cattle played in social life. Cattle were owned by men, and used for bridewealth payments, sacrifice to ancestors, and in establishing and sustaining political relationships. This is reflected in the internal structure of settlements. Settlements were organised into outer and inner zones. The outer residential zone, is the domain of married women and incorporates the households of individual women. This zone would normally include sleeping huts, kitchens, grain bins and graves. The second zone is the inner, male dominated area. This zone contains stock kraals, public smith areas, high status burials placed below or close to the central byre, the men's court and communal grain storage facilities controlled by the leader of the settlement. The CCP is restricted to Eastern Bantu speakers who are patrilineal, prefer cattle as a form of bridewealth, and have male hereditary leadership and beliefs centred on the role of ancestors in daily life (Huffman 2001: 21).

Archaeologically, the CCP can be identified by open central areas, surrounded by houses and grain bins with storage pits in and around cattle kraals that contain prestige burials. Status of burials is determined by burial position and grave contents. Burials that are in a sitting position and that contain ivory grave goods are usually recognised as being those of high status. First millennium sites where these features have been identified include Broederstroom (Huffman 1998), Riverside (Huffman 1993) and KwaGandaganda (Whitelaw 1994/1995). Since the CCP has been identified on sites associated with both the Kwale and Kalundu EIA ceramic traditions, Huffman (2001: 30) believes that the CCP was already a feature of EIA society when these communities entered southern Africa. The relationship between settlement size and political importance observed in traditional Bantu society is also implied by the CCP. The leader is the wealthiest person in society, since he owns the most cattle, accumulated through death dues, court fines, forfeits, tribute, raids and brideprice (Huffman 1986). The usefulness of this correlation in EIA archaeology is hampered by poor preservation and reoccupation of sites. Although Urewe settlements are generally smaller than those of later EIA phases, being typically two hectares or more in extent (Maggs 1984b), large Urewe sites evidently did exist as is indicated by the 5$^{th}$ to 7$^{th}$ century settlement of Broederstroom which was inhabited by at least 200 to 300 individuals (Huffman 1993: 226). The presence of the CCP in EIA society implies that these communities were probably hierarchically organised societies with hereditary leaders and that production was probably organized on a communal level.

Despite archaeological evidence from EIA sites like Broederstroom (Huffman 1993), and KwaGandaganda (Whitelaw 1994), the presence of the CCP in the EIA is contested by some archaeologists (e.g. Hall 1986; Lane 1994/1995; Maggs 1994/1995). Hall (1986) believes that the scarcity of cattle in faunal assemblages means that they could not have been used in political transactions and bridewealth at that time. Archaeologically the presence of one cow may, however, indicate a breeding population of at least 100 (Huffman 1998) and the social importance of cattle is not necessarily reflected in numbers (Mitchell 2002: 283). Maggs (1994/1995) disputes the presence of the CCP before AD1000 on the grounds of a break in cultural practises such as dental mutilation, fish eating, settlement location and settlement longevity. Huffman (2001: 30) feels that these traits do not form part of the organizing principles of the CCP and are therefore low level differences in cultural practises, not covered by the CCP. A further objection concerns that of metal production. Maggs (1994/1995) feels that iron was forged and smelted within the settlement in contrast to more recent practise where smelting activities are secluded while forging takes place in public places. Evidence for smelting within the settlement is the presence of furnace walls and iron slag. Huffman (2001: 31) questions the usefulness of this data since the precise spatial relationship between the forge areas and the rest of the settlement is unclear. In the absence of such data, smelting could therefore have taken place within isolated ritual enclosures or outside the settlement boundaries.

The recognition of the CCP resolves many aspects regarding the socio-economic organization of EIA settlements. Questions remain regarding the economic organization around natural resources. An aspect of the EIA economy that has long been recognised, is salt production. Three sites in the northern Lowveld, all within a 100km radius from Baleni, have been identified as areas of EIA salt production (Evers 1974, 1981). These studies were, as most archaeological research of the period, primarily concerned with the creation of a culture historical sequence for the region. Salt production sites provide an opportunity for the archaeologist to investigate production during the EIA. A common aspect of archaeological research on salt production sites, have been the use of traditional salt making practises to inform the archaeological data (e.g. Connah 1991; Evers 1981; Fagan and Yellen 1968; Gouletquer 1975; Sutton and Roberts 1968). The next chapter reviews some archaeological approaches to salt production sites as well as Africanist research on the various sources and methods utilised in traditional salt production.

# CHAPTER IV

# THE ARCHAEOLOGY OF SALT PRODUCTION

Although in-depth archaeological studies of salt production in Africa are rare, ethnographic and historical literature describing salt production provide a body of comparative data to create a framework for prehistoric salt making activities at Baleni. In this Chapter I review some of these examples in order to create a working model of prehistoric salt production methods at Baleni.

## Salt Sources and Methods of Production: Examples from Africa

Most of the archaeological case studies pertain to the salt producing areas of Uganda, Tanzania and South Africa (e.g. Connah 1991, 1996; Evers 1974, 1981; Fagan and Yellen 1968; Sutton and Roberts 1968). A specific aim of these studies was the reconstruction of culture historical sequences. Salt production sites are uniquely suited to these aims as they usually have a long history of exploitation and production deposits typically have well stratified sequences and large ceramic assemblages.

Archaeological research on salt production sites in the South Africa, are typical examples of this predominant approach of reconstructing the culture historical sequence. Besides Baleni, three other brine springs in close proximity to each other have been recorded in the Lowveld. The three other sites, Rhoda, Harmony and Eiland, are all located within 100km of Baleni.

### *Rhoda*

The Rhoda spring is located south of Phalaborwa, on the southern bank of the Selati River. In 1937 mention was made of the presence of soapstone bowls on the site which were probably used in prehistoric salt making (Schwellnus 1937). In his account of salt extraction at Rhoda during the early 1960's, Witt (in Terblanche 1994: 189) described that brine was placed in the soapstone bowls and was turned into crystalline salt by means of solar evaporation. No archaeological excavations have taken place on the site, and since it has been destroyed by construction activities, its archaeological significance is lost.

*Eiland*

The archaeological salt extraction site of Eiland consists of low mounds of leached earth and debris scattered along the banks of the Mamazapi stream, between the eye of a mineral spring and the Groot Letaba River. Radiocarbon dates (Pta-1524 and Pta-1608) indicate that the site was worked from *c.* AD 300 (Evers 1981). The earliest ceramic component in the assemblage was identified as Mzonjani. Excavations of the debris mounds yielded large quantities of potsherds. In the more recent levels of salt production, the excavations recovered soapstone bowls and comparatively fewer shards, which could indicate that the more durable soapstone bowls replaced ceramic pots in the production process.

*Harmony*

In his analysis of salt production at Harmony, Evers (1974, 1977) showed a direct link between the salt production site, a nearby soapstone bowl factory site, and a Late Iron Age settlement located 1,6km from the salt extraction area. Analysis of the faunal assemblage from the salt extraction area showed that butchering probably did not take place at the site itself. This, and the absence of any signs of habitation at the salt source, leads Evers to argue that the saltworkers made forays from the village to the source. The presence of a perforated soapstone strainer, shallow soapstone bowls as well as ceramics in context with hearths, indicates that a variety of salt extraction methods were employed at the Harmony sites. Evers (1974) found that the Harmony deposits were largely similar in content to that of the Eiland deposits. The dating and time depth of the Harmony salt production site is still problematic. Only one C14 date (RL 206) is available and this is calibrated to 320 BP. Ceramic data, however, indicates that salt was produced from at least the 4$^{th}$ century A.D. As found at Eiland, the earliest ceramic assemblage phase identified at the site was Mzonjani.

**Other Archaeological Examples**

A longstanding research project was carried out by Graham Connah on the salt production site of Kibiro (Connah 1991, 1996; Connah *et al.* 1990). In his research at Kibiro, located on the shore of Lake Albert in Uganda, Connah (1991, 1996) uses the archaeological data from the salt production site, to inform him on regional socioeconomic developments. Present-day salt production at Kibiro is a crucial activity for the inhabitants of Kibiro village. The surrounding soils are shallow and rocky and as a result, little or no cultivation of crops can take place. Only by producing salt for trade at local markets can the village obtain essential food items (Connah *et al.* 1990: 25). This specialised level of production is facilitated by the use of saltgardens, which enable the producers to maximise production activities. Connah's excavations of the salt production area showed that the surplus production of salt for trade, was directly linked to the rise and expansion of the historical Bunyoro State (Connah 1991).

Sutton and Roberts (1968) excavated four salt production sites located around brine springs in the Uvinza region of Tanzania. Excavations yielded three stratigraphically defined saltmaking ceramic assemblages, some exclusively associated with salt production. Circular clay lined pits, 0,5m to 1,5m in diameter, were also uncovered during excavations. By reference to early nineteenth century descriptions, the authors interpret these features to be tanks used to concentrate brine (Sutton and Roberts 1968: 50, 61). Oral traditions and historic accounts indicate that salt production at Uvinza was a purely seasonal activity, with saltmakers living in temporary structures on the site during salt production. One nineteenth century description of salt production describes the aftermath of a salt production season at Uvinza:

> *Near the crossing on either side are the salt-pans of Uvinza, which furnish a respectable revenue to its king. A square mile of ground is strewn with broken pots, embers of fires, the refuse of the salt, lumps of burnt clay, and ruined huts.*
>
> (Stanley 1880: 325 in Sutton and Roberts 1968: 50)

Accounts indicate that salt produced here was widely sought after and traded (Sutton and Roberts 1968: 46-47, 67-70). By the mid-nineteenth century, frequent caravans passed through the village to obtain salt, which was traded en route for food and other necessities. Production was also encouraged by local leaders who collected tribute from the producers. Nineteenth century accounts indicate that, to meet their own demands, up to 20 000 people came from areas as far away as Burundi to harvest salt (Sutton and Roberts 1968: 69). The authors also indicate that the territories of three nineteenth-century "chiefdoms" converged on the brine springs (Sutton and Roberts 1968: 70). All the surrounding villages were allowed to make salt and the revenue generated by the output at the brine springs were subsequently shared by the "chiefs". This implies that aspects of territoriality and resource control might have been modified in the context of access to the areas of salt production.

A second archaeological study conducted on a salt production site during the 1960's, was that by Fagan and Yellen on the Ivuna salt pans (1968). Although excavations were primarily aimed at creating a culture historical sequence for Tanzania, the detailed analysis of ceramics identified no specific vessels linked exclusively to salt production activities (Fagan and Yellen 1968: 31). The authors were able to interpret their excavated data in the light of oral traditions of more recent production methods at the site (Fagan and Yellen 1968: 30-31). Excavations also uncovered signs of permanent occupation on the salt production site from the thirteenth century onwards. Evidence points to a scenario where salt production took place within the village, along with other economic activities such as cereal cultivation, stock keeping and hunting.

The work at Kibiro, Ivuna and Uvinza, serves as a good example of how archaeologists working on salt production sites use historic and ethnographic examples of traditional production methods to interpret the archaeological data. Ethnographic and historical descriptions form part of a relatively large body of work on un-mechanised salt production in Africa. In the absence of archaeological excavations, however, no data on the age or nature of salt production is available for most of these sources. This means that the technology used in the production of salt, as well as its economic and social roles in many prehistoric African contexts, remains speculative. The available literature on salt production points to a variety of production methods, with similarities from different areas, geographically separated by thousands of kilometres. Below I will discuss selected salt making practises from Africa by drawing on ethnographic and historic accounts.

**Unprocessed Salt Collecting**

The most basic form of salt extraction is the collection of unprocessed crystalline salt. This characterises a variety of salt production methods that do not entail any additional refinement processes to obtain crystalline salt. Since no refinement is involved, this collection usually only takes place at sources where salt can be found in a very pure form. An exception is Guelele, in Niger, where the unprocessed salty crust, formed on the low-lying ground around salt springs during the dry season, is sold for animal intake (Gouletquer 1975: 47).

Rock salt or haline sources are very rare in Africa. These are pure deposits of crystalline salt that can be quarried in slabs without any further processing. Most documented haline sources are found in the deserts of Mauritania and Mali (Alexander 1997: 538) as well as Kisama in Angola (Birmingham 1999: 34-36).

Another method of unprocessed collection of crystalline salt occurs on the southern Sahara fringe. Here, a salt crust forms along the bottom of salt pits located within artificial depressions dug in the desert sand. These depressions vary from 10 meters to 30 meters in diameter, and are several meters deep. At the bottom of these depressions, salt pits are sunk; usually two to three meters deep. The saline groundwater that seeps into these pits forms salt crystals which can then be collected (Gouletquer 1975:47-49; Lovejoy 1986: 56-61).

In Uganda and Tanzania, salt crystals form on the water surface of shallow salty lakes late in the dry season. Strong winds blow these crystals across the water surface where they accumulate against low brush barriers, erected for this specific purpose. From here the salt can easily be collected (Parsons 2001: 210).

**Leaching Devices**

Although brine can be obtained directly from the water of saline springs (e.g. Lovejoy 1986; Sutton and Roberts 1968), it is more commonly produced by the leaching of water through salt rich material (Connah 1991: 483; Connah *et al.* 1990: 47; Davison 1993: 16-33; Gouletquer 1975; Junod 1927: 35; Lovejoy 1986: 63; Stayt 1968: 47-48; Terblanche 1994: 197). Ethnographic accounts describe a variety of leaching methods employed throughout the continent. The two most common leaching devices are woven or basket-type filters and perforated ceramic strainers.

Various accounts describe the use of vessels with perforated bases (Connah *et al.* 1990: 33; Davison 1993: 12-13; Junod 1927: 35; Stayt 1968: 47-48). Salt rich material such as plant ash or saline earth is placed within the pot. Before filtering, the holes are covered with small stones or grass. Water is poured over the mixture to produce brine, which slowly drips from the holes, and is collected underneath. Leaching pots are sometimes arrayed as more permanent facilities in lines of 4-8 vessels incorporated within a supporting earthen embankment (e.g. Anonymous 1939, 1958 in Parsons 2001: 216).

While perforated ceramic strainers are identifiable in the archaeological record, basket filters perish easily. Accounts that describe the use of woven strainers are found throughout sub-

Saharan Africa. Descriptions from Ghana (Sutton 1983: 17) and Niger (Gouletquer 1975: 49), indicate the use of a clay lined, woven basket supported on a wooden frame. In the Manga region of the Sudan, Lovejoy (1986: 80) describes the use of funnel-shaped filters made from woven straw mats measuring 1,5m in diameter being supported on wooden posts about a meter high. In Malawi, Davison (1993: 11-12) reports the use of woven filters similar to that of West Africa, which she associates with a high level of salt production. Basket-type filters are all associated with the leaching of salt rich earth. The collected soil is placed inside the basket and water is poured over it to produce brine, which is collected in a receptacle underneath the filter. Once all the salt has been leached, the filter content is discarded. This process typically results in the formation of large mounds around areas of salt production (e.g. Connah *et al.* 1990: 33; Fagan and Yellen 1968: 4; Gouletquer 1975: 49; Sutton and Roberts 1968: 61).

A third example of a filtering device has been recorded at Ivuna in southern Tanzania. Here, Fagan and Yellen (1968: 30-31) refer to a process where brine is strained through a large wooden trough or gourd, supported on wooden posts. The resulting brine is then passed through a second trough before it is poured into clay pots for boiling.

**Leaching from Plants**

While leaves or roots can be used directly in cooking to achieve a salty taste, plant derived crystalline salt can only be obtained by collecting large quantities of suitable plants, burning them and filtering water through the ashes to make brine (Alexander 1997; Davison 1993: 10-16; Gouletquer 1975: 51; Parsons 2001: 222-227). Some cultivated plants also yield potassium-rich salts, the "strongest" coming from cassava-peelings. Other sources of salt include shelled maize cobs and sheaths, banana leaves and husks from finger millet (Davison 1993: 10-11). Because salt from plants is potassium rich, it has a bitter taste, and crystalline salt from mineral sources is generally preferred.

**Salt Gardens**

Saltgardens at Kibiro in Uganda, harness the capillary actions of salt ions from the uppermost few centimetres of soil, to maximize the precipitation of salt on the ground surface (Connah 1996-46). At Kibiro village, saline springs and a resultant stream seeps into the lacustrine plain on the edge of Lake Albert. This seepage impregnates the surrounding soils with salt.

Saltgardens are prepared within this area by first cleaning and levelling a piece of earth in order to form an evaporation surface. After this has been done, a thin layer of loose soil is spread over the surface. Salt becomes concentrated within this loose layer of soil by means of the capillary actions of salt ions. The salt rich soil is scraped up at the end of each day to prevent salt from leaching back into the ground when temperatures drop during the night. Each morning the soil is re-spread and the process repeated until the salt content of the soil is sufficiently high. When it reaches this stage, the salt impregnated soil is placed in a leaching device where the salt is transferred to clean brine for evaporation or boiling (Connah 1996: 47-48). Salt gardens can remain in use for a long time and are only abandoned when the yield falls and they are fallowed, or if too many stones appear on the surface (Connah 1996: 46; Connah *et al.* 1990: 33).

**Solar Evaporation**

In the south central Sahara and neighbouring savannah, saltmakers build brine ponds that rely on solar evaporation to produce crystalline salt. This is made possible by the high temperatures and low humidity in the dry season. The ponds are often constructed in the muddy areas around the diminished salt lake at the beginning of the dry season. These ponds are usually shallow enclosures, defined by low earth walls, and plastered with impermeable clay or lime to prevent seepage. These are kept in good repair throughout the saltmaking season in order to prevent seepage. In some cases the brine is kept within a single pan, and the salt crystals are skimmed off the surface and piled up against the edges of the surrounding embankments (Parsons 2001: 208-209). In other examples the brine is carried or led through a series of interconnected ponds (Gouletquer 1975: 47-48).

**Brine Boiling**

In most cases, solar energy alone is not enough to efficiently produce salt crystals, and brine is boiled to help the process along. Usually brine boiling consists of simply placing pots filled with brine over a fire, and refilling the pots as liquid evaporates. This process is repeated until the solution acquires a certain texture, which is usually a porridge-like consistency (Parsons 2001: 213). At this stage the fire is allowed to go out and the contents left to cool down (Lovejoy 1986: 71). In the Lake Chad Basin, Lovejoy (1986: 68-69) as well as Gouletquer (1975: 51) in Niger, describes a complex furnace system that could accommodate between 40 and 170 individual boiling vessels. These furnaces are formed by piling earth around wooden posts, forming kiln-like walled hearths in which boiling vessels are placed above burning fuel on ceramic pedestals. These pedestals are usually pointed at the bottom end and trumpet-shaped at the top. The pedestal tops' were connected to each other and to the walls of the kiln, by balls of soft clay and supported by pedestal fragments.

The brine boiling process can take as little as two hours when small batches of salt are made (Connah *et al.* 1990: 34), but in one recorded case it took 4,5 hours to reduce 6,4 litres of brine to 1,4 litres of salt (Grey 1945: 468). In other cases it can take up to 24 hours of non-stop boiling to reduce the brine to crystalline salt (Parsons 2001: 221). Brine boiling is an exacting task, since it is quite easy to burn the salt. The saltmaker needs to carefully watch the changing nature of the crystallization process in order to remove the mixture from the fire at the appropriate stage.

Salt production results in masses of ceramic shards that usually end up on refuse mounds in the salt workshop. Boiling vessels are subject to great physical stress due to the caustic nature of the brine, as well as the intense heat from the fire. In some cases the boiling vessels only serve as moulds for shaping hard cakes of salt and are broken to remove the salt after a single use (Gouletquer 1975: 50; Lovejoy 1986: 63, 71; Parsons 2001: 214). Most boiling vessels used more than once, are wide-mouthed pots, some employed exclusively for salt boiling (Grey 1945: 468; Sutton and Roberts 1968: 57; see also Muller 1984: 492; Cardale-Schrimpff 1975: 84; Flad *et al.*: 12619) while others are undistinguishable from domestic wares (Connah 1991: 490-491; Fagan and Yellen 1968: 15-16; Sutton and Roberts 1968: 53-56).

## Salt Production at Baleni

Although the present study is the first systematic archaeological investigation at Baleni, archaeologists have visited the site in the past - drawing on the modern salt extraction activities for comparative data applicable to their own studies (e.g. Evers 1974). Evers (1974: 64-65, 1981: 78), remarked on the similarities of the Baleni deposits to that of other Lowveld salt production sites such as Harmony and Eiland. Observations at Baleni have also been used to reconstruct traditional salt production methods at the Tsonga Kraal Open Air Museum. The continued extraction and the methods employed at Baleni have further been recorded by ethnographic observers (e.g. Terblanche 1994; Witt 1966). The first detailed account of salt production at Baleni was published by Witt (1966), curator of the Tzaneen

Museum. The most recent description of the process was presented by Terblanche (1994), in her graduate dissertation on traditional crafts practised by Tsonga women. The following description is largely based on accounts of these two authors.

**Background**

Observation in recent decades indicates that present-day salt extraction at Baleni is an exclusively dry season activity. The "salt-season" usually starts in May. The precise day of commencement is decided by consulting the ancestral spirits (Terblanche 1994: 194). Before any activities start on the site, a ceremony takes place in which the spirits are implored for a successful season. This involves the placing of offerings (usually bundles of sticks, tobacco, snuff or copper coins) at the base of a dead Leadwood tree (*Combretum imberde*) near the northern edge of the swamp. Witt observed in 1966, that the salt workers brought sleeping mats with them and that they erected temporary structures when making salt.

**Salt Extraction Methods at Baleni**

Harvesting starts during the dry winter months when the waterline of the swamp recedes and a salt crust forms on the low-lying ground around the water's edge. The first step in the production process, is to construct the strainers or filters through which the brine is leached. The strainers are mostly made from the branches and bark of the mopane tree (*Colophospermun mopane*). Although they vary in size, the filters must be high enough to place a container underneath. The strainer is built by first planting four forked poles into the ground approximately 40 – 60 centimetres from each other to form a square. Four other poles are then placed in the forks of the planted poles and tied together using bark from a mopane tree. A hanging sieve of bark and thin branches is then woven onto this structure. This sieve is held in position by supple mopane rods and lined with dry grass. The inside is built up into a cone shape using clay from an anthill, leaving only a small hole in the bottom through which water can drip. This hole is also usually covered with dry grass or leaves (Terblanche 1994: 197-198).

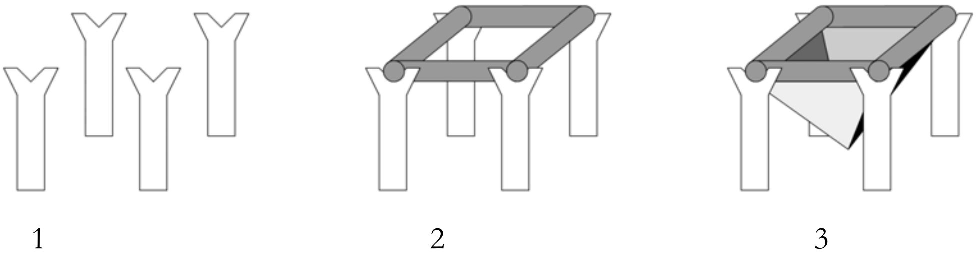



Figure 8: Steps in filter construction. (1) Four forked poles are planted in the ground. (2) A frame is placed in the forks of the planted poles. (3) A hanging sieve is woven onto the frame.

Figure 9: Salt filter at Baleni.

Figure 10: View of woven basket in which the collected salt crust is placed.

The next step is to scrape off the salt crust on the edge of the swamp. Terblanche observed that the shell of a freshwater mussel is used for this practice. This mixture of soil and salt is then taken to the filter where it is mixed with an equal amount of river sand. The river sand loosens the texture of the gathered crust, which would otherwise be too clayey. A suitable quantity of this mixture is then placed in the filter. Once in the filter, water is poured over the mixture. This process is repeated until the receptacle underneath the filter is filled with the saltwater extraction. After water has been poured over the salt-soil mixture two or three times, the content of the filter is scraped out and discarded next to it (Terblanche 1994: 198).

The brine mixture is then placed in a container over a fire and boiled slowly to evaporate the water, and leave only moist salt behind. The crystallized salt is then scraped into a pot, a large potsherd or calabash, again using a freshwater mussel shell. On questioning the meaning of the shell's use, Terblanche (1994: 198) was informed that it had always been the practice since iron objects will rust on contact with the salt.

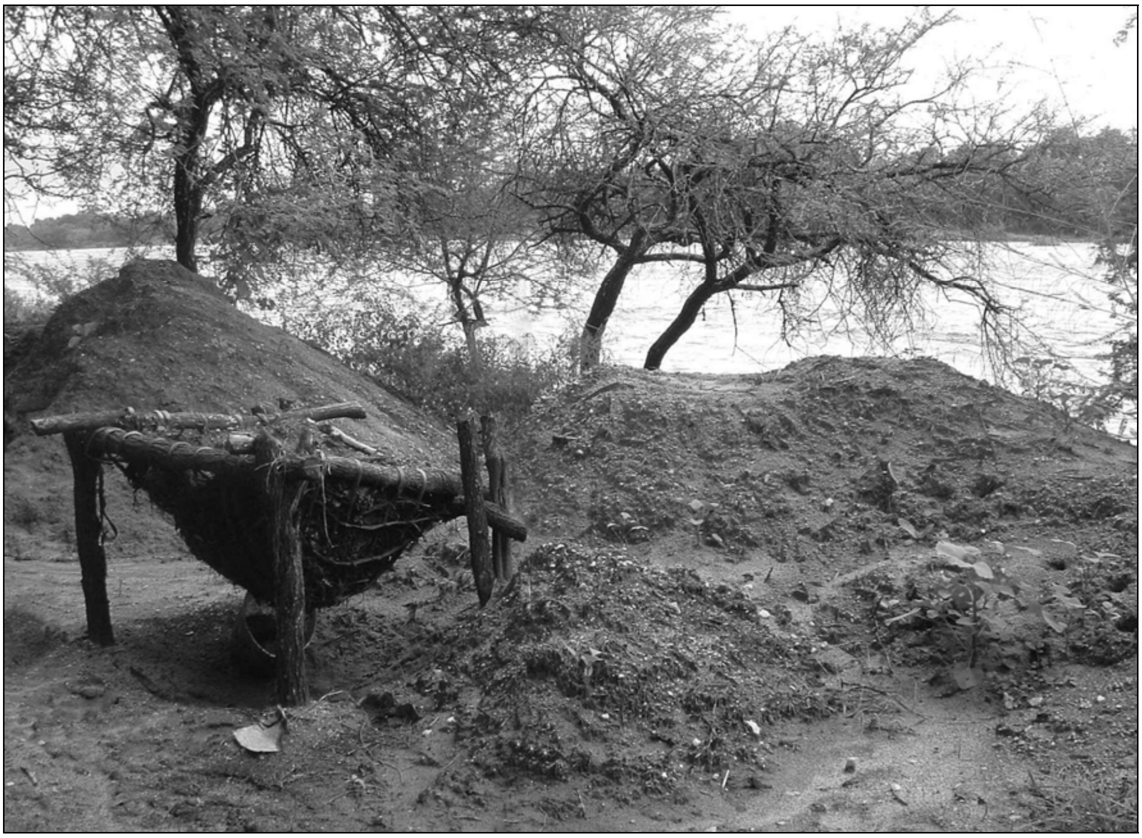


Figure 11: Typical salt production workshop at Baleni with a filter and the leached out content discarded next to it on a mound.

When there is a sufficient amount, the damp salt is formed into a cone shape (Figure 12). This is done by pouring the damp salt onto a flat surface and forming a cone by shaping it with the hands. Embers are placed on the cone to form a hard crust on the surface. Sometimes the cone is also placed on dry grass, which is then burnt in order to produce the same effect. Witt (1966: 21) mentions a process where the cone is placed in the sun in order for it to dry, and then baked in a clay pot placed on a fire. Measurements of the cones found that they weighed between one and two kilograms (Terblanche 1994: 200). Terblanche (1994: 199-200) asked her informants why the cone shapes were used and was provided with a variety of different answers. Some of the reasons provided include, it being easier to transport and trade this way.

Figure 12: Salt cone produced at Baleni on display at the Baleni Ivory Route Camp (scale in centimetres).

## Remarks

Present day salt production at Baleni is very similar to activities observed at other locations where salt is harvested from brine springs. General trends observed at these sites offer plausible interpretations for prehistoric salt production at Baleni.

Overall, salt extraction at brine springs, is largely a seasonal activity and during the rest of the year, salt workers are involved in other economic pursuits. In all the examples where salt extraction relied on the collection of salt crusts around brine springs similar to Baleni, production was a dry season activity since the process relies on a receding waterline around the aquifer. A common feature on sites is the filtering of the unprocessed saline crust. As witnessed at Baleni, this results in significant transformations of the local landscape. Active and abandoned salt working sites are associated with mounds of leached (see Figure 11) earth and debris that contain many ceramic fragments from vessels broken during the process of boiling and moulding salt (see Figure 13). A variety of ceramic vessels is often required in the saltmaking workshop for drying, storing, moulding, packaging and transporting the finished salt. In many cases, these vessels are types exclusively associated with salt making (Davison 1993: 12; Grey 1945: 468).

Figure 13: Ceramic fragments visible on the surface of a salt production mound.

Several actions may be taken to maximize salt production output. Salt gardens for example encourage the precipitation of salt on the ground surface. Since producers make use of the capillary action of the sun, they do not need to wait for the water levels to drop before salt production can take place. Excavations at Uvinza indicate the use of brine tanks to concentrate the salt content of brine. Using special ceramics vessels in production activities can also speed up production. These include the use of temporary moulds that are broken after production, or enlarged vessels that can contain more brine. Specialist furnaces, such as the pedestal and arrayed furnaces found in West Africa, offer more efficient evaporation techniques than boiling in single vessels. In South Africa, the archaeological sites of Harmony and Eiland, have soapstone bowls in the upper limits of the excavations. These represent more durable and efficient production tools than fragile ceramic vessels used in earlier times.

Traditional salt production therefore offers the archaeologist valuable analogous data. The next chapter will focus on the empirical archaeological research covered during the course of this dissertation. In this chapter, I discuss the archaeological research and methodology carried out at Baleni.

# CHAPTER V

# ARCHAEOLOGICAL RESEARCH AT THE BALENI THERMAL SPRING

The central focus of this dissertation is to characterise salt production during the EIA by identifying the context, intensity and concentration of production. Each of these parameters require specific research strategies. This chapter is structured around these specific research goals as presented in Chapter I. The first part deals with the archaeological research concerned with salt production activity areas. The ensuing data is primarily related to the discussion of the context and intensity of production. Research on this theme covers a series of surveys and excavations conducted in the immediate area around the swamp. Excavations in this area also allowed the creation of a culture historical sequence of salt production activities at Baleni.

The second part of this chapter is primarily related to research on the concentration of production. The degree of concentration, as indicated in Chapter I, describes whether producers are nucleated within a single production community. To this aim, I sought to identify the presence of producer communities around Baleni within a 1,5km radius of the spring. A survey of this area identified two settlements that fell within the temporal scope of this study. Their spatial proximity to the salt production source does not inevitably imply nucleated production. Because these sites may represent prolonged seasonal extraction, excavations at these sites sought to clarify both the length of occupation and the nature of activities carried out there.

## Areas of Salt Production

As indicated in Chapter II, salt can be obtained from a variety of sources at Baleni. A salt crust can be gathered from around the swamp, as well as from the swampy depressions around secondary spring eyes and small rivulets. Salt production processes, both past and present, have uniquely transformed the surroundings of Baleni. The most visible alteration are the distinct mounds of leached-out earth, which, continued over numerous years have resulted in a landscape, pockmarked by hundreds of mounds. These mounds constitute the

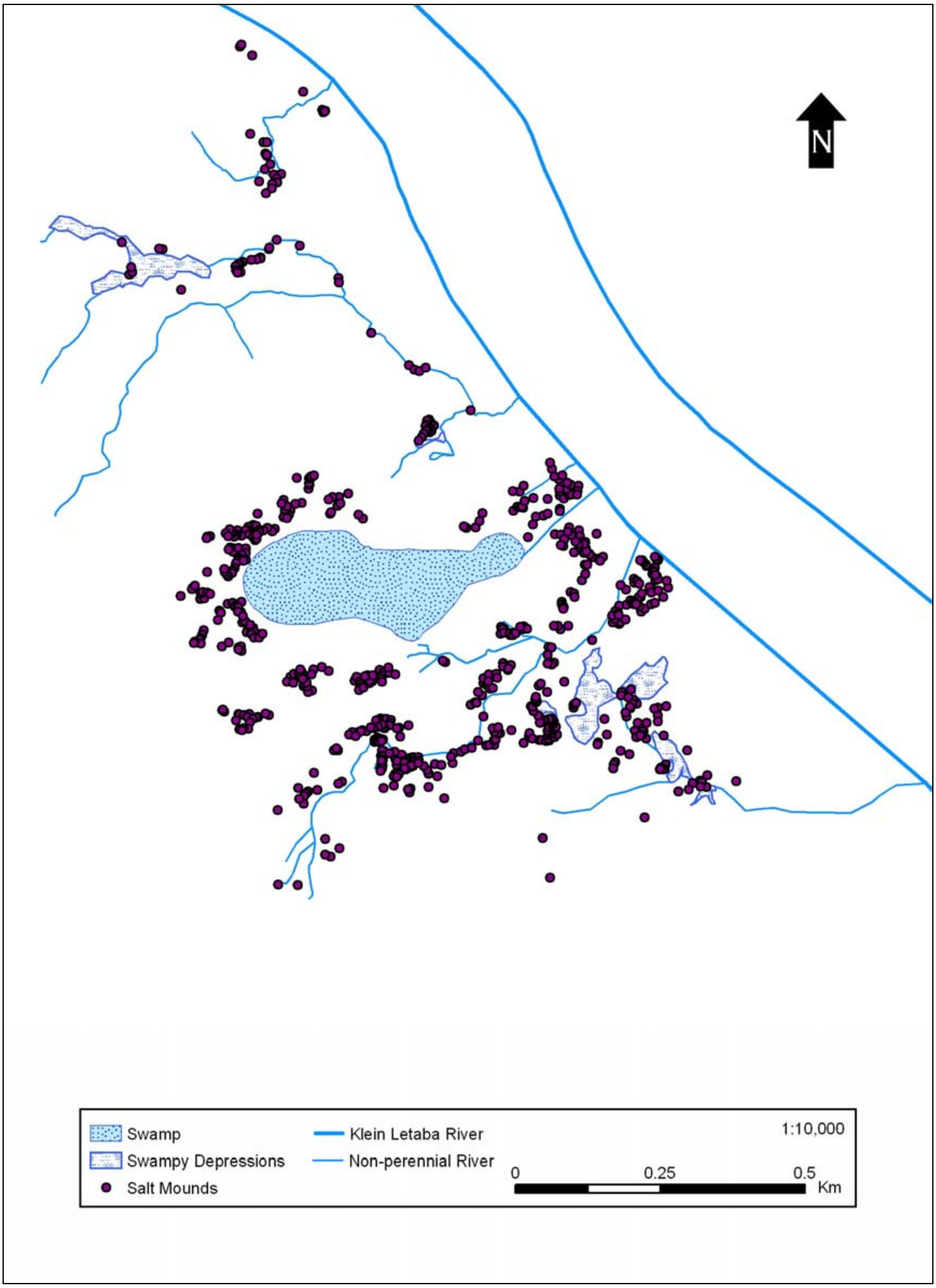



Figure 14: Location of mounds of salt making activity areas

physical remains of past salt production, and three surveys recorded their spatial distribution as an indication of the extent of production activities. The first survey completed during May 2003, focused on the immediate area adjacent to the swamp within a radius of approximately 500m. Two additional surveys in September 2003 and September 2004 recorded workshops in the adjacent region up to 1,5km away from the spring. All three were pedestrian surveys during which individual, leached out mounds were plotted using both a Global Positioning System (GPS) and an Electronic Distance Measurement device (EDM).

The surveys recorded 730 individual mounds in total (Figure 14). The spatial variation of the mounds is represented by a trend surface map (Figure 16) compiled using a Geographic Information System (GIS). The results indicate a clear preference in the location of salt making activities. Production mounds are concentrated within 250m of the southern, eastern and western edges of the swamp. The highest density of production occurs mostly on the banks of dry streams within this area. Mounds along the western edge of the swamp were generally much higher. Here, numerous mounds have formed on top of each other to create embankments in excess of 2m. Lower concentrations of mounds are also located along the edges of the swampy depressions. Although the salt crust that forms in these areas was evidently utilised, the swamp formed the centre of production activities.

Figure 15: Mound formed of leached out filter content containing archaeological material.

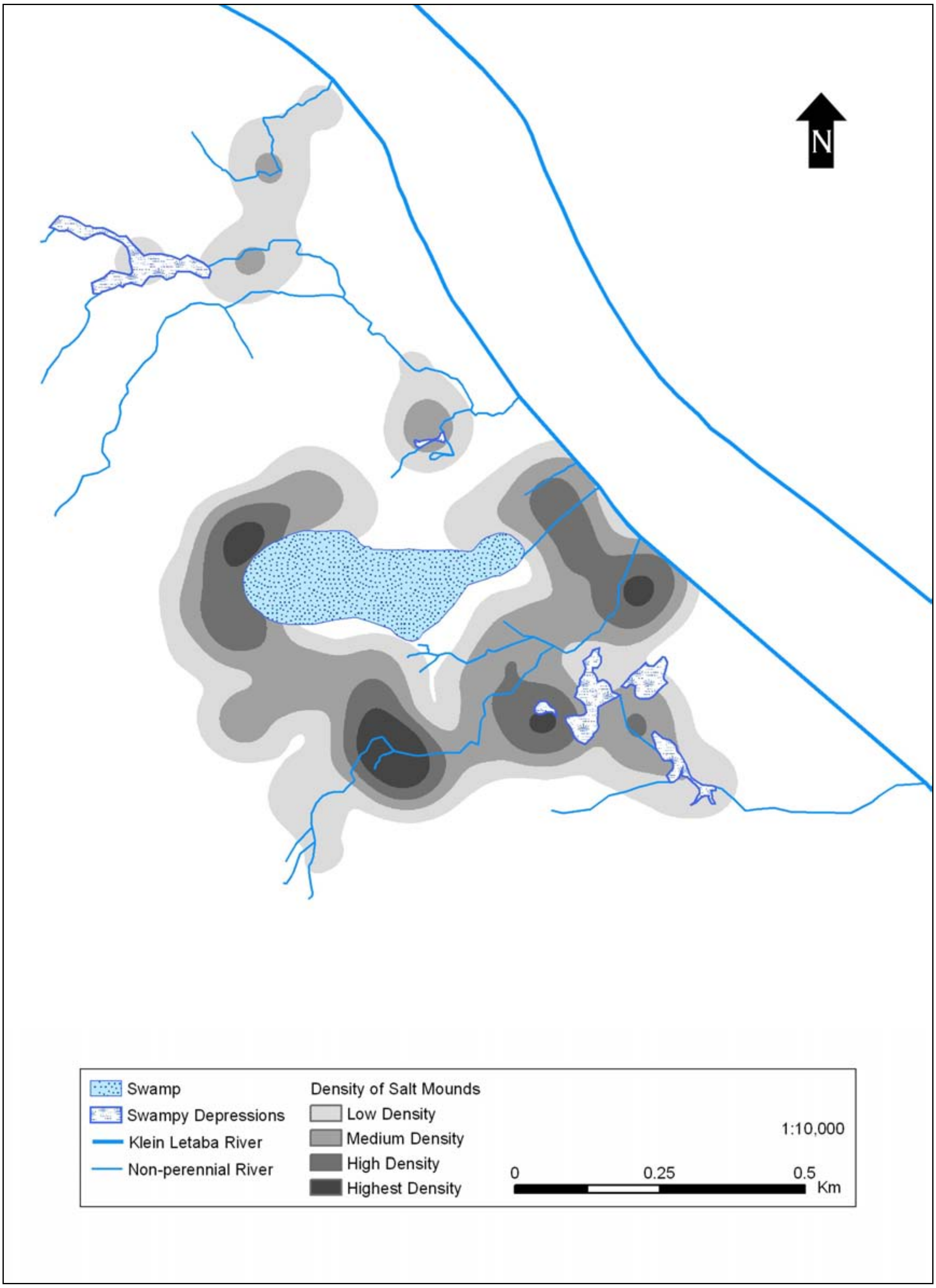



Figure 16: Trend surface map of the density salt making production activities.

**Excavation Methodology**

The excavations at the Baleni salt production areas were investigations into the chronology of the sites, and did not cover a particularly large surface area. The excavations were used to provide an "archaeological clock" which would place the settlements "in time" (cf. Connah 1996: 65).

Three cuttings were placed at different locations around the swamp (Figure 17). Excavations were carried out during two periods. The first of these was between 8 and 13 February 2004. During this period two cuttings, BAL01 and BAL02 were completed. The third cutting, BAL03, was completed between 19 and 25 March 2004. The excavation teams during both periods, were comprised primarily of graduate students from the University of Pretoria. Excavations proceeded with trowels, brushes and buckets. All the excavated materials were dry screened through a 5mm steel mesh and hand sorted. All biological and cultural material were kept and transported to Pretoria for analysis.

The excavation at BAL03, located at the south-western edge of the swamp, was a 2m x 1,5m cutting that reached sterile soil at 2,1m below surface. This excavation provided a detailed multi component ceramic assemblage, which together with four C14 samples provided a chronological "key" to Baleni. BAL01 and BAL02 were single component excavations of mounds on the bank of a non-perennial stream that drains into the Klein Letaba River. Horizontal expansion of the stream had cut into the surrounding deposit to form deep, vertical sidewalls exposing leached out mounds located on the banks. The excavation procedure entailed placing the excavation units parallel to the bank, approximately 30cm from the edge. The exposed sidewall was cleared and levelled up to the edge of the excavation unit. This provided a "readymade" profile from which the natural strata were easily identifiable. The rationale behind this method was that it would provide a lot of data in relatively quick time. This was indeed the case, but it quickly became evident that the excavations at BAL01 and BAL02 were limited in terms of chronological depth.

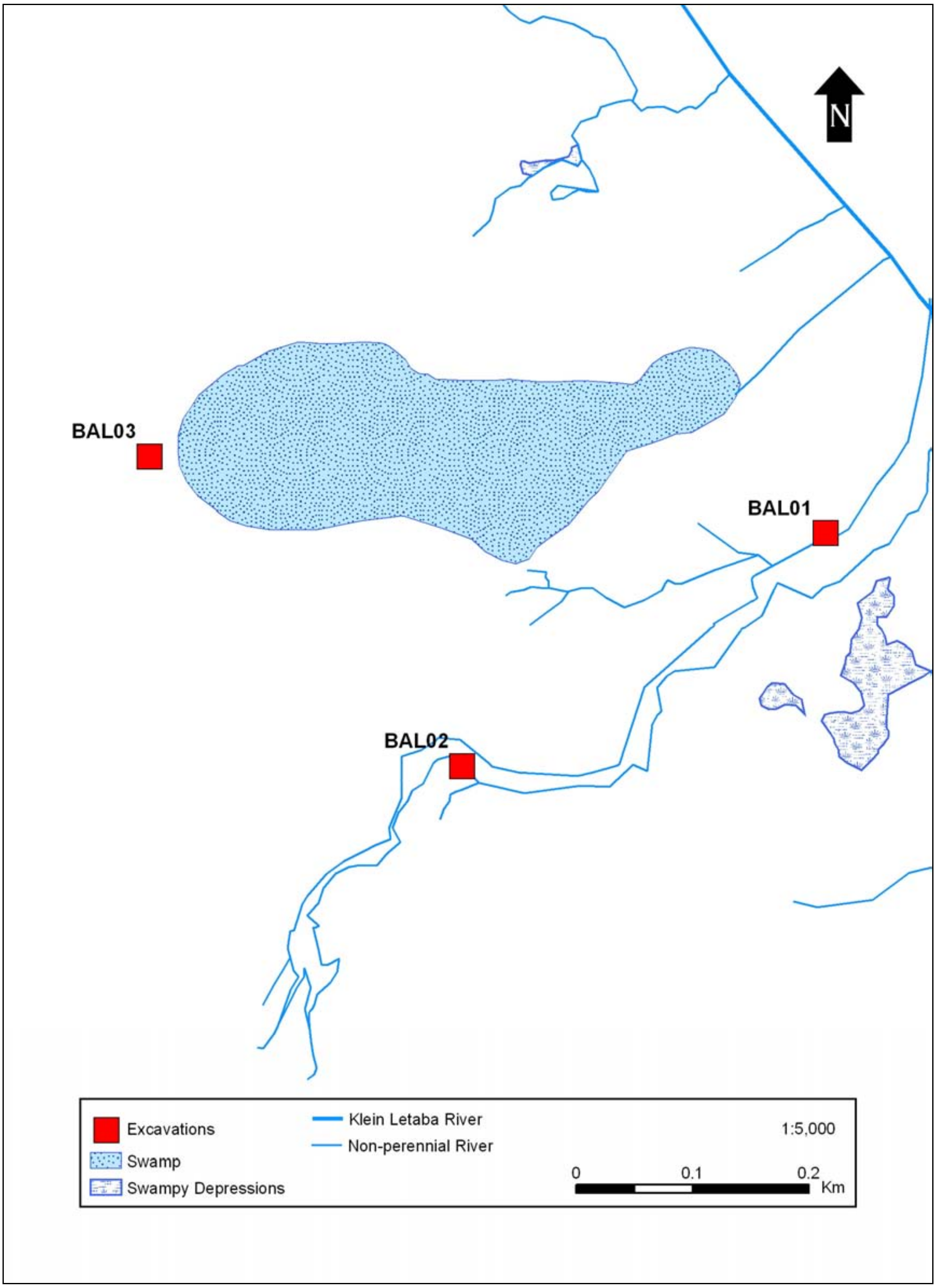



Figure 17: Location of excavations of salt production areas.

**Excavation BAL01**

At BAL01, the non-perennial stream that the unit was placed next to, forms a deep vertical wall on its northern bank. Because of horizontal movement by the stream, new archaeological deposits are constantly being exposed in its sidewalls. The opposite southern bank of the stream is much lower and slopes away gradually. The only time when water can be found in this stream is directly after heavy rains when water flows quickly down the river. Water flow in the stream results in cycles of sand deposition and removal on the stream bed. This results in varying depth in the stream bed, which was measured at 2,78m below Datum BAL01 on 9 February 2003 by means of level and staff (Figure 18).

The cutting at BAL01 measured 1,5m x 1m, with the two longer sides parallel to the edge of the bank and the orientation of the unit being 330° magnetic north. The northwest corner of the cutting was placed 6m south of Datum BAL01 (S23 °25' 12.1"; E30° 54' 54.4"). All measurements during excavations were taken from Datum BAL01. The excavations proceeded with trowels and brushes.

Figure 18: South-west profile of BAL01 before it was cleared.

BAL01 is a single component Mzonjani site (see Chapter 6). The excavation provided a straightforward stratigraphy comprised of only two contemporary strata, excavated in natural layers. Both layers were sandy loam in texture, but were well defined in terms of colour. Leaching and root activity resulted in a diffused limit between the two strata in the south-eastern corner of the excavation. The first stratigraphic layer was dark brown in colour, humus-like and contained a lot of organic material and coarse gravel inclusions lower down. The second layer was greyish dark brown, with scattered small ash lenses, which was excavated with the rest of the layer. The excavation ended on reaching sterile soil 0.60m below datum (Figure 21).

The most abundant finds were ceramic fragments. Isolated bone fragments were present in both strata. Stratigraphic unit 2 also contained fragments of a freshwater mussel shell. Charcoal was collected in unit 2 and kept for future dating requirements.

As seen in Figure 20, stratigraphic event 2 contained a comparatively greater volume of ceramics than event 1. These shards were also better preserved and less fragmented.

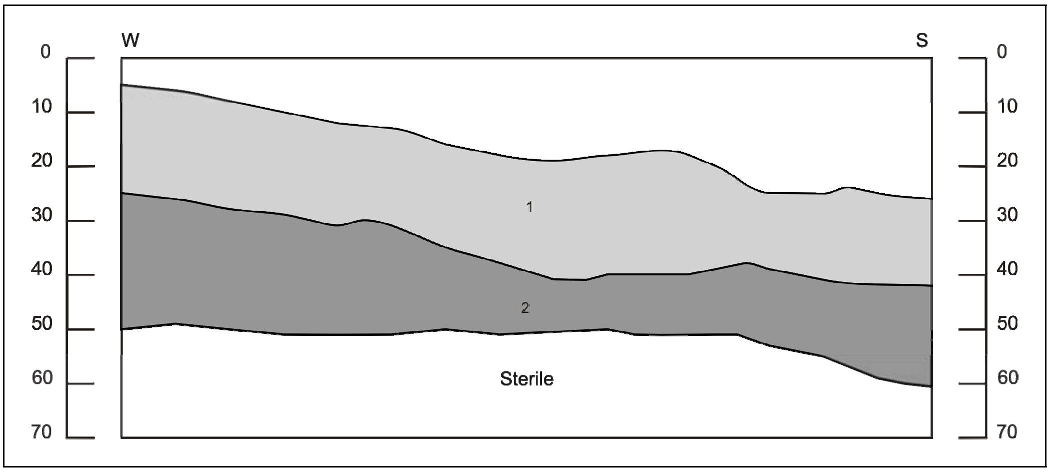



Figure 19: South-west profile of BAL01 after it was cleared.

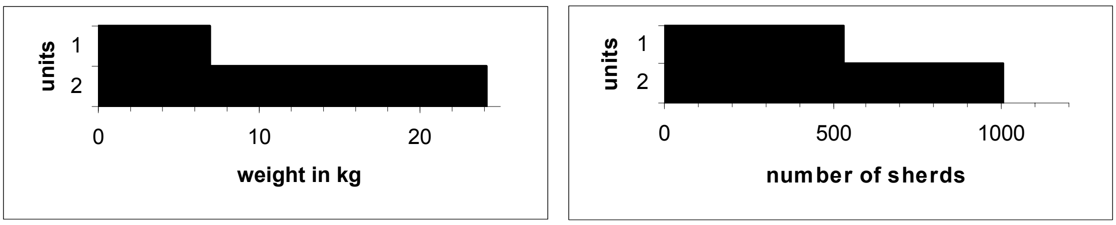



Figure 20: Shard weight per stratigraphic unit and the number of shards per stratigraphic unit in BAL01.

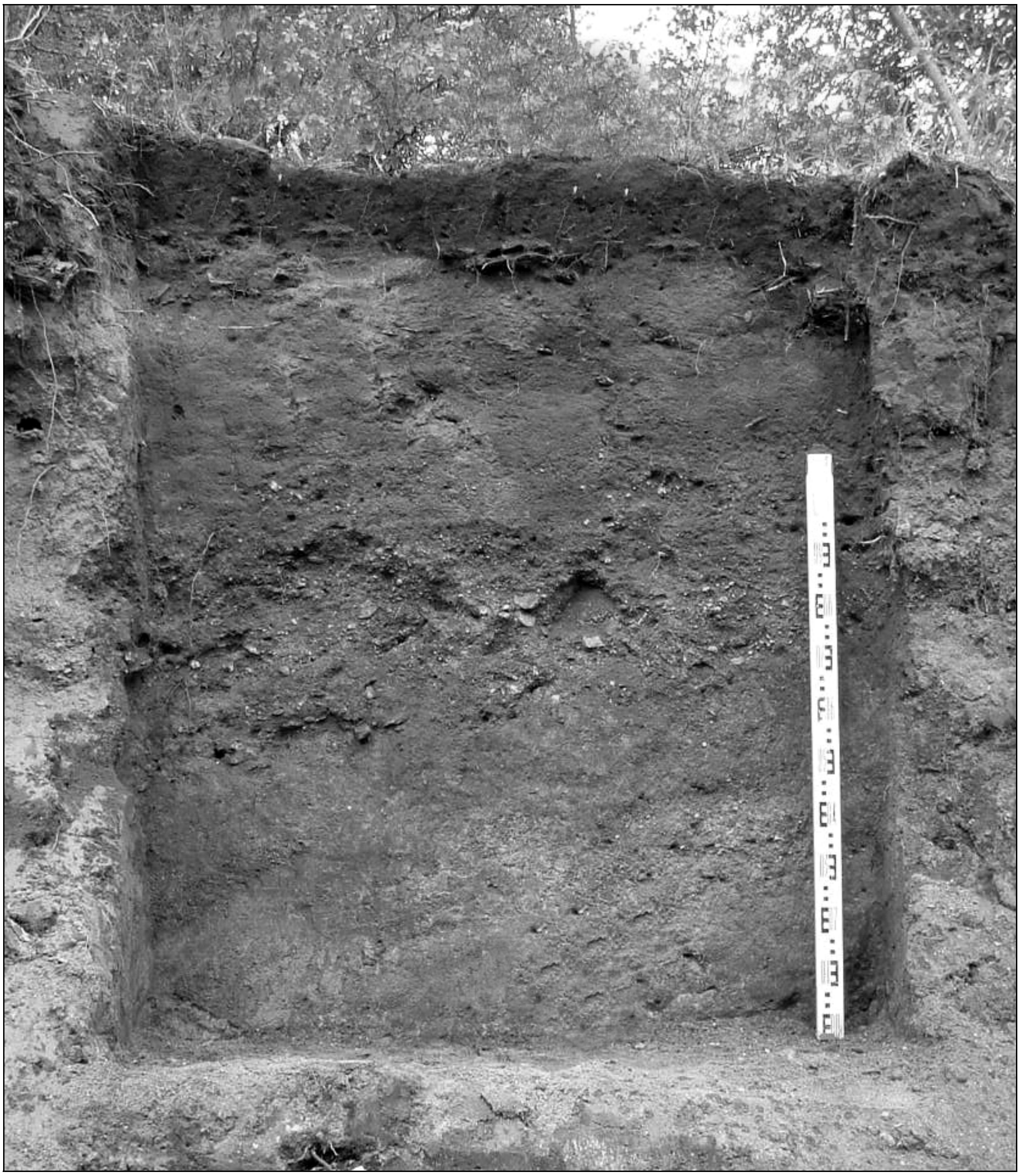


Figure 21: North-east profile of BAL01 at the end of excavation.

**Excavation BAL02**

The cutting at BAL 02 was placed 300m west of BAL01, on the southern bank of the same stream. Here, the bank gradually slopes up and does not cut into the natural deposit as steeply as at BAL01. At BAL02 a series of leached out mounds, located in a turn in the stream, forms an artificial embankment (Figure 22). Datum BAL02 (S23º 25' 19.00"; E30 54' 43.7") was placed on the top of the embankment. Horizontal expansion of the stream had cut into the mounds along the edge of the embankment and this served as the location for BAL02. The mound's base was approximately 40cm higher than that of the stream bed. The bed was measured at 2.67m below Datum BAL02 on the 10th of February 2004 by means of level and staff. All measurements of depth during the excavation were taken from Datum BAL02.

Figure 22: BAL02 prior to excavation.

BAL02 was a 1,8m x 0,5m cutting with the longest side laid out parallel to, and 30cm from the stream edge. The longer sides of the excavation unit was orientated 310° magnetic north, and placed 2,5m south (180° magnetic north) from Datum BAL02.

The eroded profile was prepared for excavation by removing loose earth and debris and cutting a straight edge with a shovel and trowels (Figure 24). The cleared section revealed a very complex stratigraphy. The deposit of BAL02 displayed a mound-like stratification and contained numerous lenses and pockets of river sand, ash and charcoal. This suggests that it formed through deposition of the leached out content from salt strainers. The deposits were therefore the result of one depositional event as was evident in the cleared north-eastern profile (Figure 23). Although the strata were culturally from the same period, 10cm spits were employed to assert vertical control.

Excavation of BAL02 was terminated before reaching sterile soil. This was done since the unit was virtually devoid of any archaeological material and due to time constraints, it would prove unproductive to continue at BAL02. The main aim of the excavation was to collect datable material, and since inspection of the lower stratigraphic units visible in section indicated that even less material would be forthcoming from these levels, the excavation of BAL 02 was discontinued at a depth of 50cm below the datum. Up to that point, the excavation had only delivered a few ceramic fragments that were identified as being from the Late Iron Age Letaba phase.

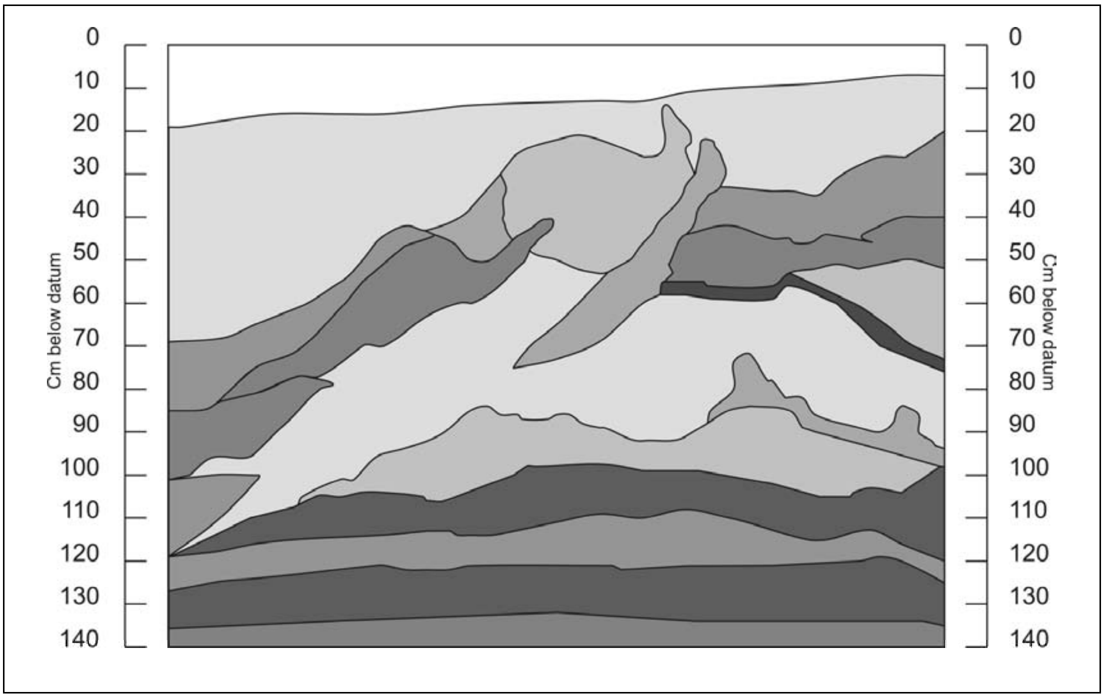



Figure 23: BAL02 north-east profile.

Figure 24: Cleared south-east profile before excavation.

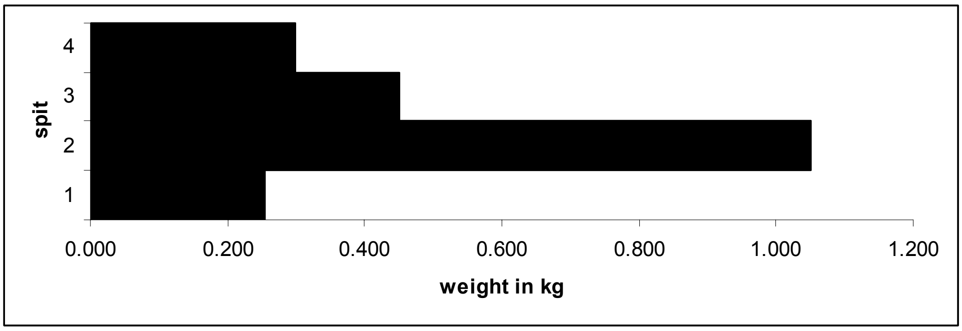



Figure 25: Ceramic weight per spit of BAL02.

**Excavation BAL03**

Along the south-western edge of the swamp, concentrated salt making has resulted in the formation of a large embankment (Figure 26). The possibility of this area to provide a deep well stratified chronology led to the excavation of BAL03. The cutting at BAL03 measured 2m x 1,5m and was orientated with its sides to the cardinal points of the compass, the two longer sides being the northern and southern profiles. The cutting was placed 24m north and 6m east from the datum BAL03 (S23º 25' 10.49"; E30º 54' 34.78"). All the excavation's depth measurements were taken from Datum BAL03-A placed 24m along the primary northern axis and 1,75m above the primary datum BAL03 (Figure 27).

Figure 26: View of the BAL03 mound area.

Experience from the excavation of BAL02 made it clear that the quick deposition that characterises the formation of a salt mound would entail various layers butting against or intertwined with those next to, and above them. Discerning natural levels during excavations would therefore prove difficult and time consuming. Since the quick deposition of sediment would make most strata on a horizontal level contemporary, excavation of BAL03 proceeded by means of 10cm spits. This method would provide the needed vertical control during excavations (cf. Hester 1997: 242).

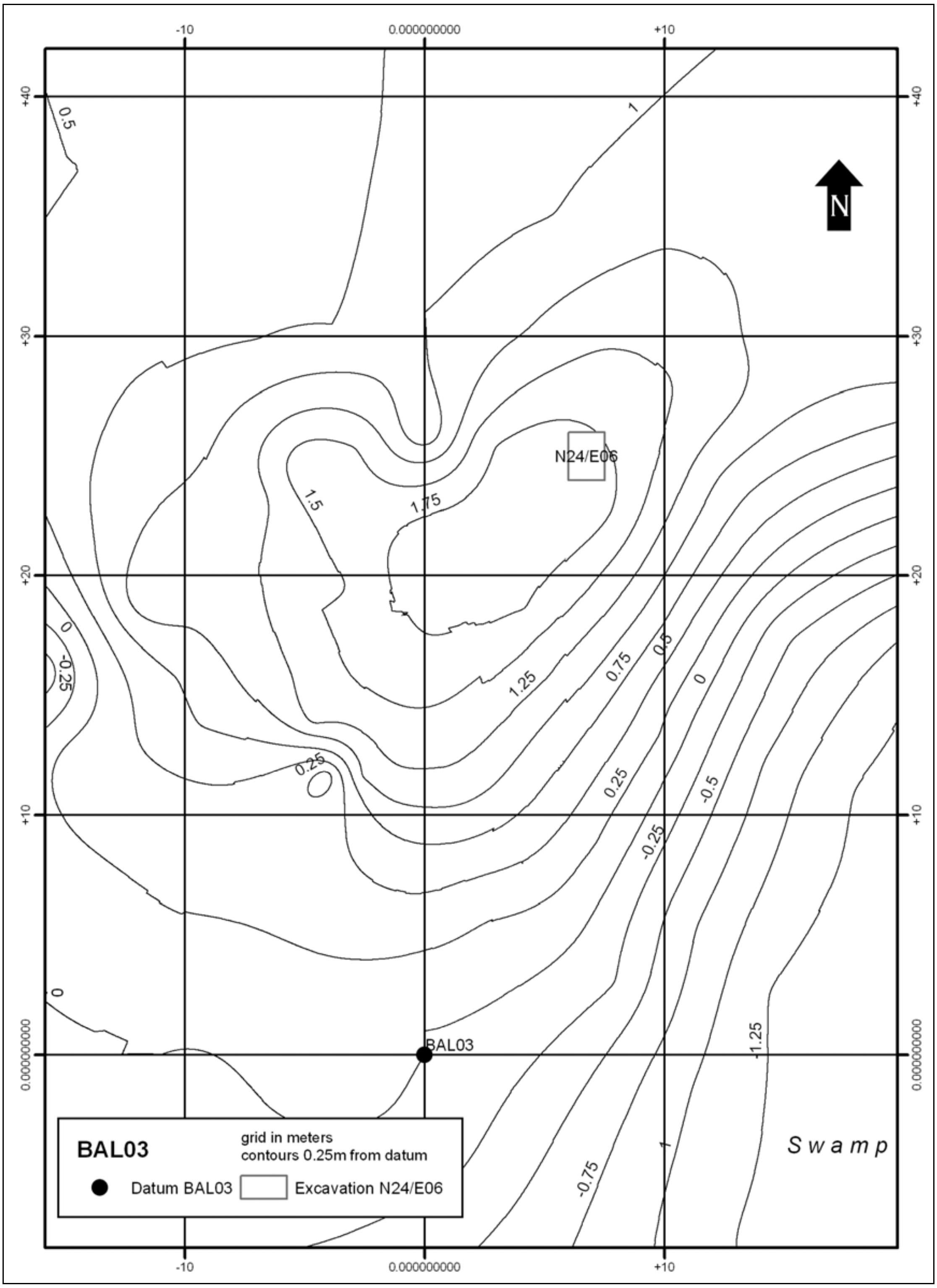



Figure 27: Site map of BAL03 indicating location of excavation unit N24/E06

By combining the profiles in isometric view, five distinct salt production events are clearly visible. An event, in this case, is the formation of a single "mound", through the rapid deposition of material. Each event is associated with a specific ceramic phase. Five carbon samples, one from each event, were sent to the Quaternary Dating Research Unit (QUADRU) at the Centre of Science Industry and Research (CSIR) in Pretoria for radiocarbon analysis. The results will be discussed in more detail in the next chapter (Chapter VI) when the dates will be placed in the context of the associated ceramic assemblage from each event. All the dates mentioned in the text were calibrated with the radiocarbon calibration curve from the data of Stuiver and Pearson (1993) and adjusted for the southern hemisphere (Talma and Vogel 1993). The discussion of the excavation of BAL03 presented below, will be in terms of the five identified events.

*Event 1*

The most recent event comprised the top 60cm of the excavation (Figure 28). The deposit was mostly a uniform yellowish-dark brown, sandy loam interspersed with small ash lenses. This deposit was loosely compact with gravel inclusions found throughout. Charcoal samples from spit 4 (50-60cm below datum) were collected and calibrated to AD 1646 ±45 (Pta-9340). The associated ceramic phase for this event is Letaba.

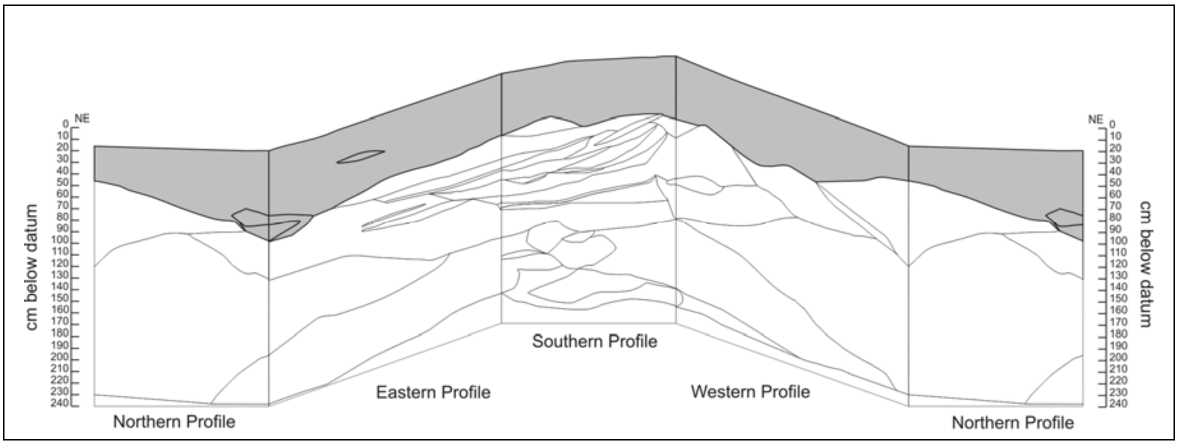



Figure 28: BAL03 Event 1

*Event 2*

The next depositional event was found between 50cm and 140cm (Figure 29). This event is characterized by a series of diagonal stratigraphic layers, most visible in the southern profile. A mound-like stratification is clearly visible as it slopes down in a west-east direction. The C14 sample for this event was collected from spit 9 (100cm -110cm below datum) and calibrated to AD 1658 ± 45 (Pta-9351). Letaba ceramics also characterise this event.

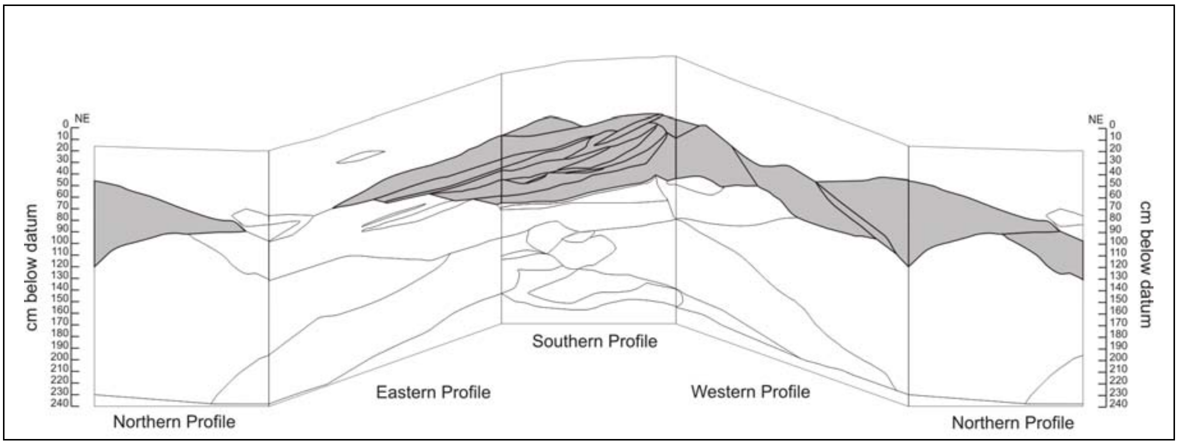



Figure 29: BAL03 Event 2

*Event 3*

The third event is located around 100cm - 140cm below datum (Figure 30). As opposed to the numerous small strata of the previous event, this event contained one primary layer of dark brown sandy loam, visible in the eastern, southern and northern profiles with smaller well defined layers of orange and red clay butting against it. Interspersed within the deposit were layers and lenses of well defined coarse, orange sand and very fine light grey ash with charcoal inclusions. Carbon samples from spit 12 (130cm – 140cm below datum) were collected and calibrated to AD 1430 ±50 (Pta-9341). This event is associated with Eiland ceramics.

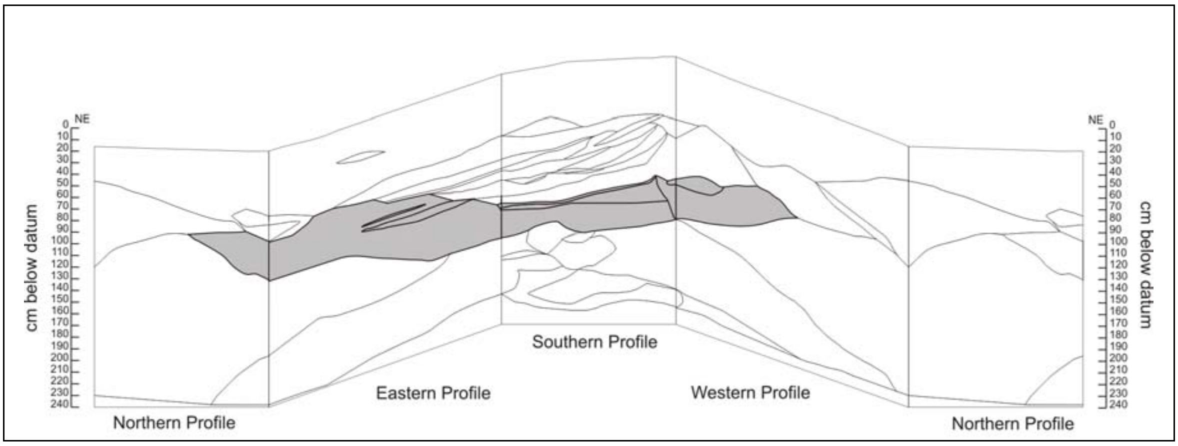



Figure 30: BAL03 Event 3

*Event 4*

The fourth event was located from 100cm to 240cm below datum (Figure 31). This uniform sandy-loam layer was a dark orange-brown with darker and reddish brown inclusions. Pockets of grey inclusions indicated the remnants of ash lenses that had fused with the surrounding sandy loam matrix. The limits of the inclusions were not well defined and the entire event had a general diffused character caused by water seepage. Contained in the event were numerous, almost intact, Mzonjani phase vessels. The associated radiocarbon date (Pta-9422) was calibrated to AD 400± 60.

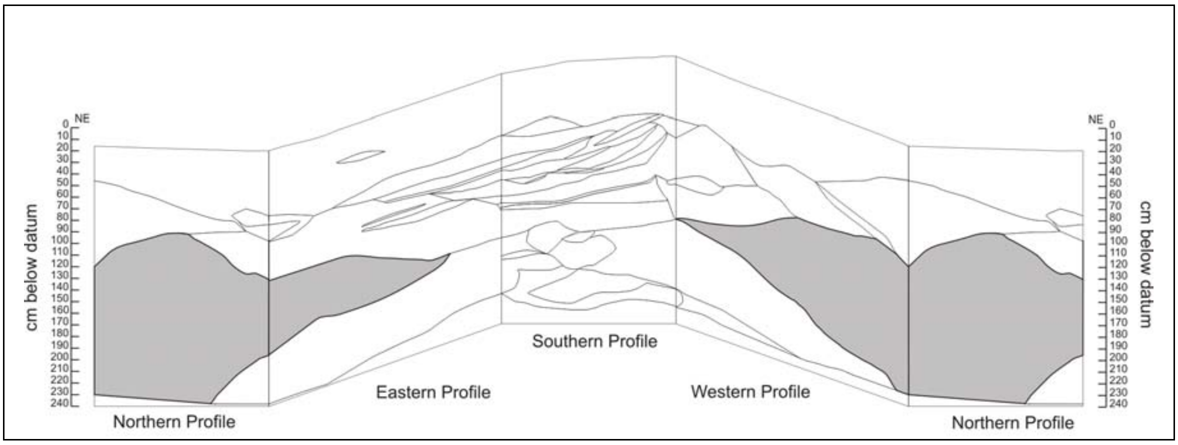



Figure 31: BAL03 Event 4

*Event 5*

The earliest event consisted of a series of contemporary strata and lenses deposited to form a mound between 140cm and 240cm (Figure 32). The bottom-most stratigraphic layer in this event was one of blackish dark brown clay with a high quantity of charcoal inclusions. Charcoal from this layer was collected and was calibrated to AD 60 ±50 (Pta-9349). Being on the same level as the swamp, this bottom level was very moist, with water seeping in from the sides of the cutting. The permanent waterlogged state of this layer resulted in the shards being extremely weathered. The strata above were mostly sandy loam of blackish brown and yellowish dark-brown colour. The strata were very diffused without any clear boundaries or limits. The excavation was ended on bedrock, which was a solid bed of shist, 2.4m below Datum BAL03-A.

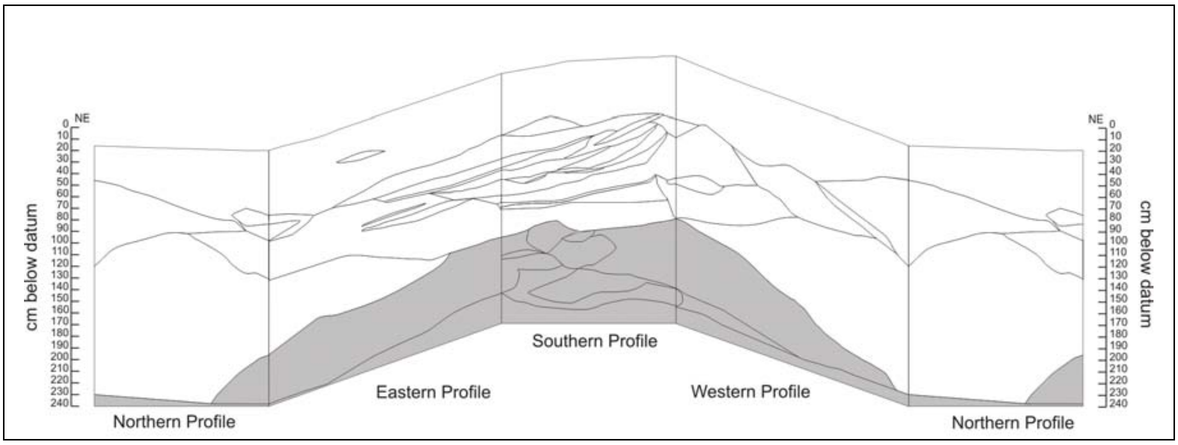



Figure 32: BAL03 Event 5

*Results*

Ceramics were the most abundant material and were present in every spit. There was a much greater number of shards and total ceramic weight in the lower levels of BAL03 (Figure 33). In some spits, the ceramics displayed extreme fragmentation. This can best be seen by comparing the histograms showing the weight of shards per spit (Figure 33), and the number of shards per spit (Figure 34).

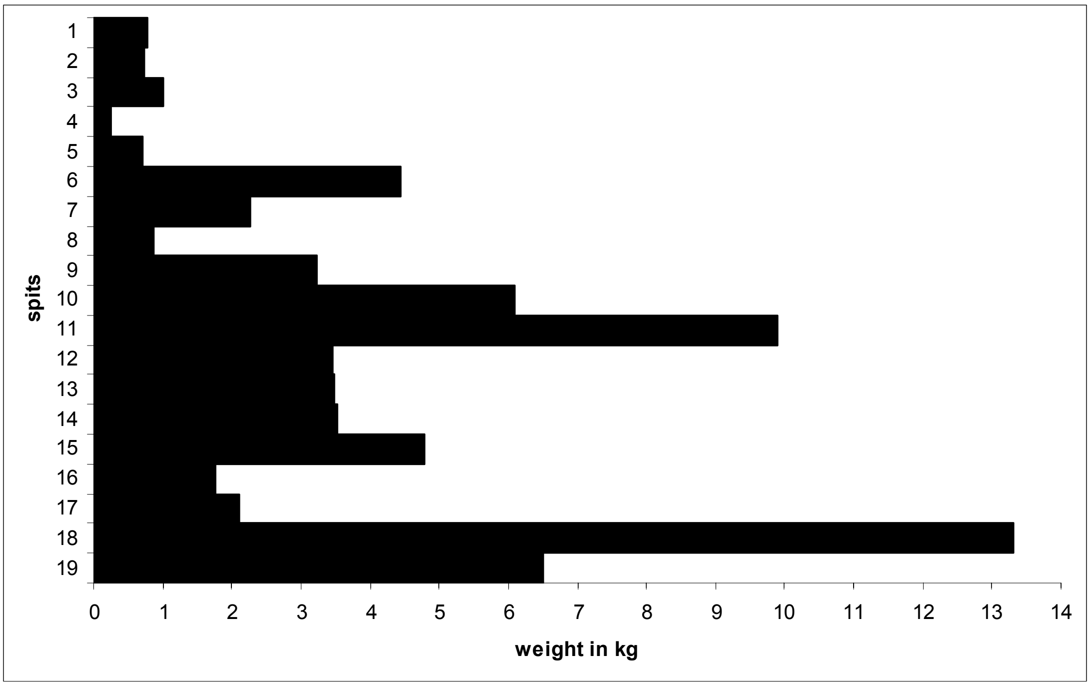



Figure 33: Weight of ceramic shards per spit

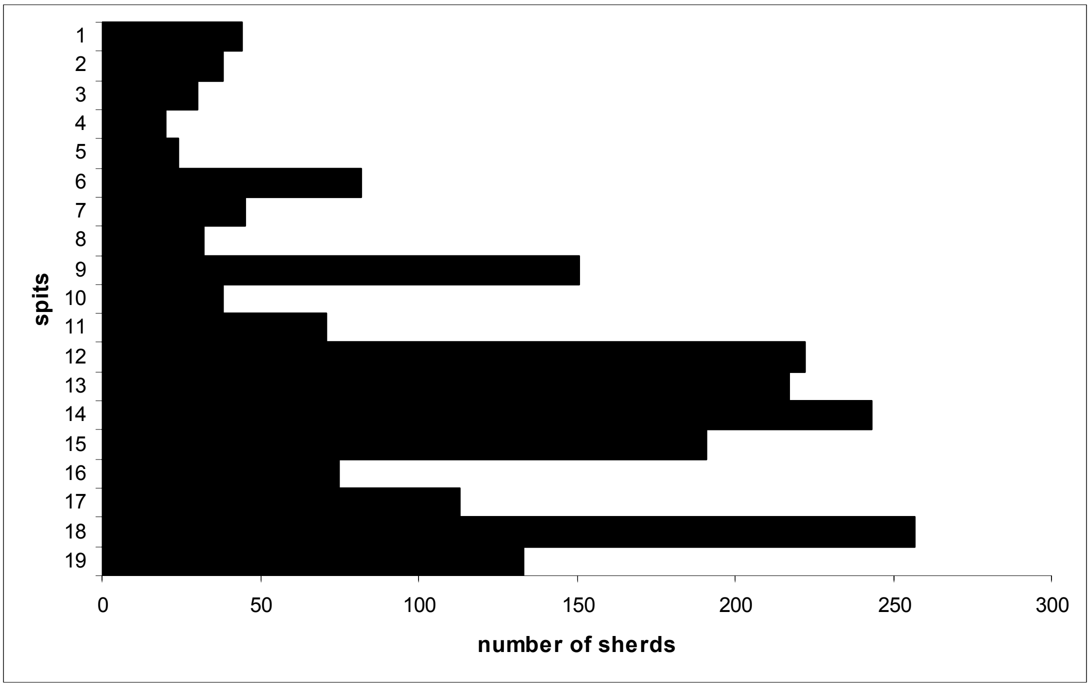



Figure 34: Number of ceramic shards per spit

## Producing Communities at Baleni

The final phase of research was on EIA settlements located within the 1.5km radius around the spring. As indicated earlier, the presence of such settlements are essential in considerations of the concentration of production. Concentration of production, as defined in Chapter I, entails the spatial relationship between producers and consumers. This could take the form of a permanent community of producers, or temporary exploitation. Temporary production activities could also vary in length of time, and result in evidence of prolonged habitation (cf. Burton 1984; White and Pigott 1996). To investigate the parameter of concentration, a pedestrian survey covered the area in a radius of 1.5km around the Baleni spring.

Visible signs of architecture served as the primary criteria for the positive classification of a feature as a settlement. This included stonewalls as well as dagga and hut floors. Secondary diagnostic features included upper and lower grinding stones and ceramic scatters. These were not classified as settlements if no primary indicators were found in context. The central coordinates of each identified feature were captured with a handheld GPS (Garmin E-Trex Legend). Coordinates were fed into a Geographic Information System, and a distribution map was compiled of settlements and associated features.

### Survey Methodology

The method employed in site location and initial recording was an orthodox methodology developed for total coverage pedestrian surveys by Feder (1997: 54-55). Prior surveys of salt workshops had already covered the immediate area around the swamp (see **Areas of Salt Production** above, p.43 to p60). As a result, this survey was started 300m out from a base point located on the eastern edge of the swamp and extended a further 1200m away in a circular pattern (Figure 35). Coverage was achieved by walking 30 transects spaced at 12° increments. The first transect was started at true north (0°), with the following 29 transects covering the full 360°. The survey team consisted of nine individuals spaced 10m-15m apart, thereby effectively covering 100m - 135m per transect. A Geographic Information System was employed to import the start and end coordinates of the transects into a handheld GPS as waypoints. During the survey, a combination of GPS and prismatic compass were used to follow the transect route which would otherwise have proven difficult with just a compass in dense undergrowth.

**Survey Adequacy**

The structure of the survey meant that total coverage was obtained in the areas closest to the pan where the transects were spaced right next to one another. Distance between the transects increased with distance away from the pan. At the furthest point from the survey base, the distance between transects was approximately 60m. While this small distance can be seen as insignificant, I nevertheless tested the adequacy of the survey by applying a simple formula suggested by Sundstrom (1993). The formula computes the probability of sites being intersected by the transects. The expression is a function of the size and shape of the archaeological site, and the spacing of the transects.

In the test, I assume that the target sites are circular in shape, with a radius of at least 20m, and therefore a surface area of $1256m^2$. This relatively small size is seen as an adequate estimate. The probability (P), of finding a site of this size, at the end of a transect where spacing is 60m, would be:

$$P = \frac{2\sqrt{(a^2 + b^2)/2}}{d} = \frac{2\sqrt{(20^2 + 20^2)/2}}{60} = 0.66$$

Equation 1: Test for survey adequacy, where *a* and *b* are the two semi-axes of the ellipse (in this case the site is circular), and *d* the distance between the transects.

At the point where the distance between transects was greatest, the survey had a 66% probability of finding archaeological sites above $1256m^2$. As the transects move in towards the base point, this figure increases to 100% over a distance of 300m. This means that the survey obtained full coverage for 95% of the survey area and a very high probability of locating sites for the remaining 5%.

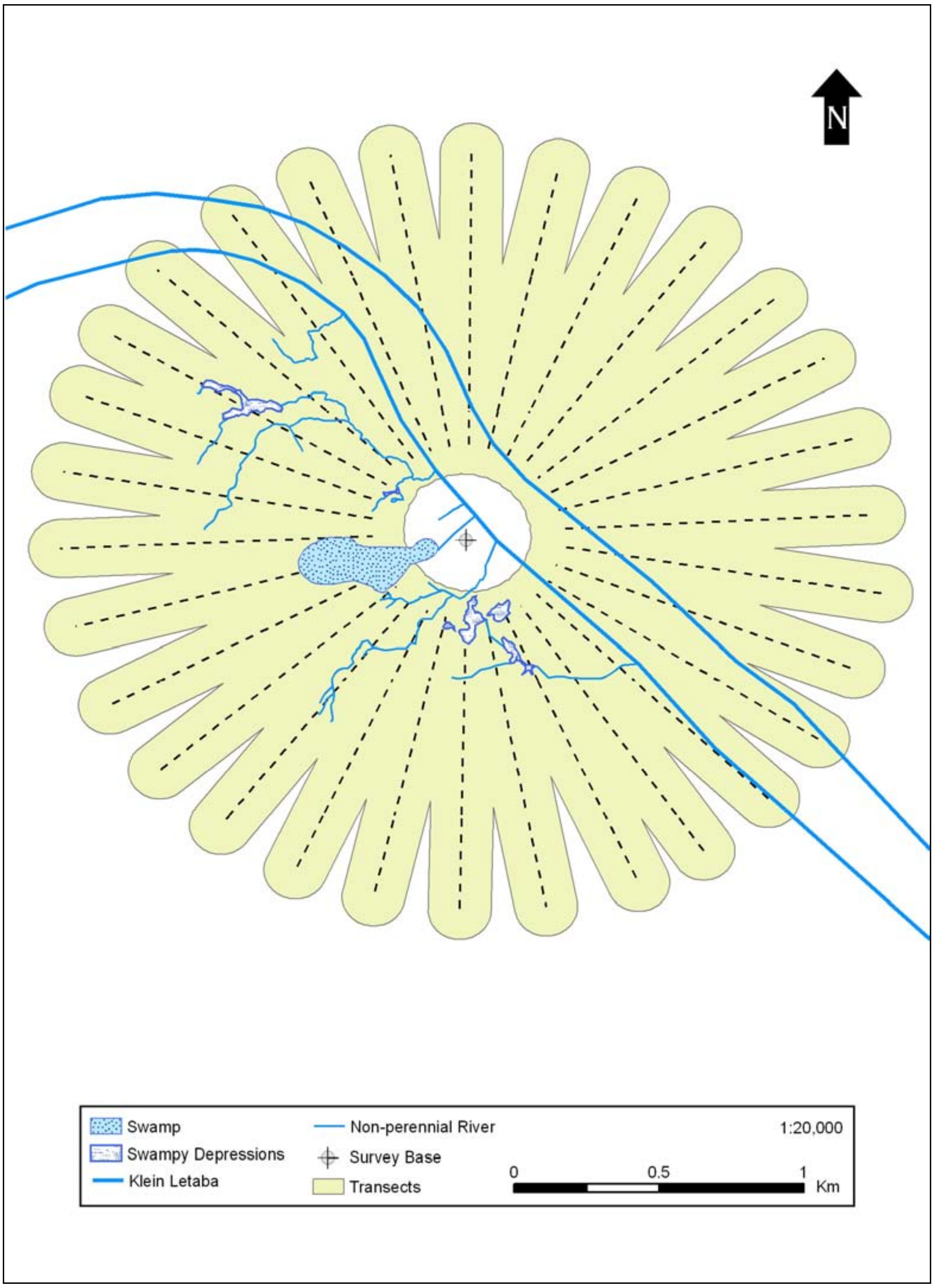



Figure 35: Survey transects and area covered by survey.

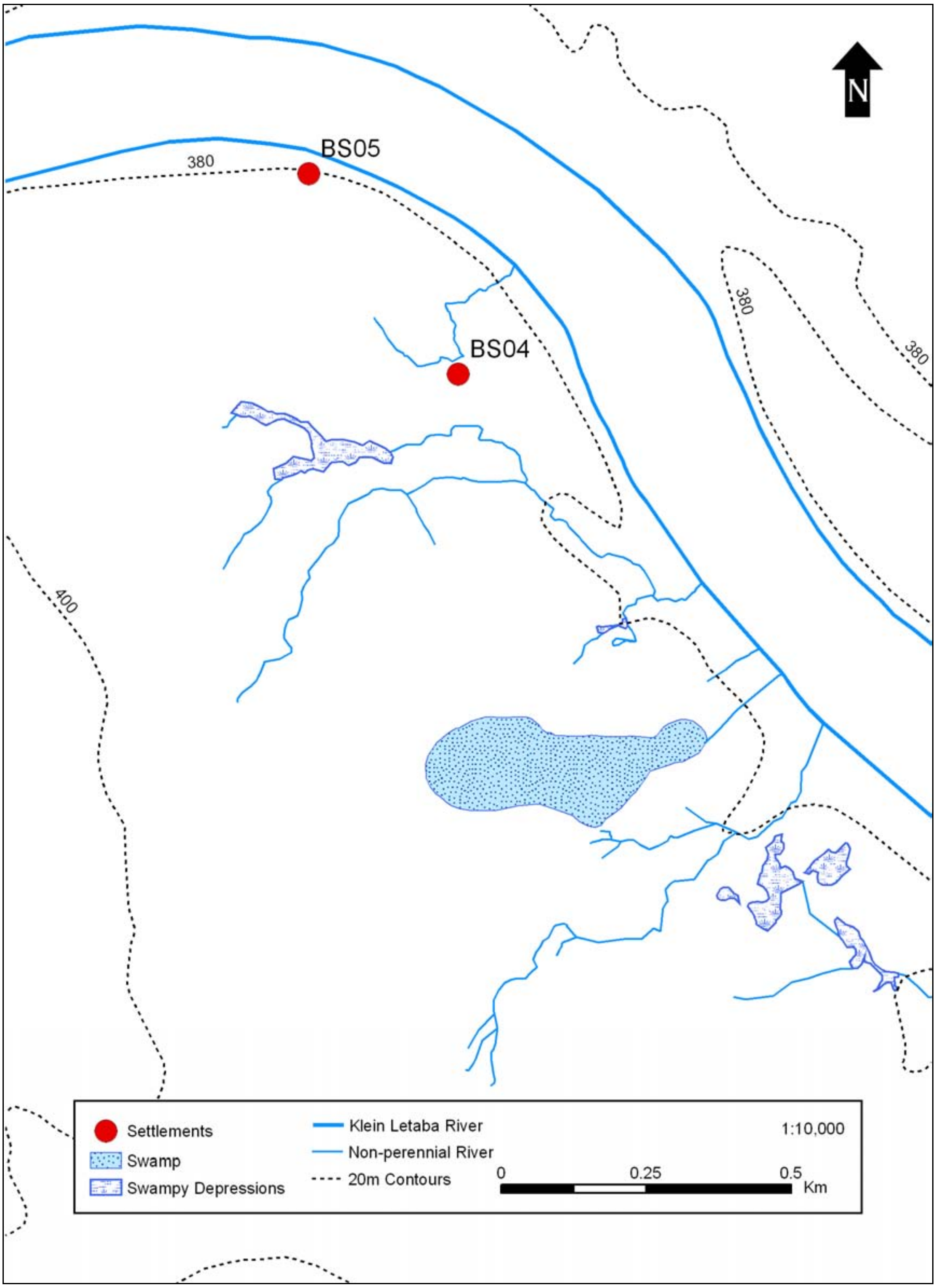



Figure 36: Settlements identified during survey

The survey identified two early first millennium settlements within the coverage area (Figure 36). Both sites were located more than 1.5km from the swamp. Despite being located a distance form the area of concentrated production, the sites are situated close to a large swampy depression where a salt crust forms during the dry season. Excavations of both sites during September 2004 analysed how these settlements utilised the available salt resources.

**Settlement BS04**

This site (located at S23 24' 48.12"; E30 54' 37.38") is situated 250m from the southern bank of the Klein Letaba River and was identified by the presence of ceramic and daga scatters on the surface. A deep erosion gully cuts through the middle of the site (Figure 38) and archaeological material was recovered from both sides of the donga (Figure 37 and Figure 39). The extensive erosion made it difficult to determine the approximate size of the settlement. Estimates are that it did not exceed $2000m^2$.

During the September 2004 fieldwork period, a detailed survey was carried out and a series of shovel test pits placed in arbitrary positions on the site. These actions made it clear that the site had been almost totally destroyed by the erosion gully. Daga was identified in four places, all on the edge of the donga. These daga features had been eroded to a point where no interpretative context remains. The daga was on sterile soil without any cultural deposits below it. Although the fragments were mostly very small, some had post mark impressions. There was no indication that the daga was burnt, negating its archaeological preservation. Seen in view of the first millennium ceramics on the site, the daga could be from either grain bins or huts. Additional test pits placed further away from the donga indicates that the cultural deposit on the site only extended approximately 5cm down before sterile soil is reached. Despite the disturbed nature of the site, the test pits did provide diagnostic ceramic fragments that allowed me to establish a temporal context for the daga. Subsequent analysis of ceramic vessels (see Chapter VI) indicates that occupation of BS04 occurred during the Silver Leaves ceramic phase. The location of the site, close to the Klein Letaba River, is consistent with patterns observed for EIA settlements in KwaZulu-Natal and the Kruger National Park (Maggs 1994/1995: 172; Meyer 1984: 297). The size of the site is, however, smaller than most settlements from this period. Although the extensive erosion limits the interpretive implications of the site, the small size and general lack of cultural material does seem to indicate that BS04 was an atypical EIA site.

Figure 37: Ceramic material exposed in sidewall of donga.

Figure 38: Sidewall of donga that cuts through BS04.

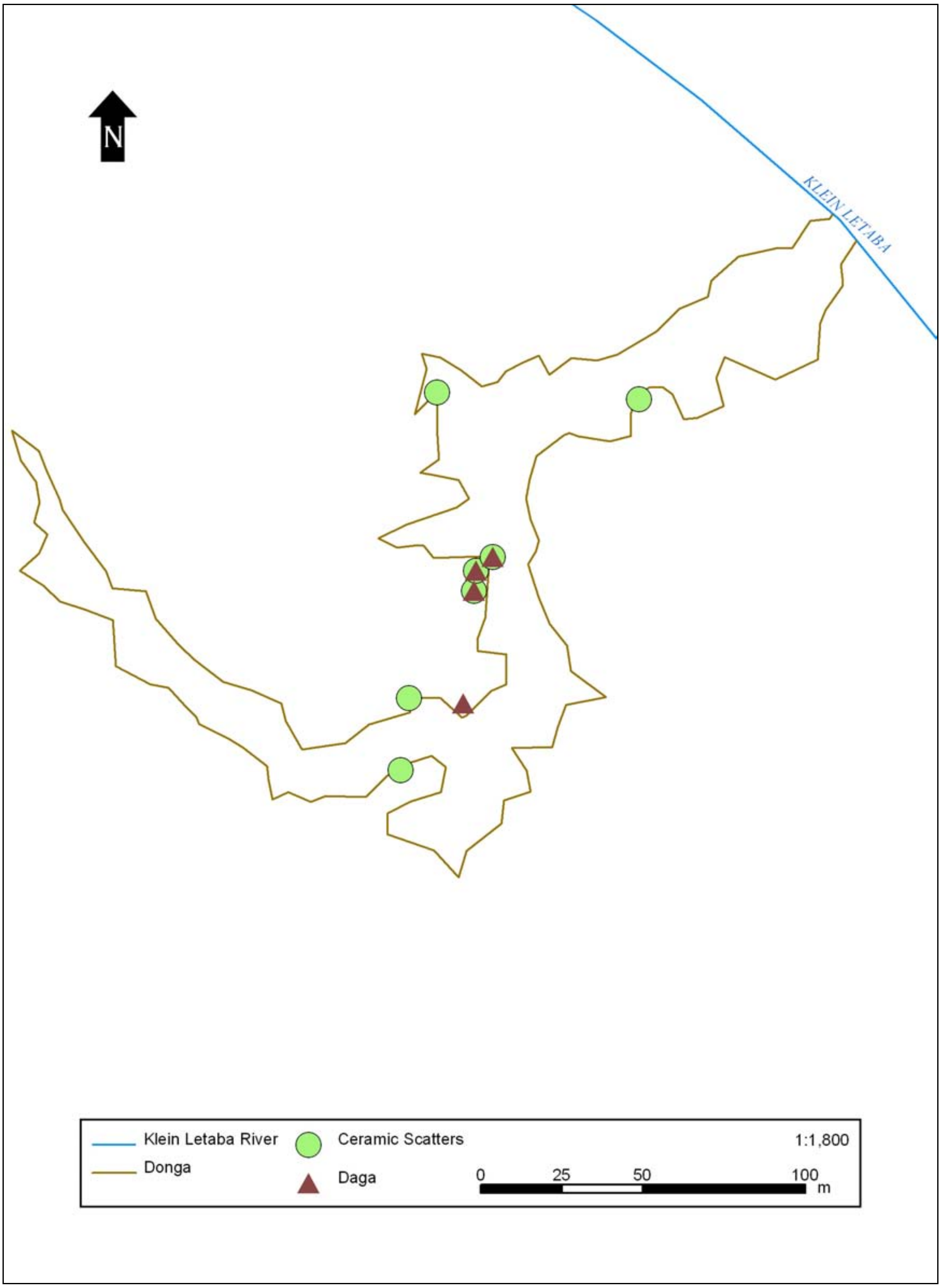



Figure 39: BS04 with associated hut rubble and ceramic scatters

**Settlement BS05**

BS05 is located 500m north-east of BS04 on the steep southern bank of the Klein Letaba River. The site was identified by the presence of ceramic scatters and hut rubble visible on the surface. Although limited erosion had taken place in some areas, the archaeological deposit on most of the site was undisturbed (Figure 40)Figure 40: View of BS05 from west to east.. Estimates of the site size were around 5000m$^2$. Because initial investigation indicated that BS05 was the best preserved of the two EIA settlements, the site was intensively sampled by means of a detailed survey and mapping, shovel test pits and 5 excavations units (Figure 41).

Figure 40: View of BS05 from west to east.

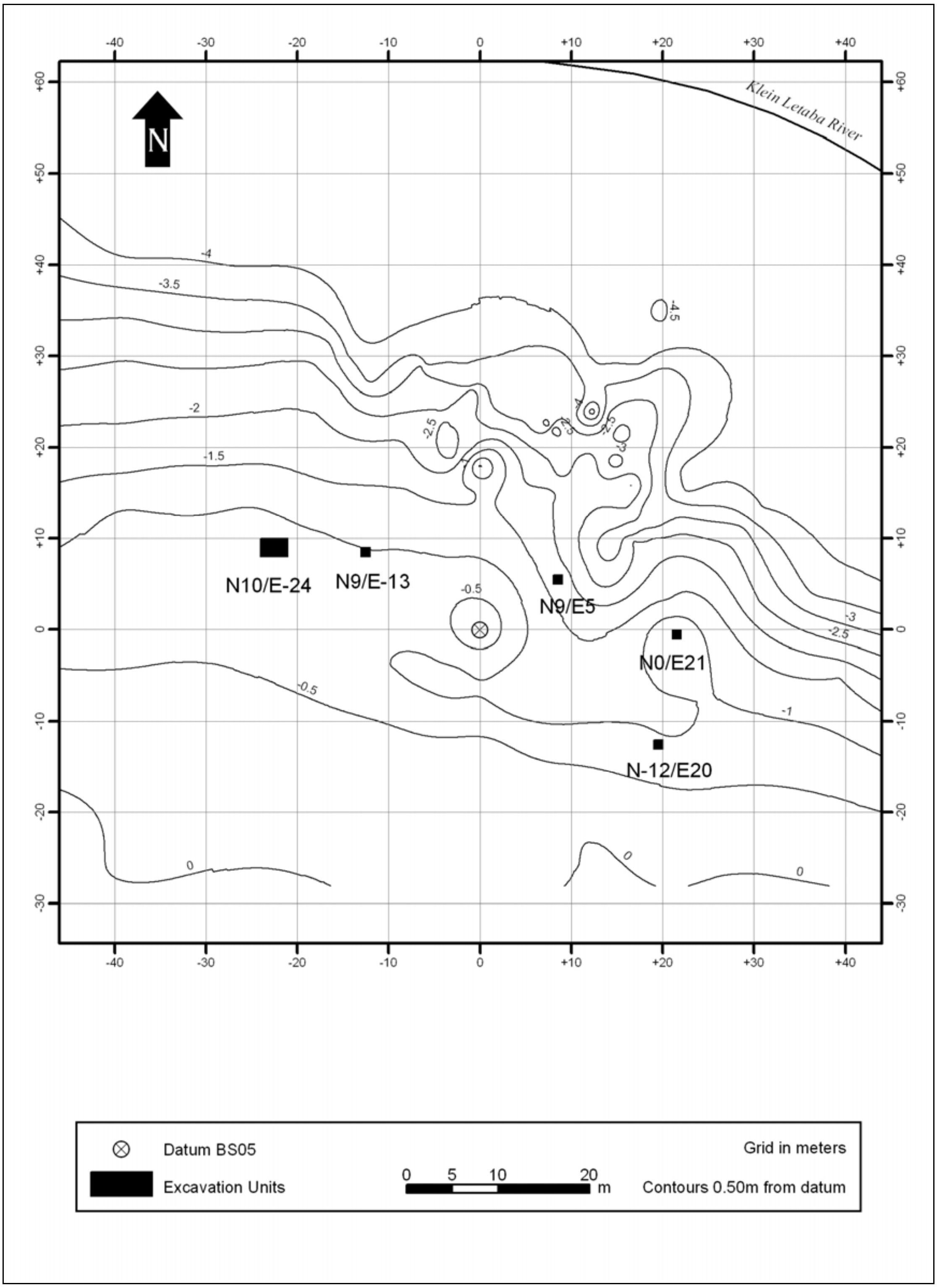



Figure 41 BS05 site map and location of excavations

*Shovel Test Pits*

Shovel test pits were dug to determine settlement layout, obtain datable material and locate possible areas where excavation trenches could be placed. During a three day period, 177 shovel test pits that covered the spatial extent of the site, were completed (Figure 42). Test pits were spaced in a 3m grid, with its origin at the centrally located Datum BS05 (S23° 24' 36.12"; E30° 54' 24.54"). Deposits from the test pits were screened through a 5mm steel mesh and all cultural and biological material was bagged and recorded. The profiles of the test pits were also recorded in order to observe any stratigraphic changes. Other observations included depth of the deposits and soil descriptions.

Six daga structures were uncovered by the test pits and their positions plotted (Figure 43). The weight of the ceramics recovered from individual test pits was used in order to determine which areas had a high concentration of archaeological material. The north-western area exhibited a significantly higher ceramic density than any other area of the site. Subsequent excavations (see below) indicated that this area was a low mound of leached out filter content associated with salt production.

*Excavations*

The test pits identified several areas that necessitated further investigation. The abnormally high density of ceramics in the north-western area of the site (Figure 44) indicated that the area could provide important data concerning site function. The daga features visible on the surface and uncovered by the test pits were also excavated. Here the specific aim was to determine whether these structures were huts or grain bins. All excavations were carried out with trowel and brush. Deposits were screened through a 5mm steel mesh and all cultural and biological material was collected for later analysis.

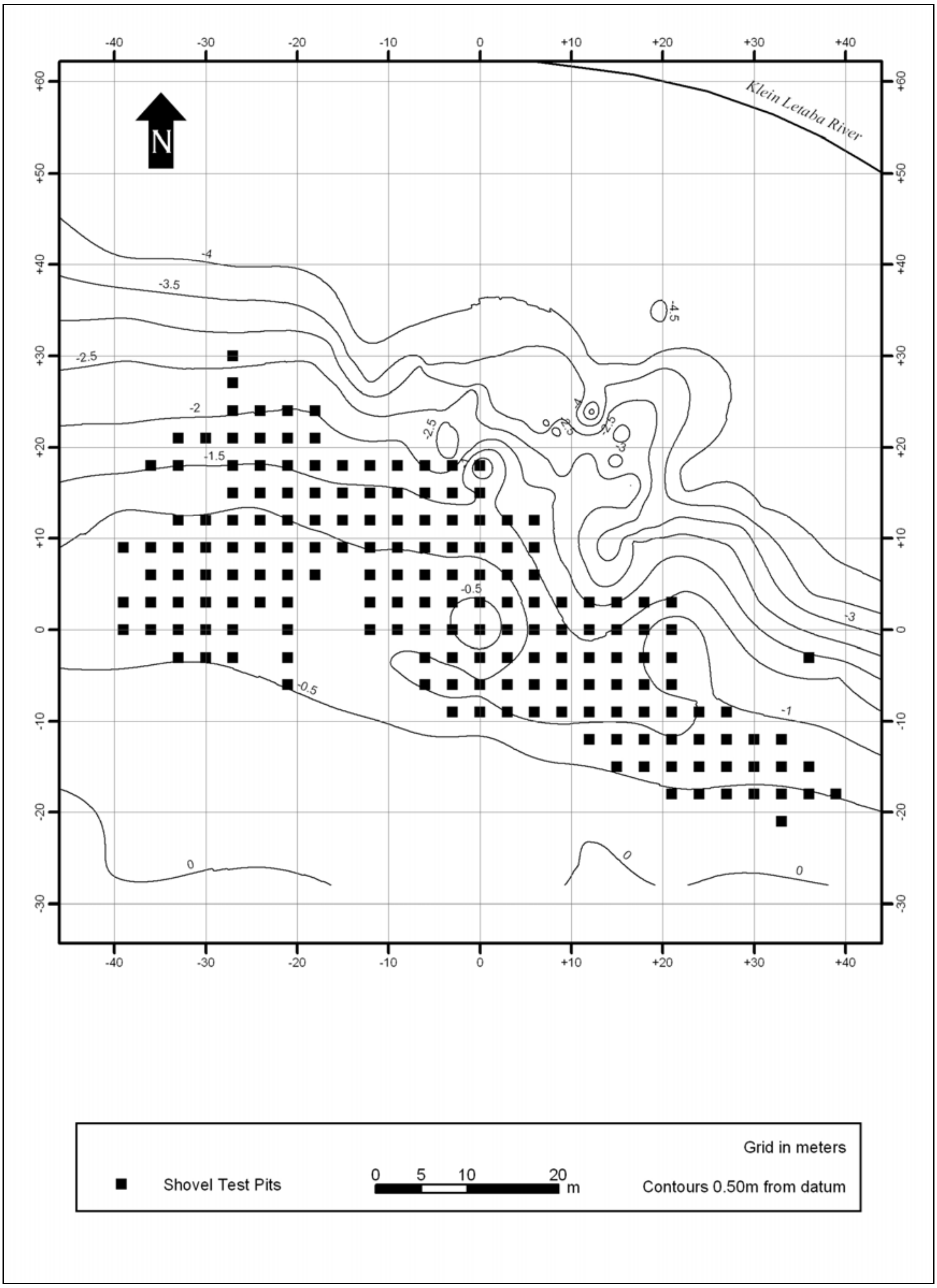



Figure 42: Shovel test pits at BS05

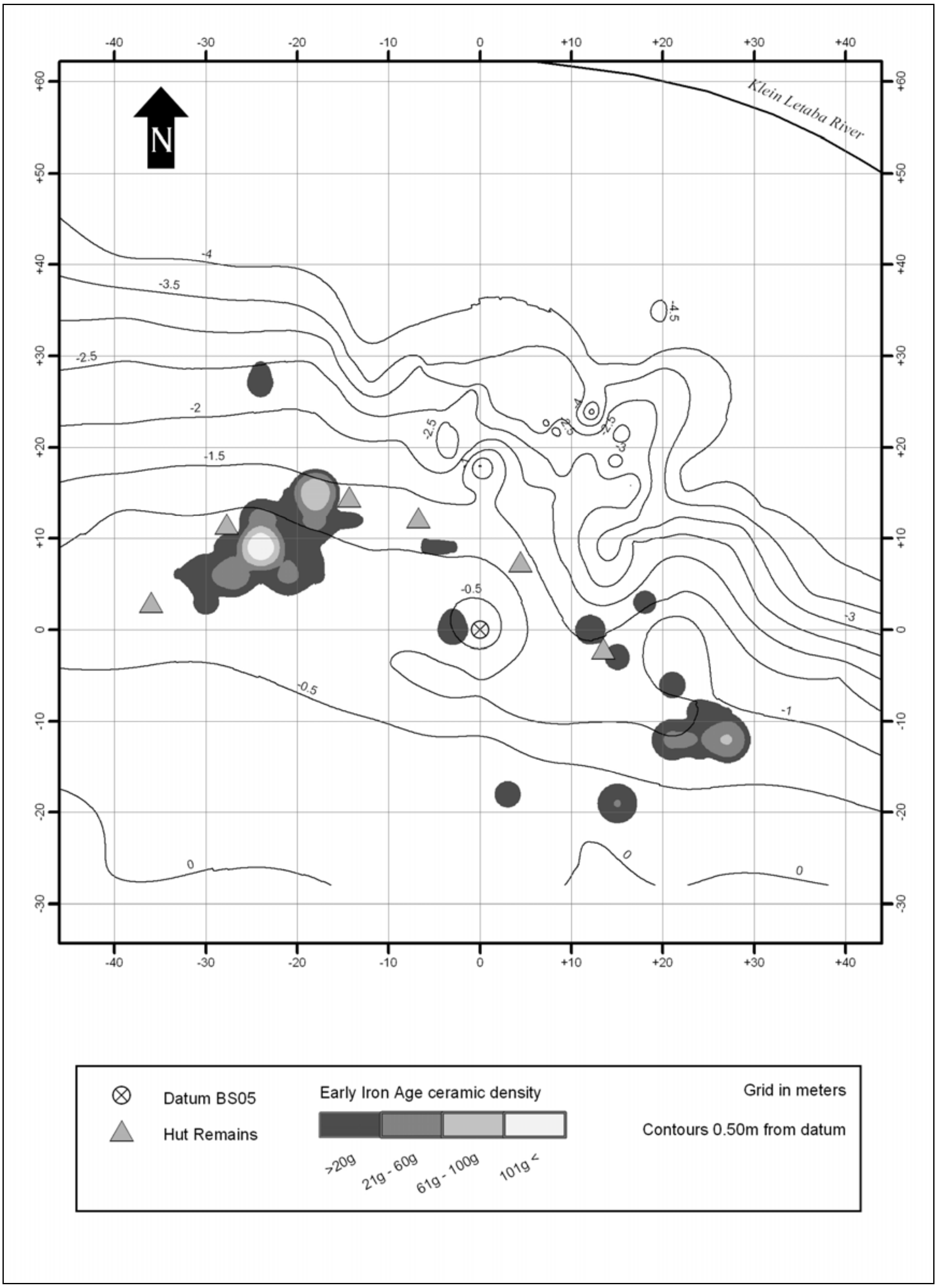



Figure 43: Trend surface map of ceramic density calculated from ceramic weights from test pits.

*N10/E-24*

This excavation was a 3m x 2m unit placed in the north-western area that had an abnormally high ceramic density. All archaeological material came from one layer of unstratified sandy clay of reddish brown colour. Excavations reached sterile soil at approximately 20cm below datum. The uniform deposit had inclusions of fine gravel and a few cobbles. The lower parts of the deposit produced a very high density of potshards almost forming a ceramic floor above the sterile ground. These ceramics displayed a high rate of fragmentation. In the centre of the unit, a small concentration of daga was also found that extended into the sterile layer. Excavating into the sterile soil indicated that the solid daga chunk continued down a further 5cm. The absence of any other daga, its small size and the absence of a floor surface, indicates that it probably was not part of a structure, but deposited together with the ceramics, and trampled into the ground. The only other archaeological material that came from the unit were small fragments of non-identifiable bone.

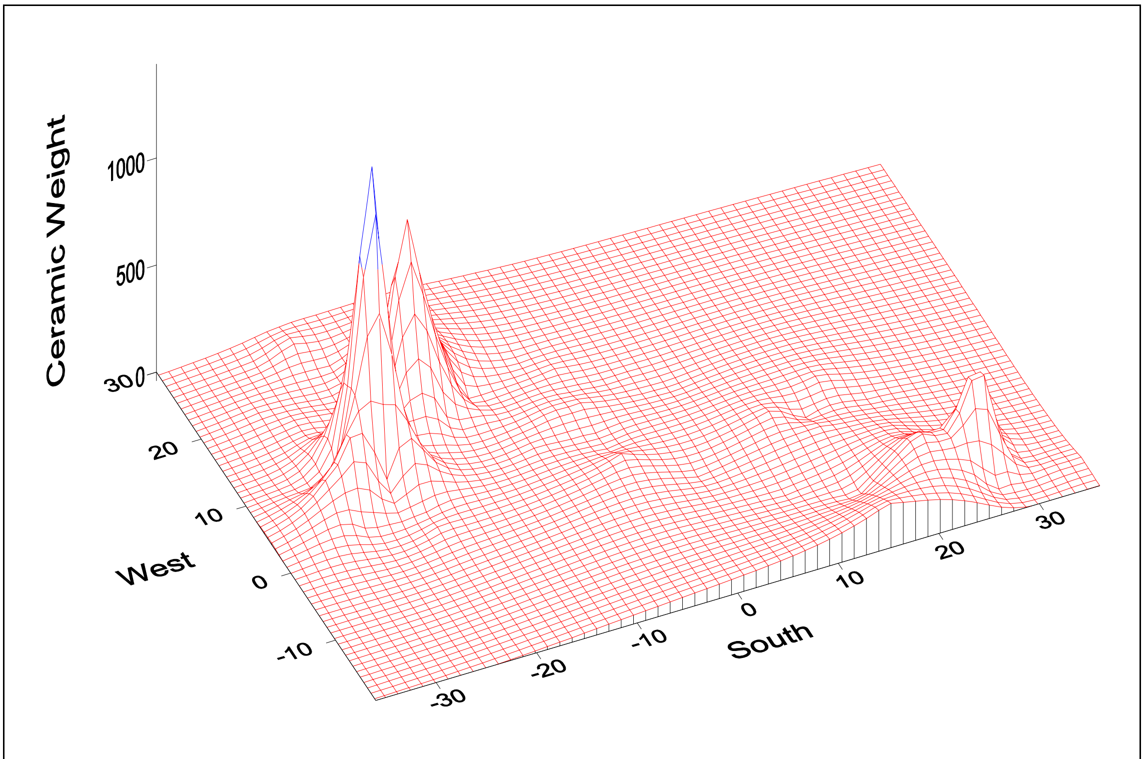



Figure 44: Ceramic weights from shovel test pits, with peaks in the north-western region indicating mound area.

*N09/E05*

This 1,5m x 1,5m unit was placed over daga visible on the surface. An adjacent test pit had shown that the solid rubble continued down below the surface. A thin layer of topsoil was removed before a deposit of solid daga rubble of reddish-brown colour was encountered. This deposit was a dense layer of debris above portions of a flat daga floor, 1.5cm thick, which rested on sterile soil. Fragments of a curved wall with post impressions of approximately 10cm in diameter were excavated above the floor (Figure 45). Excavations stopped on virgin soil 10cm below the surface. The only additional material from this excavation was undecorated ceramic fragments.

Figure 45: Post impression in daga.

*N09/E-13*

This excavation was a 1m x 1m unit placed next to a shovel test pit that had produced a high number of ceramics. The unit consisted out of two loci, the first a thin layer of topsoil, and the second a 10cm layer of deposit above sterile. This reddish-brown layer had a few gravel inclusions. The excavation uncovered only a few undecorated ceramic fragments.

*N0/E21*

This unit was placed over a test pit that had produced ceramic fragments from a single pot, and the excavations intended to obtain additional material from this area of the site. After the topsoil was removed, the deposit was a uniform reddish loam with gravel inclusions. The only excavated material was a few undecorated ceramic shards. Excavations stopped on sterile, 20cm below the surface.

*N-12/E20*

This 1m x 1m unit was opened on the eastern part of the settlement and aimed to provide additional material from this area. The unit contained two stratigraphic layers. The first was top soil, 5cm deep, that did not produce any material. The second locus was a very compact sandy clay with a large quantity of gravel inclusions. The excavations delivered a high quantity of ceramics and a few bone fragments and was ended on sterile 18cm below datum.

## Occupation at Baleni during the Early First Millennium AD

The excavations at BS05 indicated that there was a single occupation of the site during the early first millennium AD and the ceramic data (discussed in Chapter VI) attributes it to the Mzonjani phase. The daga rubble uncovered by test pits and excavation N09/E05 are consistent with huts uncovered at other EIA settlements. These structures on BS05 did not have the stone-and-floor features usually associated with collapsed grain bins (cf. Huffman 1993: 222). Daga visible on the surface were concentrated in roughly circular areas of 1,5m - 2m in extent, indicating an approximate size of these structures. The mound-like area, excavated as N10/E-24, generally resembles the salt workshop mounds excavated at BAL01, BAL02 and BAL03. It was, however, lower than the mounds around the spring and lacked the small lenses and complex stratigraphy that characterized the other deposits. This could be due to erosion processes that washed away the surrounding matrix of ash and sand, leaving only a compacted layer of ceramics. To asses whether the hypothesis concerning this area's function as a salt production area is correct, ceramics from N10/E-24 were analysed for use-wear patterns and compared with the workshop assemblages. The results (see Chapter VI for discussion of the procedures and results in detail) indicated that the assemblage is, in terms of use-wear and typologically, consistent with the pattern expected for a salt workshop.

Excavations at BS05 did not yield evidence usually associated with EIA settlements such as pits, grain bins, middens, burials and evidence of stock keeping. Similarly, no evidence of metal working, typically found on sites from this period was encountered. The absence of these features could not be due to the sampling strategy, since the 177 shovel test pits and subsequent excavations covered the spatial extent of the site. The very limited faunal remains could be due to preservation conditions, but no features associated with food production (such as grinding stones) were uncovered. The single, unstratified layer of deposit and the lack of additional cultural features indicate that BS05 was not a permanent settlement, or that occupation lasted for a relatively short period. Combined with the data from the mound area it is clear that salt production took place during a short period of occupation. These lines of evidence support a hypothesis whereby BS05 was a temporary EIA settlement with its inhabitants being actively involved in salt production activities.

The excavations of salt production sites and the temporary settlements produced a substantial ceramic assemblage. Ceramic vessels, as the principal artefact associated with salt production activities, present an opportunity to characterise production during the EIA in terms of production technology. The next chapter presents the analysis of the ceramic data and interprets it in terms of the culture historical sequence, as well as parameters of production organization.

# CHAPTER VI

# CERAMIC ANALYSIS

This analysis of the ceramics from Baleni was structured to answer the specific aims of this dissertation. Firstly, the ceramic typology established the chronological framework for salt making activities at Baleni. Secondly, results from the ceramic analysis add to the empirical data in the discussion of the organization of production during the EIA. The format of this chapter follows these aims in that I present and discuss the typological and chronological sequence of the Baleni ceramic assemblages. This is contextualised by the radiocarbon results from Baleni, as well as ceramic and radiocarbon data from associated southern African Iron Age sites. In the second part, I focus exclusively on the Kwale assemblages from Baleni. I analyse vessels from Baleni in terms of morphological variability and use-ware patterns. The emphasis is on the ceramic assemblage as an indicator of salt production technology.

## Typological Sequence of Ceramics from Baleni

To establish the typological ceramic sequence for salt production at Baleni, I apply the multidimensional analysis formulated by Huffman (1980) for South African Iron Age ceramics. Comparisons have shown that this method accurately classifies assemblages and is widely applied by Iron Age archaeologists in southern Africa (e.g. Calabrese 2000; Evers 1982; Evers and Van der Merwe 1987; Loubser 1993; Whitelaw 1996).

In this multidimensional analysis, (1) vessel profile, (2) the area of the vessel that is decorated, and (3) decoration, are combined in a structured manner. The results are used to form modal and affiliate set classes. Affiliates are the total combination of design elements (the smallest portion of any qualitative category) on a vessel, for example, the complete decoration on a vessel. Affiliate set classes are affiliates that share major elements, for example, the same geometric pattern of decorations. These are subdivisions of modal classes. Modal classes are formed around sets of significant alternatives of affiliates (Huffman 1980: 137). The multidimensional method classes individual vessels only once, and therefore retains an element of reality and remains largely unaffected by purely functional attributes (Evers and Van der Merwe 1987: 93). The 269 vessels in the multidimensional analysis of Baleni, therefore, constitute the minimum number of vessels. These are from excavations at the salt production sites (BAL01, BAL02 and BAL03) and the settlement areas (BS04 and BS05). In the multidimensional typology of the Baleni ceramics, I grouped the dimensions into two pairs: (1) vessel profile (shape) and decoration placement and (2) individual motifs, with motifs and motif combinations. Modal classes are formed by intersecting the placement/profile mode and the motif/motif combination modes.

As indicated in the previous chapter, BAL03 provided a deep stratigraphic sequence that contained five salt production events. By combining the multi-component BAL03 assemblage with the single component assemblages from BAL01, BAL02, BS04 and BS05, four ceramic phases, Letaba, Eiland/Kgopolwe, Mzonjani and Silver Leaves were identified at Baleni.

**The Letaba Assemblage**

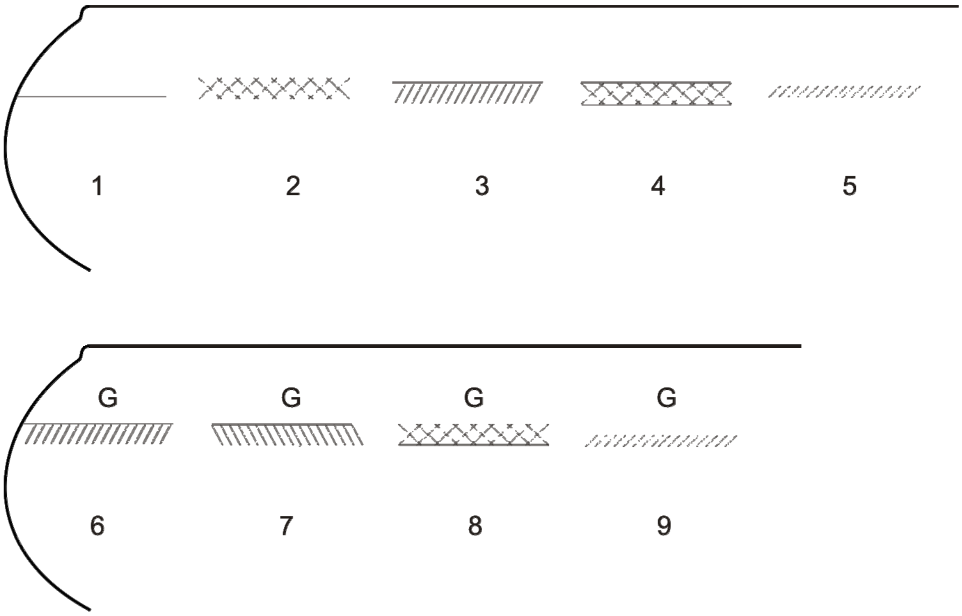
Letaba ceramics characterize the most recent phase of salt production at Baleni. The Baleni Letaba assemblage contained 41 vessels distributed in three type classes (refer to figures in Appendix A).

| | |
|---|---|
| Class 1 | Spherical profile with either a single horizontal band of incisions, hatching or crosshatching on the shoulder area, or with graphite burnishing between the decoration and rim (Figure 61, Figure 62 and Figure 63). |
| Class 2 | Spherical profile with graphite burnishing all over (Figure 60). |
| Class 3 | Sub-spherical bowl with hatching or bordered crosshatching below the rim (Figure 59). |

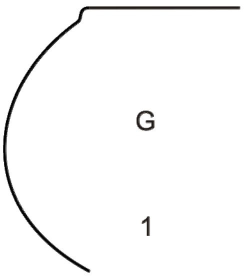
Letaba vessels were excavated in all levels of BAL02 and in Events 1 and 2 at BAL03. The vessel profile, decoration motifs and placement is similar to assemblages from other Lowveld sites such as Harmony village and saltworks (Evers 1974), the top levels of the Eiland Saltworks (Evers 1981) and the later assemblages from sites in the Phalaborwa (Evers and Van der Merwe 1987) and Soutpansberg (Loubser 1988) regions.

Two radiocarbon dates, Pta-9340 and Pta-9351, were obtained from Event 1 and Event 2 respectively. Pta-9340 calibrated to AD 1646 ±45 and Pta-9351 to AD 1658 ±45. These dates indicate that the salt production activities that produced stratigraphic Events 1 and 2, took place in relatively quick succession. Both dates compare well to other dates for Letaba assemblages, which typically range from the early sixteenth century up to present times. The mid-seventeenth century dates from Baleni places it well within the chronological range of sites with Letaba ceramics.

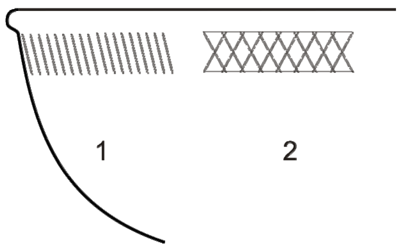
Class 1




Class 2




Class 3




Letaba ceramics originate in the Soutpansberg region. Khami-type ceramics are associated with the Khami state in south-west Zimbabwe, which developed after the demise of Great Zimbabwe. Khami ceramics are also found further south in the Soutpansberg in northern South Africa (Loubser 1988: 267). In the Soutpansberg, Loubser (1988: 267-271) believes that there was increased contact between people that made Khami ceramics and groups associated with Moloko ceramics. This increased social contact is reflected in the development of a new ceramic entity, called Tavhatshena, which, according to Loubser (1988: 271), incorporates stylistic elements from both Khami and Moloko ceramic traditions.

Letaba ceramics, as found at Baleni, are regarded as a further amalgamation between Tshavatshena, Moloko and Khami ceramic traditions (Loubser 1981: 273-275). After 1550 Letaba replaces all earlier ceramics styles in the Lowveld and Soutpansberg region.

Van der Merwe and Scully (1971: 192) found that Letaba ceramics excavated from archaeological contexts at Phalaborwa, were identical to modern pottery made by the local north-eastern Sotho speaking population of the area. Letaba ceramics are widely distributed in the Lowveld region and have been associated with the Venda , northern Ndebele and Koni language groups (Dippenaar 1985: 185; Loubser 1981: 158; Mason 1968: 182). Although made by a wide range of linguistic and cultural groups, the distribution of Letaba ceramics are generally associated with the area historically under Venda political and economic influence (Krige 1937: 330; Liesegang 1977: 181; Scully 1978: 239).

**Eiland/Kgopolwe**

Eiland ceramics were only recovered from BAL03, in stratigraphic Event 3. Although the assemblage contained the smallest number of vessels, it displayed the greatest variation in Modal Classes of all the ceramic phases. Three classes and four fragmentary classes were identified (refer to figures in Appendix A).

| | |
|---|---|
| Class 1 | Necked jar with a single band of hatching against the rim and a band of bordered crosshatching on the shoulder (Figure 64). |
| Class 2 | Necked jar with a single band of bordered hatching on the shoulder (Figure 65). |
| Class 3 | Necked jar with multiple grouped bands of herringbone against the rim (Figure 66). |
| Class 4 | Fragmentary Type: Necked jar with arcades filled with herringbone on the shoulder, and graphite above the arcade (Figure 67). |
| Class 5 | Fragmentary Type: Necked jar with multiple grouped bands of hatching against the rim (Figure 68). |
| Class 6 | Fragmentary Type: Spherical profile with band of herringbone on shoulder (Figure 69). |
| Class 7 | Fragmentary Type: Vessel of undetermined shape decorated with band of spaced counter hatched triangles (Figure 70). |

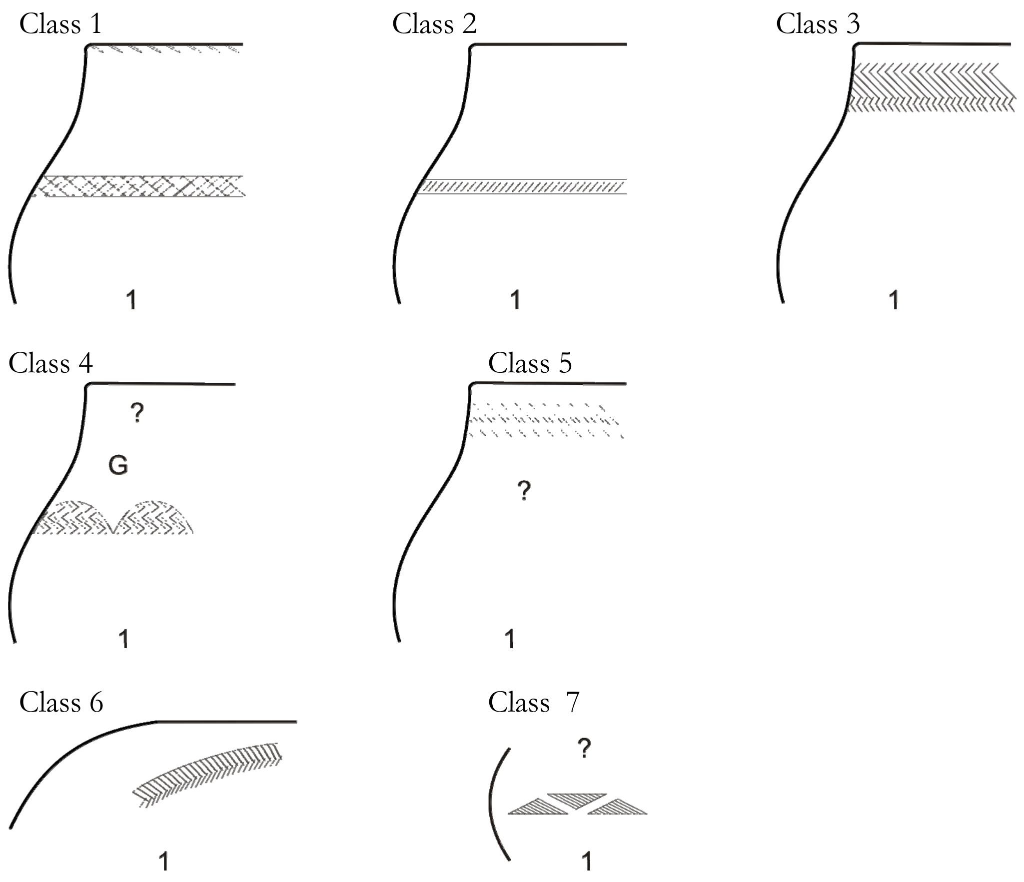
The Baleni Eiland Classes, contain typical attributes of the Eiland ceramic phase (see Klapwijk and Evers 1987). Typologically, Eiland assemblages are characterised by finely executed herringbone and arcade motifs, cross hatching and graphite or ochre burnish placed on the rims, and necks of slightly necked jars. Assemblages also contain simple open and inturned bowl shapes with the same decoration profiles. (Evers 1981: 70-73; Evers and Van der Merwe 1987: 104; Klapwijk and Evers 1987: 41-42; Loubser 1988: 354-358).

Eiland represents the last phase of the Kalundu ceramic tradition in the South African interior and has a very wide distribution. Assemblages have been found in an area that extends from Tzaneen on the eastern escarpment in the east, into eastern Botswana in the west (Denbow 1981) with the Magaliesberg as the southern boundary (Evers and Van der Merwe 1987). Eiland ceramics also occur in small clusters outside this distribution area at Mapungubwe and various Toutswe sites.

A Lowveld expression of Eiland known as Kgopolwe has been defined from excavations at Phalaborwa (Evers and Van der Merwe 1987). Kgopolwe shares with Eiland the same jar and bowl shapes, single and multiple bands of decoration and rows of triangles, but lacks the predominant grouped bands and arcades. Although the Baleni assemblage is clearly associated with Eiland, as indicated by the predominance of necked jar types and herringbone decorations, it contains an insufficient number of vessels to confidently ascribe it to either Eiland or Kgopolwe traditions.

The associated radiocarbon date from Event 3 (Pta-9341) was calibrated to AD 1430 ±50. Elsewhere, Eiland has been firmly dated to between the eleventh and thirteenth centuries (Evers and Van der Merwe 1987; Klapwijk and Evers 1987). Denbow (1981: 70) indicates that in southern Botswana, Eiland continues into at least the fourteenth century. Two possible explanations for such a late date from Baleni can be considered. Firstly, the assemblage may be late Kgopolwe. Although Kgopolwe seems to be a somewhat later development of Eiland, its temporal limits have not been firmly defined. The Baleni date would therefore represent the upper time limit of Kgopolwe's known temporal occurrence. It has been noted that there is a gap in the Lowveld Iron Age sequence between AD1300 and AD1500. All the evidence points to the absence of, or a very low human population in the Lowveld at that time (Evers and Van der Merwe 1987: 105; Meyer 1986: 241-242; Plug 1988: 306). The hiatus lasts until Letaba ceramics appear in the sixteenth century (Evers 1981;

Evers and Van der Merwe 1987). The mid AD 1400 date from Baleni could therefore be indicative of communities associated with Kgopolwe ceramics still living in the Lowveld area.




A second explanation for this late date is that it could be due to the contamination of the sample by the Letaba events above it. This can be expected for a site where high impact activities such as salt production occur. If contamination took place from a later sample, a degree of similarity between the dates from Event 2 and 3 would be expected since both would be from the same salt making event. As indicated in Table 2, there is no overlap between the dates, as they are placed in chronological sequence. Contamination with Event 2 therefore does not seem a likely explanation for the late Eiland assemblage date.

Table 2: Sigma ranges of dates from Event 2 and Event 3

| | | 1-Sigma | 2-Sigma |
|---|---|---|---|
| **Event 2** | Pta-9351 | 1644 - 1671<br>1777 - 1797 | 1525 - 1560<br>1630 – 1685<br>1734 - 1809 |
| **Event 3** | Pta-9341 | 1417 - 1451 | 1403 - 1487 |

.

**Mzonjani and Silver Leaves**

The earliest phase of salt production at Baleni is characterised by ceramics from the Kwale branch of the Urewe tradition. The Baleni Kwale assemblages, also define the temporal frame of reference of this dissertation.

Four Classes, one of them fragmentary, were identified (refer to figures in Appendix A). For comparative purposes (see below) I also add one undecorated class:

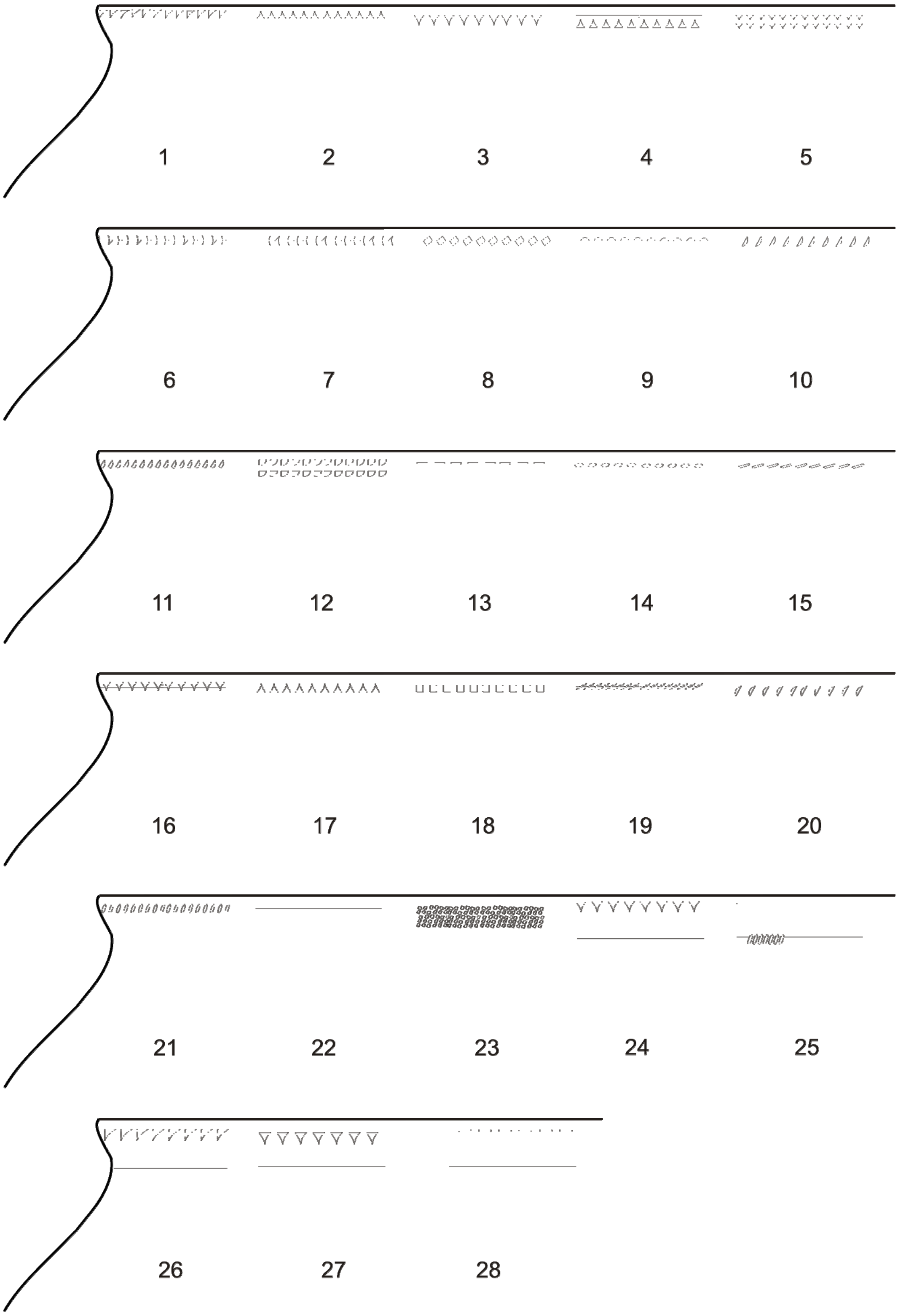
| | |
|---|---|
| Class 1 | Pot with everted rim and either a band incision or a row of punctuates below the lip, a band of punctuates or incisions below the lip and a single incised band at the base of the rim, a band of punctuates on the rim, an incised line below the lip and an incised line and spaced punctuate decoration on the rim base, or a combination of these motifs (Figure 71 to Figure 76). |
| Class 2 | Pot with everted rim and a band of decoration on the rim consisting of punctuates and incisions below the lip and a spaced motif on the body (Figure 77 to Figure 79). |
| Class 3 | Pot with everted, bevelled rim and decorated with either an incised line band below the lip or incised lines below the lip and on the rim base (Figure 80). |
| Class 4 | Fragmentary type: Everted rim with diagonal incisions on lip (Figure 81). |
| Class 5 | Undecorated pot with everted rim. |

In South Africa, the Kwale branch is divided into two ceramic phases: The first phase, dated AD 250 – AD 430, is termed Silver Leaves, which develops into Mzonjani after AD 430. Stylistically Mzonjani represents the continuation of the vessel profile and layout of Silver Leaves assemblages, but without the characteristic predominance of multiple bevels on jar rims and flutes on bowls. Mzonjani is seen as a slightly later development from Silver Leaves (Klapwijk and Huffman 1996: 91).

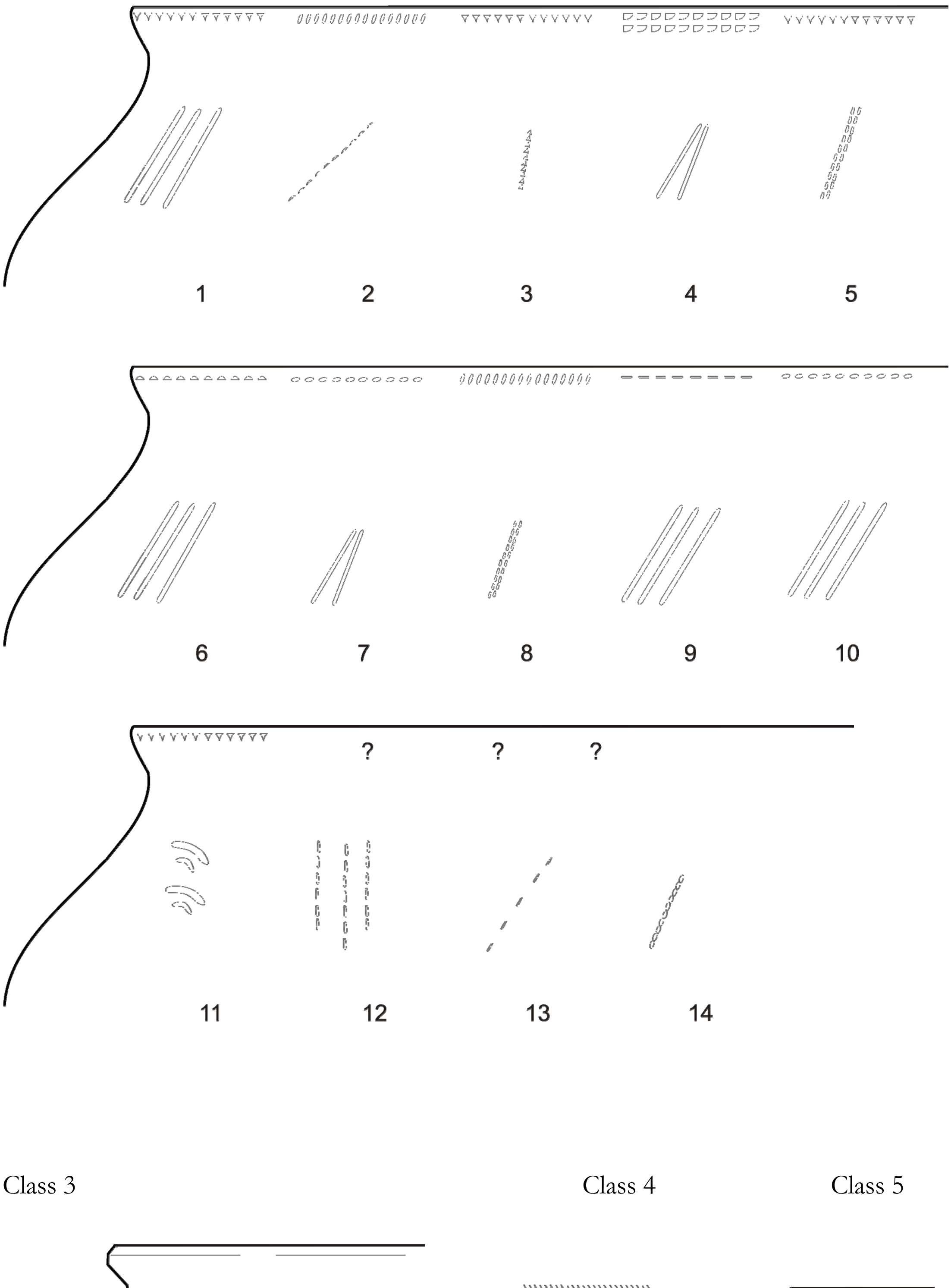
Ceramics from both phases were excavated at Baleni. The only true Silver Leaves type vessels are Class 4. This type only occurs at BAL04, and account for 30% of the overall assemblage from this site. This assemblage is, however, very small and contains only 15 vessels. The remaining vessels from BS04 were all Class 1 vessels, decorated with a single line band, a characteristic feature of Silver Leaves assemblages (cf. Klapwijk 1974; Klapwijk and Huffman

1996). Although BS04 has mostly been destroyed by an erosion gully (as indicated in Chapter V), it is the only Silver Leaves ceramic component at Baleni.

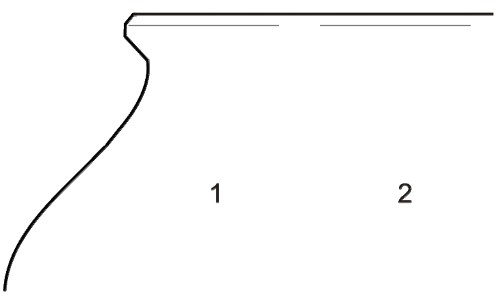
Class 1



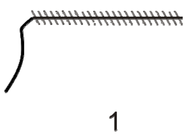
Class 2



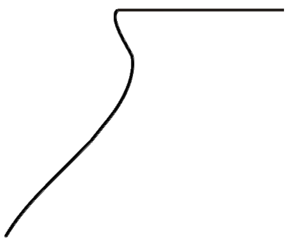

Class 3




Class 4




Class 5



The lack of bevelled jar rims in the vessels from BAL01, BAL03 and BS05, means that the predominant Kwale assemblage at Baleni is Mzonjani. All the vessels were jars with everted rims, with mostly single bands of decoration on the rim (Class 1), while some vessels had a spaced motif on the body (Class 2). Stratigraphic Events 4 and 5 in BAL03 contained Mzonjani components, while excavations BAL01 and BS05 were single component Mzonjani assemblages. Typologically, these assemblages are similar to associated assemblages excavated in the Lowveld at the Eiland and Harmony Saltworks (Evers 1974, 1981) and Riverside (Huffman 1998) and in KwaZulu-Natal at Mzonjani (Maggs 1980a), Inanda Quarry (Whitelaw and Moon 1996) and Enkwazini (Hall 1980).

To test the overall similarity between the ceramics from the four excavations, presence and absence scores were calculated from each excavation. Presence-absence scores yield a weighted average calculated from the sum of the common scores divided by the maximum possible common score (Huffman 1980). The results indicate affinity on an ordinal scale. At a regional level, the scores indicate the level of affinity between ceramic groups and when applied on a site level, scores are interpreted as clusters of association (Huffman 1980). Applied to Baleni, the three Mzonjani assemblages (BAL 01, BAL03 and BS05) display a cluster of affinity between 80% and 100%. The 80% affinity with BS05 is due to the absence of Class 4 vessels in BAL03 and BAL01. This type is a fragmentary class, and is only known from one fragment obtained from a shovel test pit at BS05. If this type is omitted, affinity between the three assemblages is 100%. The lower level of affinity with BS04 indicates the disparity between the Mzonjani cluster and the Silver Leaves site BS04.

Table 3: Distribution of Mzonjani/Silver Leaves Ceramic Classes.

| | **Class** | | | |
|---|---|---|---|---|
| | **1 (*n*)** | **2 (*n*)** | **3 (*n*)** | **4 (*n*)** |
| **BAL01** | 79 | 5 | - | - |
| **BAL03** | 51 | 19 | - | - |
| **BS05** | 55 | 1 | - | 1 |
| **BS04** | 5 | - | 4 | - |

Table 4: Similarity scores between the various excavations at Baleni.

| | **BAL01** | **BAL03** | **BS05** | **BS04** |
|---|---|---|---|---|
| **BAL01** | | | | |
| **BAL03** | 100 | | | |
| **BS05** | 80 | 80 | | |
| **BS04** | 40 | 40 | 40 | |

**Regional Comparisons**

In order to establish how the salt production assemblages from Baleni compare to those of contemporary settlement sites, I used multidimensional classes from settlements in KwaZulu-Natal where the majority of Mzonjani sites are located. The Baleni Class types used in the comparisons are Class 1, 2 and 5. Class Types 3 and 4 are omitted because Class 3 constitutes the Silver Leaves assemblage only found on BS04, and Class 4 is known from only one fragment that is inconsistent with the rest of the assemblage and probably intrusive. The comparative settlement class types are derived from the Mzonjani name site, Enkwazini, and the four Mngeni Valley sites as published by Whitelaw and Moon (1996). This sample contains six multidimensional classes with an additional three undecorated classes. The Mzonjani settlement assemblages contained three profile modes, six layout modes and four decoration modes. Opposed to this, the Baleni Mzonjani assemblages contained only one profile mode, two layout modes and two decoration modes. The three Baleni Mzonajni classes were mutual, but six classes did not occur at Baleni. These were:

- A pot with an everted rim and a band of decoration on the rim with a band on the lower shoulder.
- A pot with an everted rim and a band of decoration on the neck.
- A pot with an everted rim, a band of decoration on the rim and a band of decoration on the neck.
- An open, subcarinated bowl with a line of incision, a row, or double row of impressions below the carination.
- Plain open bowl with or without carination.
- Plain, inturned bowl.

There is an overall similarity between the salt production and settlement assemblages, as indicated by the predominance of pots with everted rim types. The Baleni assemblages, however, use only two layout modes. This results in a restricted assemblage in terms of multidimensional class types. The most obvious difference between the two assemblages is the absence of open or inturned bowl types from Baleni. While these are usually underrepresented on settlements, their total absence, and low number of multidimensional classes, indicate that the use-context of salt production, results in the limited use of ceramic vessels. Salt producers during the Mzonjani phase, used only jars with everted rims. These jars are, however, far from atypical, specialised salt production tools, but similar to ordinary household vessels.

Table 5: Comparisons between multidimensional classes from Baleni and contemporary Mzonjani settlements.

| Class Type | Baleni | KZN Settlements |
|---|---|---|
| Pot with everted rim and single horizontal band of decoration on the rim. | X | X |
| Pot with everted rim and decoration on the rim, and a spaced motif on the upper shoulder. | X | X |
| Undecorated pot with everted rim | X | X |
| Open, subcarinated bowl with a line of incision or row or double row of impressions below the carination. | | X |
| Pot with everted rim, with a band of decoration on the rim and a band of decoration on the neck. | | X |
| Pot with an everted rim with a band of decoration on the rim with a band on the lower shoulder. | | X |
| pot with everted rim with a band of decoration on the neck. | | X |
| Plain open bowl with or without carination. | | X |
| Plain, inturned bowl. | | X |

The calibrated date for Event 5 (Pta-9349) is AD 60 ± 50, and the calibrated date for Event 4 (Pta-9422) is AD 400 ±60. Pta-9422 falls in the temporal range of the Mzonjani phase since it is only slightly older than the AD 410 ±40 (Pta-1980) date from the Mzonjani name site (Maggs 1980a). However, Pta-9349 does not fit the known chronological distribution of Mzonjani since it predates all other Mzonjani assemblages by some 350 years. It even predates the earliest southern Africa Silver Leaves assemblage date from Matola IV (R-1327) by 100 years.

If the date is correct, a revision of the EIA ceramic sequence in South Africa should be considered. In their synthesis, Klapwijk and Huffman (1996: 90-91) indicate that the temporal boundaries for Silver Leaves are well defined from excavations at Matola IV, University Campus, Silver Leaves and Ma38. This casts doubt on the accuracy of the very early date from Baleni. Some possibilities should be considered for this early date.

Firstly, the sample may be old wood. As Dean (1978) notes, the death of a tree may have taken place many years before it yielded the material that became firewood. Since firewood is mainly collected as dead wood, the potential therefore exists that any radiocarbon sample from burnt wood may yield a date older than the associated human activity. The processes of wood decay, procurement and the context of wood use, predominantly influence the occurrence of old wood in the archaeological record (Schiffer 1986: 17). Several hardwood species such as *Colophospermun mopane* (Mopane), *Combretum apiculatum* (Red Bushwillow) and *Combretum imberde* (Leadwood) occur around Baleni. Wood from these species is characterised by its durability (Van Wyk 1984). Seeing as the northern Lowveld has a semi-arid climate, dry wood preserves relatively well. This could lead to a vast accumulation of old wood in the environment. As Pta-9349 is associated with the earliest phases of salt production at Baleni, collection of wood would not have depleted the available stockpile of old wood around Baleni. If old wood was used in the salt production process, it would result in a considerable time lag between the actual salt making activity and the absolute date of Pta-9349.

An alternative explanation could be that the associated sample could be from a natural event (such as a veldt fire), not necessarily directly associated with the salt production event. The sample for Pta-9349 was taken in situ from a clay strata, rich in charcoal inclusions located on sterile soil. If the sample is from an older context than the salt making activity, the associated ceramic material from this level was probably trampled into the ground during later salt production activities, or as a result of post-depositional movement in the mound. This is a potential consideration seeing as salt production is a high impact activity and the stratigraphic layers of event 5 was very diffused, which could indicate vertical movement of artefacts within the deposits.

Without more radiocarbon samples from this site, the accuracy of Pta-9349 remains speculative. A primary aim of future research at Baleni should be to continue excavations at BAL03 and obtain additional samples from different areas of the site. Only then, can the significance of Pta-9349 be considered.

Despite the disputed chronological context and implications of Pta-9349, ceramic evidence and Pta-9422 do provide a firm indication that salt production is an activity directly associated with the earliest farming activities in southern Africa.

Table 6: Individual dates (AD) and calibrated dates of selected EIA sites mentioned in text. All dates are calibrated with the calibration curve presented by (Stuiver and Pearson 1993) and adjusted for the southern hemisphere by (Talma and Vogel 1993).

| Site | | Calibrated Date (AD) | 1-sigma ranges (AD) | 2-sigma ranges (AD) |
|---|---|---|---|---|
| Inanda Quarry | Pta-5492 | 539±50 | 438 – 583 | 414 – 631 |
| Enkwazini | Pta-1847 | 438±50 | 414 – 539 | 382 – 583 |
| Eiland | Wits-764 | 641±40 | 616 – 657 | 567 – 672 |
| | Pta-1607 | 534±40 | 438 – 557 | 418 – 607 |
| | Pta-1608 | 438±30 | 423 – 528 | 409 – 544 |
| | Pta-1524 | 414±40 | 390 – 433 | 339 – 528 |
| Mzonjani | Pta-1980 | 409±40 | 382 – 428 | 331 – 462; 483 - 519 |
| Castle Cavern | Y-1995 | 653±100 | 583 – 697 | 438 – 869 |
| | GrN-5022 | 534±30 | 547 – 611 | 531 – 634 |
| | Y-1712 | 557±60 | 462 – 483; 519 – 624 | 418 – 653 |
| | GrN-5315 | 557±30 | 539 – 597 | 462 – 483, 519 - 624 |
| Ma 38 | Pta-3725 | 631±50 | 583 – 653 | 539 – 672 |
| Silver Leaves | Pta-914 | 446±50 | 418 – 544 | 390 – 597 |
| | Pta-901 | 414±60 | 365 – 446 | 252 – 550 |
| | Pta-2459 | 403 40 | 365 – 423 | 264 – 291; 322 – 446 |
| | Pta-2360 | 339±50 | 248 – 397 | 222 – 423 |
| University Campus | St-9838 | 534±75 | 421 – 602 | 365 – 650 |
| | St-9836 | 269±85<br>282±85<br>327±85 | 223 – 408 | 91 – 523 |
| Matola IV | St-8547 | 637±80 | 557 – 668 | 438 AD – 716; 744 – 759 |
| | St-8546 | 390±110 | 238 – 462; 483 - 519 | 94 – 616 |
| | R-1327 | 151±50 | 111 – 238 | 66 – 264; 291- 322 |
| Baleni | Pta-9422 | 403 ±60 | 339 – 433 | 243 – 539 |
| | Pta-9349 | 60 ±50 | 5 – 94 | 49 - 141 |

## Morphological Variances and Use-Wear

This section covers the comparative analyses between the Mzonjani assemblages from workshop assemblages BAL01 and BAL03 and the temporary settlements BS04 and BS05. Since Events 4 and 5 from BAL03 both constitute salt production events from the same phase, they were combined as one assemblage from BAL03.

### Decorated and Undecorated Ceramics

As indicated in previous chapters, salt production results in a relatively short lifespan of vessels used in the production process. Vessels sometimes only serve as moulds for making cakes of salt and are broken after a single use (Gouletquer 1975: 50; Lovejoy 1986: 63, 71; Parsons 2001: 214). As a result, I calculated the occurrence of undecorated pots in the saltwork assemblages, to identify whether the context of salt production is reflected in the use of undecorated vessels. Comparisons are made between the presence of decorated and undecorated ceramic vessels in the assemblages. This is done in order to assess whether the expected short lifespan of the vessel is reflected in the predominance of undecorated ceramics in the assemblages.

Table 7 Number of decorated and undecorated vessels from each assemblage

| | **Undecorated (*n*)** | **Decorated (*n*)** |
|---|---|---|
| **BAL01** | 6 | 84 |
| **BAL03** | 0 | 70 |
| **BS04** | 1 | 9 |
| **BS05** | 4 | 56 |

The salt production assemblages from Baleni contain a very low frequency of undecorated vessels. Overall, there is little difference in the ratios of undecorated vessels within the various assemblages. The assemblage from BAL03 had no undecorated vessels, while at BAL01 only 7% of the assemblage was decorated. This pattern is continued at the temporary settlements BS05 and BS04, where undecorated vessels accounted for 6% and 10% respectively of the entire assemblage. The results show that the temporary nature of ceramic vessels used in the salt production process, is not reflected in a high proportion of undecorated vessels.

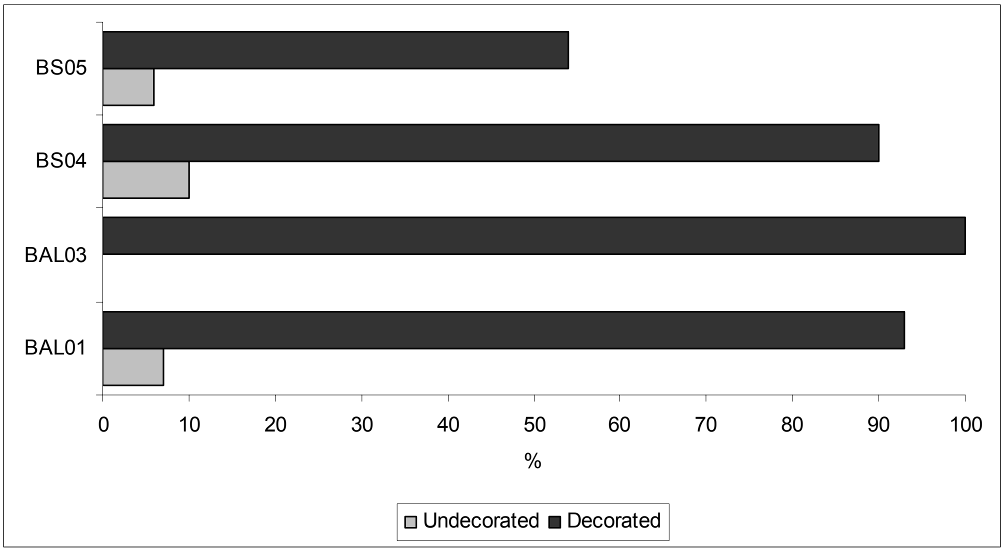



Figure 46: Distribution of decorated against that of undecorated vessels.

**Use-Wear**

Use-wear patterns were analysed as a means to trace salt production activities in the archaeological record. Two attributes, carbon deposition on vessels exteriors, and interior pitting, were identified as being related to salt production.

*Pitting*

The process of reducing caustic brine to crystalline salt acts as a tribochemical mechanism (Schiffer and Skibo 1989) that results in erosion of a ceramic vessel's interior and exposes the underlying slip (cf. Rice 1987: 234-235). The pitted marks on salt production vessels at Baleni were fairly obvious to spot and vessels were analysed without the use of magnification equipment. Analyses were done only on reconstructed or partly reconstructed vessels that had a part of the vessel body present. This was done in order to classify a single vessel only once in the analysis.

Analysis of pitting was done on 100 vessels from the four Kwale assemblages. The Silver Leaves assemblage from BS04 only had a sample of six vessels, which limits the effectiveness of its comparisons to the other assemblages. Forty vessels were analysed from BAL01, thirty from BAL03 and twenty-four vessels from BS05.

The comparisons indicate a high degree of similarity between the assemblages from BAL01, BAL03 and BS05. The pitted vessels constituted between 73% (BAL01) and 77% (BAL03) of the vessels from the salt production area, while 83% of the BS05 assemblage was pitted. All the vessels analysed from BS05 were from excavation unit N-10/E-24. As indicated in Chapter V, this unit uncovered a low mound area. The high proportion of pitted vessels from this excavation provides additional evidence that salt was produced in this area of the settlement.

Table 8: Percentage values of pitted and non-pitted vessels from the four Mzonjani assemblages.

| | BAL01 (%) | BAL03 (%) | BS04 (%) | BS05 (%) |
|---|---|---|---|---|
| **No pitting** | 28 | 23 | 50 | 17 |
| **Pitting** | 73 | 77 | 50 | 83 |

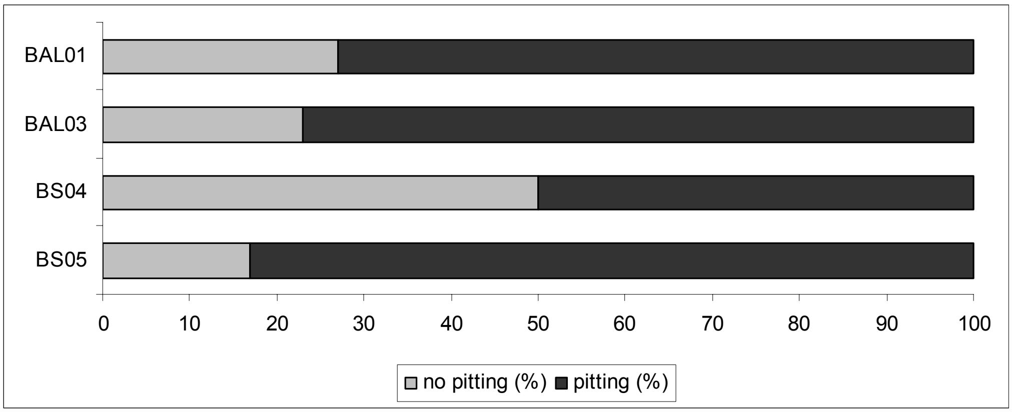



Figure 47: Comparisons between pitted vessels and vessels without pitting in the assemblages.

Figure 48: Interior pitting on salt production vessel.


Figure 49: Interior pitting on salt production vessel.

Figure 50: Interior pitting on ceramic vessel.

*Carbon Deposition*

The review of salt production methods (Chapter III) indicates that evaporation of brine to crystalline salt may be induced over an open fire or through solar evaporation. The presence of soot deposits on the exterior of a vessels is a clear indication of activities involving the use of fire (Rice 1987: 235). Induced fire evaporation, therefore, would result in sooting on vessel exteriors. Exterior carbon or soot is caused by the deposition of the by-products of wood combustion (Skibo 1992: 152). Patterns of sooting in salt production assemblages were analysed as an indication of fire induced evaporation. Due to the extreme fragmentation of the assemblages, the analysis could not determine on which part of the vessel sooting occurred, or what the minimum number of sooted vessels were. The adopted procedure entailed weighing ceramic fragments with soot on the exterior as a relative indication of carbon deposition patterns in the Mzonjani salt production assemblages from the excavations BAL01 and BAL03.

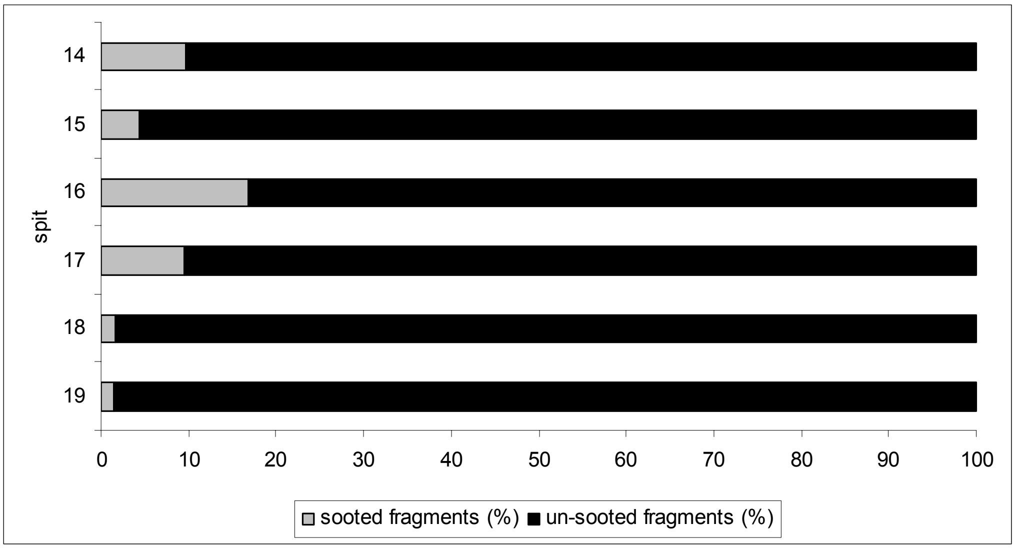



Figure 51: Percentage of ceramic fragments with soot, per spit from BAL03.

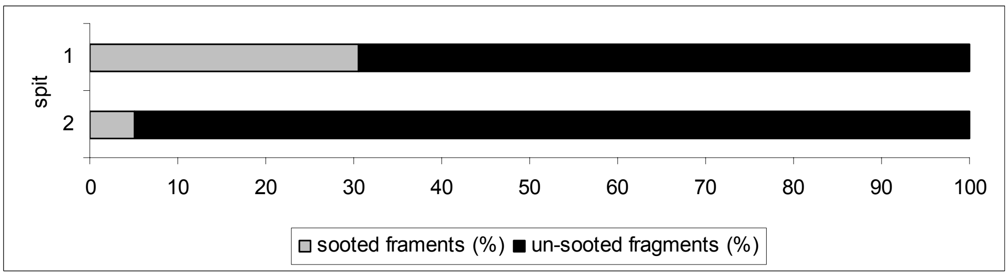



Figure 52: Percentage of ceramic fragments with soot on exterior, per spit from BAL01.

Vessels with soot marks were present in salt production assemblages from BAL01 and BAL03. In BAL03 sooting decreases towards the bottom of the excavation. This pattern is probably due to the waterlogged state at this depth of the excavation. These sooted vessels and the ash and charcoal lenses within the mound strata of BAL03 and BAL01 points to a process of fire induced reduction of brine during the EIA.

**Morphological Variances**

Analysis of the levels of variance between the assemblages was based on measurements of inflection, maximum diameter and orifice diameters. Histograms of measurements were first analysed for modality in order to identify any discrete size classes, since it is invalid to apply summary statistics to bimodal distributions (Costin and Hagstrum 1995: 631). Outliers were subsequently eliminated from the sample. Variability between the assemblages was calculated on the basis of Coefficient of Variation (*CV*). This method expresses the variability in an assemblage as a percentage and therefore allows for intra-assemblage comparisons (Blackman *et al.* 1993). It is considered to be the standard statistic in determining values of variation and is defined as the sample standard deviation divided by the sample mean, multiplied by 100 (Costin and Hagstrum 1995: 631; Roux 2003: 772).

$$CV = \frac{std \times 100}{X}$$

Equation 2: Coefficient of variation, where *std* is the standard deviation of the sample, and *X* the sample mean.

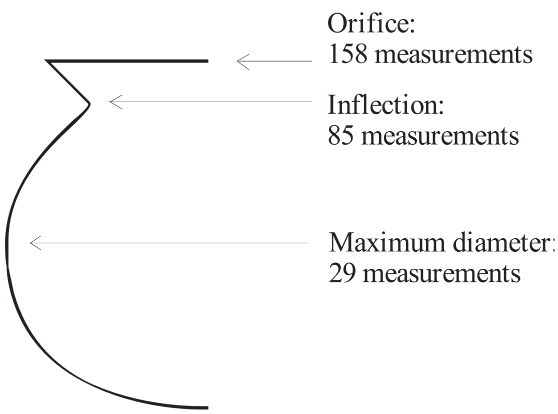



Figure 53: Vessel dimensions measured and the number of measurements taken.

Due to the fragmentary nature of the Baleni assemblages, no vessels could be completely reconstructed. This limited the potential measurements that could be taken of vessel dimensions. Since the assemblages contained vessels which all shared the same profile, all three multidimensional classes are combined in the analysis. Vessels were reconstructed as far as possible and in the end, 158 vessels were used in measurements of orifice diameter and 85 vessels in measurements of inflection. Only 29 vessels were reconstructed to the point where maximum diameter could be measured.

Table 9: Measurements of morphological attributes taken on vessels from the four EIA assemblages from Baleni. (*n* = number of vessels, mean = standard arithmetic average, min = minimum extent, max = maximum extent, SD = standard deviation, CV = coefficient of variation).

| | | ***n*** | **mean** | **min** | **max** | **SD** | **CV** |
|---|---|---|---|---|---|---|---|
| **BAL01** | | | | | | | |
| | Orifice | 50 | 29.00 | 20 | 42 | 6.59 | 22.73 |
| | Inflection | 31 | 24.00 | 18 | 38 | 5.68 | 23.67 |
| | Max Diameter | 6 | 29.33 | 18 | 36 | 6.41 | 21.85 |
| **BAL03** | | | | | | | |
| | Orifice | 43 | 26.00 | 20 | 42 | 4.23 | 16.27 |
| | Inflection | 27 | 22.44 | 16 | 40 | 4.97 | 22.15 |
| | Max Diameter | 17 | 31.76 | 26 | 42 | 4.94 | 15.56 |
| **BS05** | | | | | | | |
| | Orifice | 57 | 22.00 | 16 | 34 | 3.92 | 17.81 |
| | Inflection | 23 | 21.57 | 14 | 32 | 4.67 | 21.65 |
| | Max Diameter | 3 | 28.67 | 28 | 30 | 1.15 | 4.03 |
| **BS04** | | | | | | | |
| | Orifice | 7 | 20.00 | 18 | 22 | 2.00 | 10.00 |
| | Inflection | 4 | 17.50 | 16 | 20 | 1.91 | 10.94 |
| | Max Diameter | 3 | 26.00 | 24 | 30 | 3.46 | 13.32 |

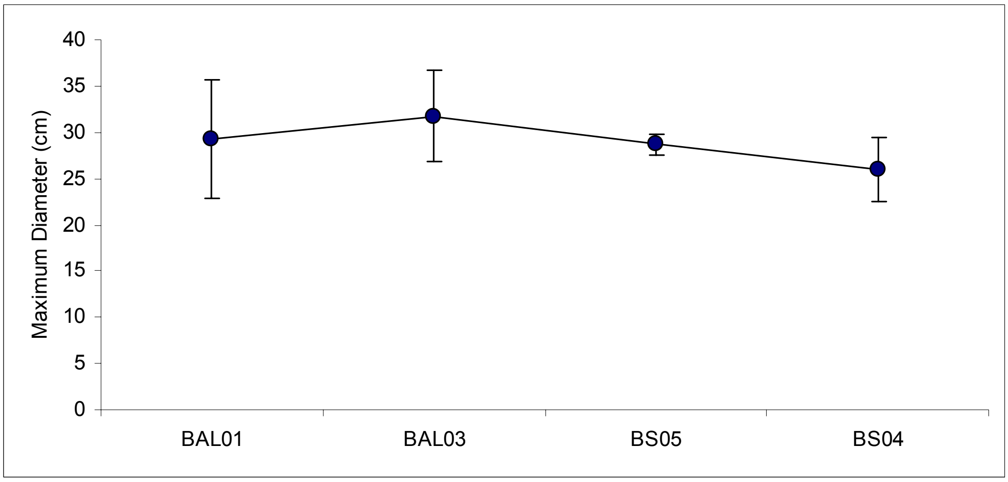



Figure 54: Intra-assemblage differences of maximum inflection diameter as shown by means and standard deviations.

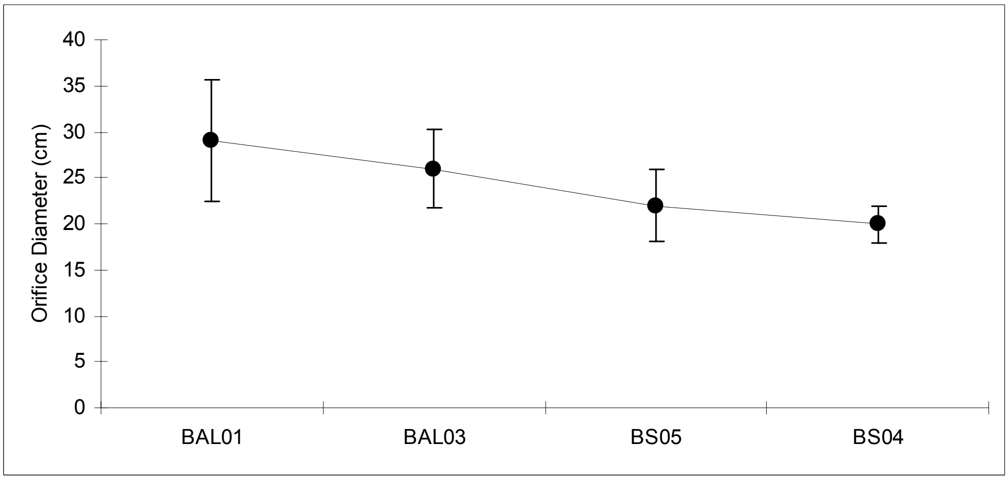



Figure 55: Intra-assemblage differences of orifice diameter as shown by means and standard deviations.

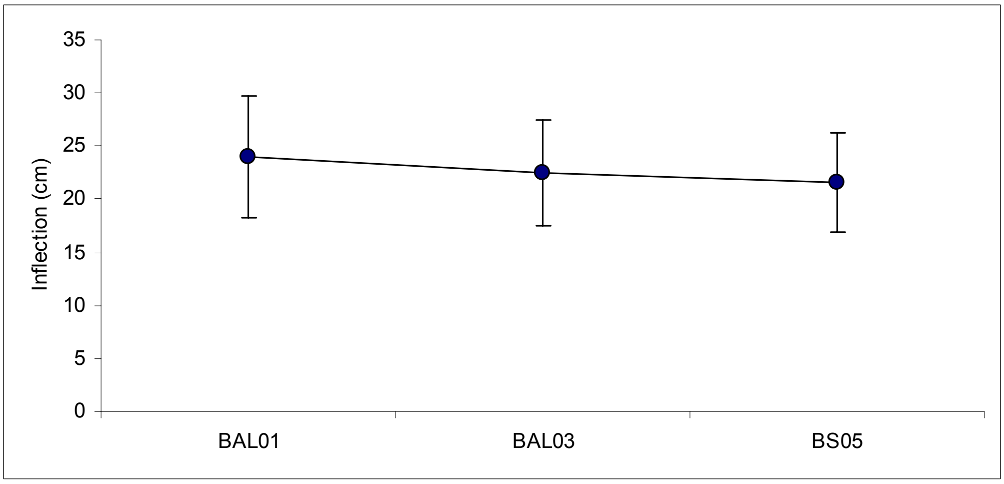



Figure 56: Intra-assemblage differences of inflection diameter as shown by means and standard deviations.

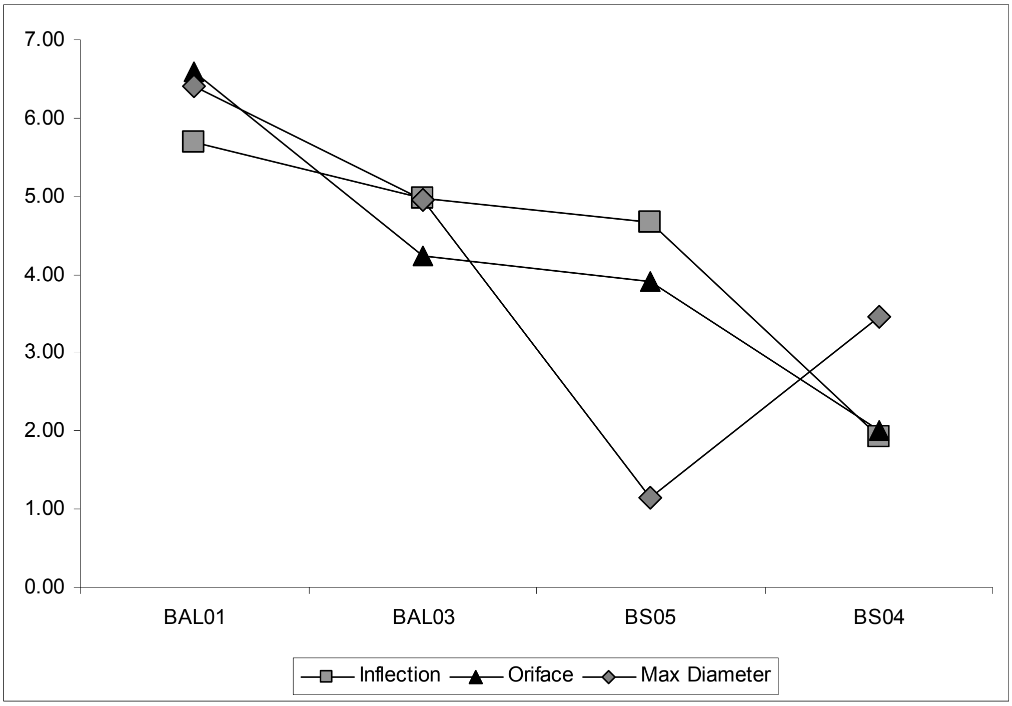



Figure 57: Standard deviations of measurements taken on Kwale ceramics from Baleni.

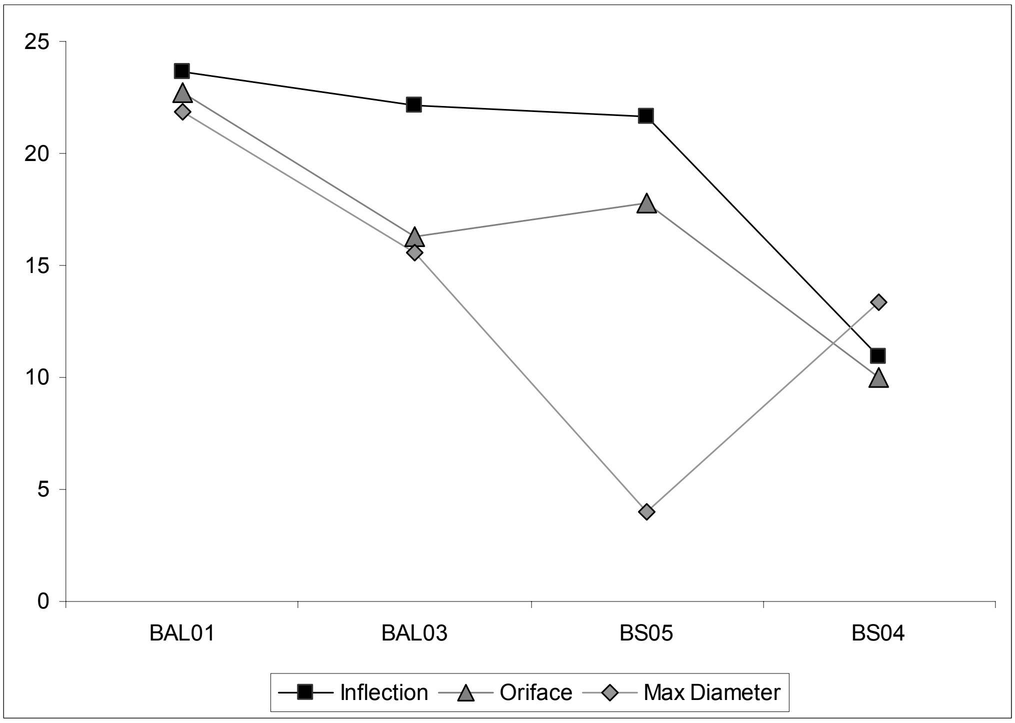



Figure 58: Coefficient of Variation of measurements taken on Kwale ceramics from Baleni.

As indicated in Table 9 and Figures 54 to 56, vessel sizes in the production assemblages from salt mounds tended to be slightly larger than that of the temporary settlements as indicated by the mean orifice, inflection and maximum diameters. The major limiting factor is the small assemblage from BS04. This restricts the possible comparisons with the other assemblages. The mean orifice diameter for the production mound excavations vary between 26cm and 29cm, while that of the settlements were between 20cm and 22cm. Similarly, the mean inflection diameters from the production mounds are 22.44cm (BAL01) and 24cm (BAL03) while that of BS05 is 17.5cm.

Although the salt production assemblages from BAL01 and BAL03 had larger vessels, they displayed a greater range of different vessel sizes. Standard deviations from BAL01 were the highest and varied between 6.41 and 6.68, while those from BAL03 varied between 4.23 and 4.97. The lower variation in vessel seizes in the temporary settlement assemblages, is reflected by standard deviations between 1.15 and 3.92. The lowest results from these assemblages are from measurements of maximum diameter, which were taken on only three vessels from each of the settlements (BS04 and BS05), and is therefore probably inaccurate.

While these measurements indicate minor levels of difference in vessels size between the assemblages, the levels of variance is best displayed in the results of the CV analyses. CV results from inflection, maximum and orifice diameter all range above 10%. When BS04 is omitted (due to the small sample), CV levels all fall above 15%, the exception being maximum diameter from BS05. In this instance, measurements were only taken on three vessels, and is therefore probably an inaccurate reflection. A clear correlation exists between the levels of variation between BAL03 and BS05. Variation within the BAL01 sample was 2% to 4% higher than any other assemblage. BS04 on the other hand, have much lower CV results which vary between 10% and 13.32%. As indicated above, this is as a result of the small sample. On a whole, the results do, however, vary within the same range. The high CV results indicate that all the assemblages are characterised by high levels of variation in vessel sizes. CV results below 10% are taken as an indication of a high degree of standardization (Costin and Hagstrum 1995: 631). The inter-assemblage variability implies that vessel dimension was not a standardised feature in salt production. It thus does not seem that vessel size was a consideration in EIA salt production at Baleni.

Although very little published comparisons exist, vessel sizes vary within the range of the Mzonjani name site assemblage (Maggs 1980a: 84; but also refer to Evers 1981 fig.2; Hall 1980 fig. 4; Whitelaw and Moon 1996 fig. 6-9). Measurements on vessels from Mzonjani were only taken on orifice diameter. The mean orifice diameter from Mzonjani was 26.8cm, which compares well to that of the Baleni assemblages, which varied between 22cm (BS05), 26cm (BAL03) and 29cm (BAL01). The largest pots from Mzonjani had an orifice diameter of 42cm, which is exactly the same size of the maximum orifice diameter from Baleni. The settlement assemblage from Mzonjani evidently had smaller pots present in the assemblage as indicated by the minimum measurement of orifice diameter, which is 10cm. This is slightly smaller than the smallest Baleni vessels, which were 16cm at BS05 and 20cm at BAL01. The presence of smaller pots would also explain the higher standard deviation in the Mzonjani site assemblage, which was calculated as 10.2. The similarities witnessed in comparisons of vessel types, between the Baleni assemblages and contemporary settlements, therefore, are mirrored in vessels sizes as well.

## Summary

The historical sequence of salt production at Baleni is defined by four ceramic phases. The most recent phase is Letaba and covers the period after AD 1600. The middle assemblage from BAL03 is Eiland/Kgopolwe. The associated date is somewhat later than expected for this phase and could imply a revision of the temporal distribution for this phase. The earliest phases of salt production at Baleni is associated with Mzonjani and Silver Leaves ceramics. Two carbon samples from the Mzonjani phases of salt production at BAL03 provided early first millennium AD dates. The oldest date, Pta-9349, is much older than other dates from this phase and certain questions surround its validity. Future research at Baleni must investigate the temporal context of this date before any meaningful conclusions can be drawn.

The ceramic analysis of the Baleni assemblages indicates that a clear similarity between salt production ceramics and that found on contemporary settlements. These assemblages are, however, characterised by the limited use of vessel types. A diagnostic attribute of salt production assemblages is a high proportion of interior pitting. Although pitting indicates a salt production context for vessels, it is not reflected in vessel types or attributes. While there is no variation in terms of vessel types, a high degree of variability exists in terms of vessel size. Salt production does not utilise any specialised or unique ceramic vessels, in terms of modal types, shapes or vessel sizes. This suggests that salt production uses relatively unspecialised production tools with a low degree of standardization. This has important implications for considerations of the organization of early salt production at Baleni, which will form the focus of the next chapter.

CHAPTER VII

DISCUSSION AND CONCLUSION: SALT PRODUCTION IN THE EARLY IRON AGE OF SOUTH AFRICA

Salt production was an activity directly associated with the earliest phases of farming communities in southern Africa. This contextual link is established through radiocarbon and ceramic analysis. The following chapter will discuss the work presented thus far in terms of the organization of production. This will serve to elucidate the character of salt production at Baleni, and place it in context of the Early Iron Age (EIA) of South Africa.

## The Demand for Salt

Costin (1991:3) recommends characterizing demand before production organization because demand will determine production features such as "cost parameters, levels of output, appropriate technology and the exclusivity of distribution". Although demand is an abstract concept, it can be identified through the quantity and function of objects as well as the social characteristics of the society who use them (Costin 2000: 396).

It is difficult to reconstruct consumption patterns for salt due to its absence from the archaeological record outside of its production context. As discussed in Chapter I, salt plays an important part in the diet of agricultural societies. It has been estimated that agricultural communities in semi-arid environments, comparable to the South African Lowveld, would need a minimum of 2g of dietary salt per person per day (Parsons 2001: 4-5). According to this figure, which excludes non-dietary uses of salt, a person would consume 0,72kg of salt per year. This is an estimated figure and can be adjusted up or down depending on assumptions around the actual demand for salt.

Because salt is a universal dietary component, consumption patterns would therefore include every household in a settlement. The presence of the Central Cattle Pattern (CCP) in the EIA implies that the distribution of goods within the settlement did not take place on an egalitarian level. The CCP entails social stratification, primarily indicated by elite burials. These burials are usually associated with special grave goods such as ivory (Huffman 1993: 220). The association between elite status and particular goods imply a situation of restricted access to certain products. An argument can be made that access to salt within the consumer village could have been controlled by social convention. However, the physical role salt played in the wellbeing of the entire population of a village is likely to negate its exclusive control by individuals of higher rank. Therefore, despite the possible restricted access to salt, controlled by subsets within the village, the wide demand for salt would fall into Costin's (1991:8) "general market of potential consumers" rather than demand by "elite patrons". It is within this framework of general, unspecified demand that salt production was organised at Baleni.

## Context: Independent Producers

Unspecified demand is usually characterized by independent producers. Archaeologically, this is reflected in evidence for low capital investment by small groups of producers using basic technology (cf. White and Pigott 1996: 157-158).

The review of salt production methods (Chapter III) indicates that salt production at brine springs usually takes place in three steps. Firstly, the principle method of making brine at these sources is to collect a salt crust that forms around the sources when the waterline recedes (Alexander 1997; Davison 1993; Gouletquer 1975; Junod 1927; Lovejoy 1986; Terblanche 1994; Witt 1966). Brine is made by mixing the collected crust with water and filtered though a strainer. Filters are usually either clay lined baskets held in position by a wooden frame, or pots with a perforated bottom. Once the salt has been leached from the salt crust inside the filter, it is scraped out and discarded. As a result, salt production sites are characterised by earthen mounds formed by the leached out filter content (e.g. Connah *et al.* 1990: 33; Fagan and Yellen 1968: 4; Gouletquer 1975: 49; Sutton and Roberts 1968: 61). These areas usually have a mound-like stratigraphy, with the bulk of the archaeological material being comprised of ceramics (e.g. Connah 1996; Evers 1974; Fagan and Yellen 1968). The final process is the reduction of brine to form crystalline salt. Usually brine boiling consists of simply placing pots filled with brine over a fire (e.g. Connah *et al.* 1990: 33-34; Sutton and Roberts 1968: 61). Reduction processes result in masses of ceramic shards, which usually end up on refuse mounds in the salt workshop. Interiors of ceramics vessels used in brine reduction are usually pitted due to the caustic nature of the brine.

Salt produced in this manner therefore offers archaeologically traceable results. The archaeological deposits at Baleni conform to this pattern in several regards. Firstly, areas of salt production around the Baleni spring, and the swamp into which it flows, are characterised by earthen mounds. Excavations of these mounds (BAL01 and BAL03) indicate a general similarity with ethnographically observed mounds. The mounds have a complex stratigraphy, indicative of a rapid and simultaneous deposition of strata. This is consistent with the recorded process of emptying out basket-type filters. The absence of perforated ceramic bases in the excavations, supplements the view that filters during the EIA were probably of the woven basket type. The general matrix of the excavated mounds is sandy loam with smaller layers and pockets of sand, clay and ash. The sandy loam matrix is most probably the leached out salt crust, since it resembles the soils around the swamp where the crust is formed. Present day saltmakers mix the collected crust with coarse river sand to loosen it up, and to make filtration easier. A similar process would account for the pockets of coarse river sand within the mounds. Woven filters are also lined with clay to waterproof them, and this is probably the origin of the clay strata found in the excavations of these mounds. The burnt exteriors of ceramic vessels and the ash and charcoal strata within the mounds, indicate that brine was reduced over an open fire at the production site. A salt production context for these mounds is also evident in the ceramic assemblages. Excavations of the mounds found that between 73% to 77% of vessels from BAL01 and BAL03 respectively, had heavily pitted interiors. EIA salt producers at Baleni, therefore, undoubtedly made use of the salt crust around the swamp after which it was filtered through a basket type filter. The last production step was to reduce brine over an open fire at the saltworking site.

The salt production context of the ceramic assemblages is not reflected in vessel types or sizes. As indicated in Chapter VI, the ceramic vessels used in salt production, were similar to vessels excavated on contemporary EIA settlements. The Baleni assemblages were characterised by high levels of variation in vessel sizes. The levels of variance were largely similar in all the Baleni assemblages, and also comparable to assemblages from contemporary settlements. This suggests that salt production used relatively unspecialised production tools. Evidence of attempts to maximise production efficiency was also absent in the excavations. Such techniques (as discussed in Chapter III) may include the use of salt gardens, permanent or specialised furnaces to speed up evaporation, arrayed leaching devises, brine tanks or special boiling vessels. Producers at Baleni also did not make use of more durable soapstone bowls as excavated in the upper levels of the Harmony Saltworks (Evers 1974). Production methods therefore used essentially simple production tools, without great emphasis on efficiency.

Small groups of producers are another characteristic of independent production. The only direct evidence of group size is reflected in the layout of BS05. The settlement contained six huts organised in a semi circle around a single salt production area. If a hut is taken to represent the presence of at least one individual, there were approximately 6 people producing salt at BS05. A similar pattern of small groups of related producers probably existed for production at the salt workshops around the spring as well.

The unspecialised production tools, small groups of producers and the seemingly small scale of production indicate a general theme of low capital investment and are consistent with salt being produced by independent specialists.

## Concentration: Non-nucleated Production

Excavations at sites of specialized salt production such as Kibiro (Connah 1991, 1996) and Ivuna (Fagan and Yellen 1968) have produced evidence of permanent habitation at the production sites and suggested nucleated salt production activities. At Baleni, in contrast, the bulk of extraction evidently occurred around the spring and associated swamp. Hundreds of mounds were located in this area, without any evidence of permanent occupation. Opposed to this area of concentrated production, two settlements were located 1,5km away from the spring. The two settlements, BS04 and BS05, lacked features such as pits, grain bins, middens, burials and evidence of stock keeping or metal production usually associated with permanent settlements. In addition, the single, unstratified layer of deposit, and the lack of additional cultural features indicate that occupation at BS05 was not permanent, or only for a very short period. Combined with the data from the mound area (N10/E-24) it is clear that salt production took place during a short period of occupation. The spatial evidence implies that salt production was of key importance: huts were organized in a semi circle around a central area, and it is within this open area that the single salt mound was located. These lines of evidence show that BS05 was a temporary EIA settlement with its inhabitants being actively involved in salt production activities.

Production activities at BS05 do not differ from that of the workshops at the spring (BAL01 and BAL03). This is primarily reflected in the ceramic assemblages. Both areas were similar in terms of multidimensional class types as well as in the variation of vessel sizes. Variation of vessel morphology (as calculated by the Coefficient of Variation for orifice and inflection diameters) were very high in all assemblages. The low levels of standardization of ceramic vessels and the absence of specialist tools suggest that production, within the temporary settlements, was by independent producers making use of unspecialised and basic production techniques. The temporary settlements were obviously not permanent villages established to exploit the available salt resource and, therefore, not centers of nucleated production.

While the evidence is not conclusive in identifying the context of production, no data suggests a permanent production community exploiting the salt spring. If such a community did exist, it was located outside of the immediate study area. Until additional data can prove otherwise, I believe the archaeological evidence indicates that salt production at Baleni was by non-nucleated small-scale producers. The absence of a permanent community at the source, the high variability in ceramic morphology, and production by independent producers are consistent with a scenario where more than one group visited Baleni to harvest salt (cf. White and Pigott 1996: 158). This is concurrent with observations of more recent salt production activities in Africa where production is often by small groups from an assortment of different villages (e.g. Fagan and Yellen 1968; Gouletquer 1975; Sutton and Roberts 1968). At Uvinza in nineteenth century Tanzania, for example, up to 20 000 people came from various villages to the salt spring to harvest salt on a seasonal basis (Sutton and Roberts 1968). EIA salt producers at Baleni were therefore probably not concentrated within a single community, but spread throughout the immediate consumer population.

### Intensity: Seasonal Exploitation at Baleni

The presence of temporary settlements such as BS04 and BS05 does raise questions regarding the intensity of production. Production methods at BS05 were comparable to the small scale production efforts witnessed at the workshops around the spring. The need to build a temporary settlement does, however, indicate a situation where salt production extended over a longer period than at the spring. The lack of domestic activities at BS05, as discussed above, implies that activities on site were solely directed to producing salt.

Identifying the intensity of production can elucidate whether this longer period of extraction reflects a different organizational pattern of salt production during the EIA.

Intensity of production essentially reflects the time producers spend on craft activities relative to other economic pursuits. Intensity reflects to what degree production was full time or part time and should not be confused with scale or production output. As indicated earlier, EIA salt production probably made use of the salt crust that forms around the swamp edge and in the nearby swampy depressions. This crust only forms when the waterline recedes. Since salt production is dependent on the decline of water levels in the swamp, salt production, therefore, would have been a dry season activity.

As a dry season activity, salt production would coincide with the primary subsistence activities of agro-pastoral farmers. The primary agricultural products for the EIA were sorghum (*Sorgum bicolour*) and millet varieties such as pearl millet (*Pennisetum americanum*), and finger millet (*Eleusine coracana*) (Hanisch 1981; Klapwijk 1974; Maggs 1984a; Maggs and Ward 1984). In the region around Baleni, millet is sown between October to February, and sorghum between September and December. Reaping takes place from May to July for sorghum, and from June to July for millet (Stayt 1968: 36). Present day rainfall patterns indicate that 90% of rain occurs between October and March during which salt could not have been produced. Subsequently, modern production only starts after May when water levels in the swamp start to drop. This leaves only a small period between August and September within which salt production can occur without conflicting with the harvesting of crops. Reaping time will therefore overlap with the period suitable for salt harvesting. Salt production therefore forms part of a system in which salt and subsistence activities would not necessarily complement each other. Literature also indicates that salt production activities are often characterised by the sexual division of labour (Connah *et al.* 1990: 35; Lovejoy 1986: 122; Sutton and Roberts 1968: 61; Terblanche 1994: 193). Salt production would therefore not necessarily be an activity in which the entire family or village engaged in. A similar scenario during the EIA would explain the small size of the community at settlements like BS05 and BS04. If the small scale production activities as indicated above are taken into account, it seems that EIA salt producers practised a semi-generalised economic strategy by practising agricultural subsistence and supplementing it with short periods of salt production.

Costin states that such a semi-generalised strategy can only take place when technology is "simple or inexpensive" (Costin 1991:17). The data from Baleni suggest that this was indeed the case. Production utilised an essentially straightforward method. This was evidently relatively inexpensive, as witnessed in the two primary production tools: ceramic vessels for brine reduction, and salt strainers for brine filtering. Salt production vessels were similar to ordinary domestic pottery as indicated by comparison with contemporary settlements. The production of ceramic vessels for salt making, therefore, did not entail the manufacture of specialised vessels and ordinary inexpensive household vessels were used. Filters could have been constructed from readily available wood and grass on the site and would have been relatively quick to make (Terblanche 1994; Witt 1966). The availability of fuel for fires to reduce brine would also not have influenced the cost of production. The analysis of faunal samples from the Holocene period in the Kruger National Park (KNP) indicates that climatic fluctuations did not cause major changes in the overall occurrence of animal and plant populations in the northern Lowveld (Plug 1988: 288-292). It is therefore expected that during the EIA, Baleni was also situated in mopane veldt, as found at the site today. This vegetation zone is dominated by dense growth of hardwood species such as *Colophospermun mopane* (Mopane), *Combretum apiculatum* (Red Bushwillow), *Acacia nigrescens* (Knob Thorn) and *Combretum imberde* (Leadwood). All these species have dense wood, which provide high temperatures for a long period of time (Van Wyk 1984). The inexpensive methods of salt production, therefore, lend support to the view of salt production as a low intensity and part-time or seasonal activity.

## Conclusion

The archaeological work conducted at Baleni shows that all EIA activities at the site were connected to aspects of salt production. Firstly, excavations carried out in the area where salt mounds were concentrated found no evidence suggesting that activities other than salt production took place around the spring. Similarly, the temporary settlements BS04 and BS05 were without features associated with a typical EIA settlement. EIA activities at Baleni, therefore, revolved around salt production - either immediately around brine sources, or in temporary settlements. This is concurrent with Muller's (1984) definition of site specialization, wherein salt production was a single, short term activity at a specific location.

The nature of EIA production, raises questions around the suggestion that salt produced in the Lowveld, was geared to meet shortages in food supplies through exchange networks (cf. Hall 1987b). The absence of specialist production as found at Baleni, does not necessarily imply the absence of exchange (cf. Masucci 1995). Part-time economic activities, such as salt production, offer producers the opportunity to manufacture small quantities of surplus goods for trade. This can provide "economic insurance against lean times" (Masucci 1995: 80). To prove this, the archaeological data should indicate that salt was produced beyond levels of local consumption. Because salt is mostly consumed, and dissolves when deposited, there is no direct way to ascertain whether it was widely traded.

The contextual evidence from the production facilities at Baleni does provide some speculative answers to this question. EIA salt production represents small, non-specialist activities within domestic contexts by non-nucleated producers. The evidence for dispersed producers negates the value of salt as a locally exchanged commodity, since local communities could be self-sufficient in terms of their salt supply through production forays to the spring. This implies that salt could have been obtained without relying on local exchange networks.

Evidence for trade from the earliest phases of the Iron Age in southern Africa is largely fragmentary. Most of the material from EIA contexts dates to late in the second half of the first millennium AD and therefore lies outside the temporal frame of this dissertation. While the spatial extent of early trade is unknown, a ninth century glazed Islamic shard and a glass bead from KwaGandaganda in KwaZulu-Natal, may indicate that coastal contact could have extended as far south as Durban by the ninth to tenth centuries AD (Whitelaw 1994). Trade contacts from this period are displayed on many inland sites by the presence of marine shells (Maggs and Ward 1984; Van Schalkwyk 1994; Voigt and Peters 1994; Whitelaw 1993, 1994) and glass beads from the Kruger National Park (Meyer 1986). The exact relationship between the coastal points of trade and the interior, however, is poorly understood, especially during the period covered in this study. It is therefore unclear what role salt played as a trade commodity during the early first millennium. Although surplus salt may have been exchanged to supplement subsistence strategies, this was seemingly small in scale and did not form the economic base of the producers (cf. Muller 1986). Production at Baleni does not conform to Costin's (1991: 4) definition of producer specialization as the "institutionalized production system in which the producers depend on extra-household exchange relationships at least in part for their livelihood, and consumers depend on the acquisition of goods they do not produce themselves".

Such a level of production, as defined by Costin, suggests organization on a scale resembling that of Kibiro in Uganda. Here, salt was produced with the specific aim of trade to supplement food supplies. Production at Kibiro is characterised by efforts to maximise production, primarily by means of saltgardens. The construction and maintenance of the saltgardens is a time consuming and labour intense operation. Present-day producers are mainly women who lived in Kibiro village and trade salt on local markets. Producers are, therefore, nucleated in a single production location, and goods are transferred between the producers and consumers. Production at Kibiro, therefore tends to be more than just a short term or temporary effort.

The organization of salt production at Baleni stands in marked contrast to that of Kibiro. Baleni production was by non-nucleated, independent producers and was temporary in nature. Production can only take place on a seasonal basis because it was dependent on receding waterlines around the main swamp and within the smaller swampy depressions. As a dry season activity, it fell within the same period as crop harvesting. The unspecialised nature of salt production suggests that these communities would have been involved in normal subsistence strategies for most of the year.

Two related patterns of extraction can be identified at Baleni during the EIA. Firstly on a temporary basis in production areas at around the brine sources, and secondly within temporary settlements located a distance away from the areas of concentrated production. Both levels of production point to a scenario where salt production took place during forays to Baleni by surrounding communities. The lack of evidence suggesting that salt production was a specialized activity during the EIA, indicates that salt production was probably not aimed at the production of surplus. Communities probably met their own demands for salt through direct access and extraction at the source. The self-sufficient nature of extraction at Baleni corresponds to the procurement of iron ore resources by EIA communities. KwaZulu-Natal and Mozambique Kwale villages are mostly situated near ore sources (Morais 1988; Whitelaw and Moon 1996) and residues from metal production within villages are typically very limited (Whitelaw and Moon 1996). This indicates that villages were procuring ore in small quantities for use within the village.

Salt production at Baleni also corresponds to other studies on EIA exploitation of natural resources. The clearest analogy is from shellfish gathering by Mzonjani communities in KwaZulu-Natal. Settlements are typically situated up to 8km away from shell middens. These middens lack signs of architecture, metal production or stock keeping, activities normally associated with settlements. The relative absence of shell within the Mzonjani levels indicates that shellfish were transported to the village where it was processed (Horwitz *et al.* 1991). The close proximity of settlements to the coast meant that inhabitants could make daily visits to gathering points to harvest enough shellfish for use within the village (Maggs 1984b). This meant that prolonged forays to the coastline were unnecessary. Longer periods of exploitation are only associated with later Msuluzi, Ndondondwane and Ntshekane ceramic phases when villages were situated further away from the coast and when there was a marked population increase (Horwitz *et al.* 1991).

This offers possible interpretations for the pattern witnessed at Baleni. As with exploitation at the shell middens, the production of salt at the swamp shows no evidence for prolonged exploitation but, rather, is indicative of short forays by nearby communities. This correlates to existing production patterns witnessed at Baleni by Witt (1966). He found that salt production only takes place for a few days and saltworkers bring sleeping mats and erect temporary shelters from branches. This short term extraction process would not leave any archaeological traces, as indicated by the paucity of evidence suggesting habitation around the spring. More prolonged extraction of shell middens are associated with larger communities living further away from collection points. A similar pattern can possibly explain the prolonged extraction as indicated by the temporary settlements BS04 and BS05. It would not be efficient for communities situated a few days journey from Baleni to make regular short trips to the salt spring. A more practical option would be prolonged periods of production. Judging from current rainfall patterns, prolonged extraction could only take place for a period of less than two months without actively infringing on subsistence activities. This semi-temporary exploitation is consistent with the archaeological data from BS05. Occupation of the site was not long enough for extensive archaeological deposits to accumulate and for normal subsistence activities to take place on the site. This may well reflect a pattern of short seasonal exploitation by communities that live further away from Baleni.

This pattern of short-term production forays to Lowveld salt sources has previously been postulated by Evers and Van der Merwe (1987) for the Eiland ceramic phase. The Eiland

Saltworks, located 60km south west of Baleni, falls within the distribution area of Kgopolwe ceramics (see Chapter VI). The authors hypothesise that the Eiland ceramics in salt production mounds, were from communities living on the escarpment within the traditional distribution zone of Eiland. This means that communities made approximately a 50km trek to the salt source. Although this hypothesis of Eiland production patterns needs testing, it complements the model of early salt production at Baleni.

The current data from Baleni is consistent with the suggestion of part-time or seasonal production on a small scale, by independent producers. Salt, during the Early Iron Age, was produced for general unspecified demand, by multiple producer communities that took advantage of the localised salt resource. Salt production at Baleni can best be characterised as the transient or seasonal exploitation by small groups of producers and should be approached as the small-scale participation in an activity vital in the daily life of local populations.

Although salt production has been long recognized as an economic activity of EIA society, this study is the first to explicitly examine the context and organization of production. On a whole, the results of this dissertation complement studies that have focused on village organization and the exploitation of other natural resources. Although the views do not necessarily necessitate a revision of current views on EIA society, it does indicate that archaeologists should approach production systems with caution, and base statements on well founded empirical data. The research has shown that production sites offer a wealth of information concerning the social and economic contexts in which production takes place. The study also shows that ceramic assemblages have the potential to provide answers beyond mere temporal classifications. As the most abundant artifact on Early Iron Age sites, ceramic vessels have the potential to inform archaeologists on a range of questions concerning production activities, as well as the context in which artifacts are used and deposited.

This study of salt production at Baleni is, however, far from comprehensive and many questions still remain unanswered. A major aim of future research should be to determine how the organization of salt production change over time and if it reflects lager socio-political development in southern Africa. It would be of immense value to future research to identify the actual settlements where salt producers came from, and determine how salt production is reflected at these sites. This will also give a better indication of the spatial distribution of producers. There is, therefore, a need to expand the existing survey area around Baleni, and indeed the northern Lowveld as a whole. There is still too little known of the first farmers in southern Africa.

# BIBLIOGRAPHY


ALEXANDER, J.

1993 The Salt Industries of West Africa: A Preliminary Study. In *The Archaeology of Africa: Food Metals and Towns*, edited by T. Shaw, P. J. J. Sinclair, B. Andah and A. I. Okpoko, pp. 652-637. Routledge, London.

1997 Salt Production and the Salt Trade. In *Encyclopedia of Precolonial Africa. Archaeology, History, Languages, Cultures and Environment*, edited by J. O. Vogel, pp. 535-539. AltaMira Press, California.

BINFORD, L. R.

1965 Archaeological Systematics and the Study of Cultural Process. *American Antiquity* 31: 203-210.

1983 *Working at Archaeology*. Academic Press, New York.

BIRMINGHAM, D.

1999 *Portugal and Africa*. Macmillan Press, London.

BLACKMAN, J. M., STEIN, G. J. and VANDIVER, P. B.

1993 The Standardization Hypothesis and Ceramic Mass Production: Technological, Compositional, and Metric Indexes of Craft Specialization at Tell Leilan, Syria. *American Antiquity* 58(**1**): 60-80.

BONSMA, J.

1976 Bosveldbome en Weistreke: 'n Praktiese Gids by die Aankoop van 'n Beesplaas. J.L. van Schaik, Pretoria.

BOWER, B.

1993 Ancient Maya Trade: Tracing Salty Swamps. *Science News* 144: 358-349.

BRANDL, G.

1987 *The Geology of the Tzaneen Area*. Government Printer, Johannesburg.

BRIGGS, D. N.

2003 Metals, Salt, and Slaves: Economic Links between Gaul and Italy from the Eighth to the Late Sixth Centuries BC. *Oxford Journal of Archaeology* 22(**3**): 243-259.

BRUMFIEL, E. M. and EARLE, T. K.

1987 Specialization, Exchange and Complex Societies: An Introduction. In *Specialization, Exchange and Complex Societies*, edited by E. M. Brumfiel and T. K. Earle. Cambridge University Press, Cambridge.

BURTON, J.

1984 Quarrying in a Tribal Society. *World Archaeology* 16(**2**): 234-247.

CALABRESE, J. A.
2000 Interregional Interaction in Southern Africa: Zhizo and Leopard's Kopje Relations in Northern South Africa, Southwestern Zimbabwe, and Eastern Botswana, AD 1000 to 1200. *African Archaeological Review* 17(**4**): 183-210.

CARDALE-SCHRIMPFF, M.
1975 Prehistoric Salt Production in Colombia, South America. In *Salt: The Study of an Ancient Industry*, edited by K. De Brisay and K. A. Evans, pp. 84. Colchester Archaeological Group, Colchester, U.K.

CARTER, C. O.
1975 Man's Need of Salt. In *Salt: The Study of an Ancient Industry*, edited by K. De Brisay and K. A. Evans, pp. 13. Colchester Archaeological Group, Colchester, U.K.

CONNAH, G.
1991 The Salt of Bunyoro: Seeking the Origins of an African Kingdom. *Antiquity* 65: 479-494.

1996 *Kibiro: The Salt of Bunyoro, Past and Present*. The British Institute in Eastern Africa, London.

CONNAH, G., KAMUHANGIRE, E. and PIPER, A.
1990 Salt-Production at Kibiro. *Azania* 25: 27-46.

COSTIN, C. L.
1991 Craft Specialization: Issues in Defining, Documenting and Explaining the Organization of Production. In *Archaeological Method and Theory*, edited by M. B. Schiffer, pp. 1-57. vol. 3. The University of Arizona Press, Tucson.

2000 The Use of Ethnoarchaeology for Study of Ceramic Production. *Journal of Archaeological Method and Theory* 7(**4**): 377-401.

2004 Craft Economies of Ancient Andean States. In *Archaeological Perspectives on Political Economies*, edited by G. M. Feinman and L. M. Nicholas, pp. 189-221. University of Utah Press, Salt Lake City.

COSTIN, C. L. and HAGSTRUM, B. M.
1995 Standardization, Labor Investment, Skill, and the Organization of Ceramic Production in Late Prehispanic Highland Peru. *American Antiquity* 60(**4**): 619-639.

DART, R. A. and BEAUMONT, P. B.
1968 Iron Age Radiocarbon Dates from Western Swaziland. *South African Archaeological Bulletin* 24: 71.

DAVISON, S.
1993 Salt Making in Early Malawi. *Azania* 28: 7-44.

DE BRISAY, K. and EVANS, K. A. (editors)
1975 *Salt: The Study of an Ancient Industry*. Colchester Archaeological Group, Colchester, U.K.

DE VAAL, J. B.
1984 Ou Handelsvoetpaaie en Wapaaie in Oos- en Noord-Transvaal. *Contree* 16: 5-15.

1985 Handel Langs die Vroegste Roetes. *Contree* 17: 5-14.

DEAN, J. S.
1978 Independent Dating in Archaeological Analysis. In *Advances in Archaeological Method and Theory*, edited by M. B. Schiffer, pp. 223-255. vol. 1. Academic Press, New York.

DENBOW, J. R.
1981 Broadhurst - A 14th Century A.D. Expression of the Early Iron Age in South-Eastern Botswana. *South African Archaeological Bulletin* 36: 66-74.

1983 *Iron Age Economics: Herding, Wealth, and Politics Along the Fringes of the Khalahari Desert During the Early Iron Age*. PhD Thesis, Idianana University.

1984 Cows and Kings: A Spatial and Economic Analysis of a Hierarchical Early Iron Age Settlements System in Eastern Botswana. In *Frontiers: Southern African Archaeology Today*, edited by M. Hall, G. Avery, D. M. Avery, M. L. Wilson and A. J. B. Humphreys, pp. 24-39. BAR International Series. vol. 207.

DIPPENAAR, S.
1985 Die Venda Kunstenaar. *Suid-Afrikaanse Tydskrif vir Etnologie* 8(**4**): 135-145.

EVERS, T. M.
1974 Excavations at the Lydenburg Heads Site, Eastern Transvaal, South Africa. *South African Archaeological Bulletin* 37: 16-33.

1974 *Three Iron Age industrial Sites in the Eastern Transvaal Lowveld*. MA Dissertation, University of the Witwatersrand.

1977 Recent Progress in Studies of the Early Iron Age in the Eastern Transvaal, South Africa. *South African Archaeological Bulletin* 73: 78-81.

1981 The Iron Age in the Eastern Transvaal, South Africa. In *Guide to archaeological sites in the Northern and Eastern Transvaal.*, edited by E. A. Voigt, pp. 65-109. Transvaal Museum., Pretoria.

1982 Two Later Iron Age Sites on Mabete, Hans Merensky Nature Reserve, Letaba District, N.E. Transvaal. *South African Archaeological Bulletin* 37: 63-67.

1989 *The Recognition of Groups in the Iron Age of Southern Africa*. PhD Thesis, University of the Witwatersrand.

EVERS, T. M. and HUFFMAN, T. N.
1988 On Why Pots are Decorated the Way they are. *Current Anthropology* 29(**5**): 739-741.

EVERS, T. M. and VAN DER MERWE, N. J.
1987 Iron Age Ceramics from Phalaborwa, North-eastern Transvaal Lowveld, South Africa. *South African Archaeological Bulletin* 42: 87-106.

FAGAN, B. M. and YELLEN, J. E.
1968 Ivuna: Ancient Salt-Working in Southern Tanzania. *Azania.* 3: 1-43.

FEDER, K. L.
1997 Site Survey. In *Field Methods in Archaeology*, edited by T. R. Hester, H. J. Shafer and K. L. Feder, pp. 41-68. Mayfield Publishing Company, London.

FLAD, R., ZHU, J., WANG, C., CHEN, P., VON FALKENHAUSEN, L., SUN, Z. and LI, S.
2005 Archaeological and Chemical Evidence for Early Salt Production in China. *PNAS* 102(**35**): 12618-12622.

FULLER, C.
1923 Tsetse in the Transvaal and Surrounding Territories. An Historical Overview. Government Press, Pretoria.

GERTENBACH, W. P. D.
1983 Landscapes of the Kruger National Park. *Koedoe* 26: 9-121.

GOULD, R. A.
1980 *Living Archaeology*. Cambridge University Press, Cambridge.

GOULETQUER, P. L.
1975 Niger, Country of Salt. In *Salt: The Study of an Ancient Industry*, edited by K. De Brisay and K. A. Evans, pp. 47-51. Colchester Archaeological Group, Colchester, U.K.

GREY, E.
1945 Notes on the Salt-Making Industry of the Nyanja People, near Lake Shirwa. *South African Journal of Science* 41: 465-475.

HALL, M.
1980 Enkwazini, an Iron Age site on the Zululand Coast. *Annals of the Natal Museum* 24(**1**): 97-109.

1983 Tribes, Traditions and Numbers: The American Model in South African Iron Age Ceramic Studies. *South African Archaeological Bulletin* 38: 51-57.

1984 Pots and Politics: Ceramic Interpretations in Southern Africa. *World Archaeology* 15(**3**): 262-273.

1986 The Role of Cattle in Southern African Agropastoral Societies: More than Bones Alone Can Tell. *South African Archaeological Society Goodwin Series* 5: 83-87.

1987a Archaeology and Modes of Production in Pre-Colonial Southern Africa. *Journal of Southern African Studies* 14(**1**): 1-17.

1987b *The Changing Past: Farmers, Kings and Traders in Southern Africa, 200 - 1860.* David Philip, Cape Town.

1990 Hidden History: Iron Age Archaeology in Southern Africa. In *History of African Archaeology.*, edited by P. Robertshaw, pp. 59-77. James Currey., London.

HANISCH, E. O. M.
1981 Schroda: A Zhizo Site in the Northern Transvaal. In *Guide to the Archaeological Sites in the Northern and Eastern Transvaal*, edited by E. A. Voigt, pp. 37-53. Transvaal Museum, Pretoria.

HARRIES, P.
1978 Production, Trade and Labour Migration from the Delagoa Bay Hinterland in the Second Half of the 19th Century. In *Centre for African Studies, African Seminar: Collected Papers.*, pp. 28-42. University of Cape Town, Cape Town.

1994 *Work, Culture and Identity. Migrant Laborers in Mozambique and South Africa, c. 1860 - 1910.* Heinemann, Portsmouth.

HARTMAN, J. B. and KRIEL, J. B.
1991 *Gazankulu en sy Mense.* Kriel & Hartman, Pretoria.

HARVARD MEDICAL SCHOOL
2003 Salt and your Health: the Role of Sodium. In *Harvard Men's Health Watch*, pp. 1-4. vol. 7.

HESTER, T. R.
1997 Methods of Excavation. In *Field Methods in Archaeology*, edited by T. R. Hester, H. J. Shafer and K. L. Feder, pp. 69-112. Mayfield, London.

HODDER, I.
1982 Symbols in Action. Ethnoarchaeological Studies of Material Culture. Cambridge University Press, Cambridge.

HORWITZ, L., MAGGS, T. M. O'C. and WARD, V.
1991 Two Shell Middens as Indicators of Shellfish Exploitation Patterns During the first Millennium AD on the Natal north Coast. *Natal Museum Journal of Humanities* 3: 1-28.

HUFFMAN, T. N.
1974 The Leopards Kopje Tradition. *Memoirs of the National Museum of Rhodesia* 6: 1-150.

1979 African Origins: Review of D.W. Phillipson: The Later Prehistory of Eastern and Southern Africa. *South African Journal of Science* 75: 233-237.

1980 Ceramics, Classification and Iron Age Entities. *African Studies* 39(**1**): 121-173.

1982 Archaeology and Ethnohistory of the African Iron Age. *Annual Review of Anthropology* 11: 133-150.

1986 Archaeological Evidence and Conventional Explanations of Southern Bantu Settlement Patterns. *Africa* 56(**3**): 280-298.

1989a Ceramics, Settlements and Late Iron Age Migrations. *African Archaeological Review* 7: 155-182.

1989b *Iron Age Migrations: The Ceramic Sequence in Southern Zambia*. Witwatersrand University Press, Johannesburg.

1993 Broederstroom and the Central Cattle Pattern. *South African Journal of Science* 89: 220-226.

1998 The Antiquity of Lobola. *South African Archaeological Bulletin* 53: 57-62.

2001 The Central Cattle Pattern and Interpreting the Past. *Natal Museum Journal of Humanities* 13: 19-35.

JUNOD, H. A.
1927 The Life of a South African Tribe. Macmillan, London.

KENT, L. E.
1947 Diatomaceous Deposits in the Union of South Africa with Special Reference to Kieselguhr. *Memoirs of the Geological Survey of South Africa* 42: 11, 75-78, 81-84.

1986 The Thermal Springs of the North-Eastern Transvaal. *Annals of the Geological Survey of South Africa* 20: 141-154.

KLAPWIJK, M.
1974 A Preliminary Report on Pottery from the North-Eastern Transvaal. *South African Archaeological Bulletin* 29: 19-23.

KLAPWIJK, M. and EVERS, T. M.
1987 A 12th Century Eiland Facies Site in the North-Eastern Transvaal. *South African Archaeological Bulletin* 42: 39-44.

KLAPWIJK, M. and HUFFMAN, T. N.
1996 Excavations at Silver Leaves: A Final Report. *South African Archaeological Bulletin* 51: 84-93.

KOPAKA, K. and CHANIOTAKIS, N.
2003 Just Taste Additive? Bronze Age Salt from Zakros, Crete. *Oxford Journal of Archaeology* 22(**1**): 53-66.

KRIGE, J. D.
1937 Traditional Origins and Tribal Relationship of the Sotho of the Northern Transvaal. *Bantu Studies* 11: 321-356.

KUPER, A.
1980 Symbolic Dimensions of the Southern Bantu Homestead. *Africa* 50(**1**): 8-23.

LANE, P.
1994/1995 The Use and Abuse of Ethnography in the Study of the Southern African Iron Age. *Azania* 24-30: 51-64.

LIESEGANG, G. J.
1977 New Light on Venda Traditions: Mahumane's Account of 1730. *History in Africa* 4: 163-181.

LOUBSER, J. N. H.
1981 *Ndebele Archaeology of the Pietersburg area.* MA Dissertation, University of the Witwatersrand.

1988 *Archaeological Contributions to Venda Ethnohistory.* PhD Thesis, University of the Witwatersrand.

1993 Ndondondwane: the Significance of Features and Finds from a Ninth-Century Site on the Lower Tukela River, Natal. *Natal Museum Journal of Humanities* 5: 109-151.

LOVEJOY, P. E.
1986 *Salt of the Desert Sun.* Cambridge University Press, Cambridge.

MAGGS, T. M. O'C.
1980a Mzonjani and the Beginning of the Iron Age in Natal. *Annals of the Natal Museum* 24(**1**): 71-96.

1980b Msuluzi Confluence: A Seventh Century Early Iron Age Site on the Tugela River. *Annals of the Natal Museum* 24(**1**): 111-145.

1984a Ndondonwane: A Preliminary Report on an Early Iron Age Site in the Lower Tugela River. *Annals of the Natal Museum* 26: 71-94.

1984b The Iron Age South of the Zambezi. In *Southern African Prehistory and Paleoenvironments*, edited by R. Klein, pp. 329 - 360. A.A. Alkema, Boston.

1994/1995 The Early Iron Age in the Extreme South: Some Patterns and Problems. *Azania* 24-30: 171-178.

MAGGS, T. M. O'C. and WARD, V.
1984 Early Iron Age sites in the Muden Area of Natal. *Annals of the Natal Museum* 26: 105-140.

MASON, R. J.
1962 *Prehistory of the Transvaal*. Witwatersrand University Press, Johannesburg.

1968 South African Iron Age and Present-Day Venda Architecture and Pottery from the Northern Transvaal, South Africa. *African Studies* 27(**4**): 181-188.

MASUCCI, M. A.
1995 Marine Shell Bead Production and the Role of Domestic Craft Activities in the Economy of the Guangala Phase, Southwest Ecuador. *Latin American Antiquity* 6(**1**): 70-84.

MEIER, D.
2004 Man and Environment in the Marsh Area of Schleswig–Holstein from Roman Until Late Medieval Times. *Quaternary International* 112: 55-69.

MEYER, A.
1984 A Profile of the Iron Age in the Kruger National Park, South Africa. In *Frontiers: Southern African Archaeology Today*, edited by M. Hall, G. Avery, D. M. Avery, M. L. Wilson and A. J. B. Humphreys, pp. 215-247. BAR International Series. vol. 207.

1986 *'n Kultuurhistoriese Interpretasie van die Ystertydperk in die Nasionale Kruger Wildtuin.* PhD Thesis, University of Pretoria.

MITCHELL, P.
2002 *The Archaeology of Southern Africa*. Cambridge University Press, Cambridge.

MOON, B. P. and HERITAGE, G. L.
2001 The Contemporary Geomorphology of the Letaba River in the Kruger National Park. *Koedoe* 44(**1**): 45-55.

MORAIS, J. M. F.
1988 *The Early Farming Communities of Southern Mozambique*. Central Board of National Antiquities, Stockholm, Sweden.

MULLER, J.
1984 Mississippian Specialization and Salt. *American Antiquity* 49(**3**): 489-507.

1986 Pans and a Grain of Salt: Mississippian Specialization Revisited. *American Antiquity* 51(**2**): 405-409.

MUTORO, H. W.
1998 Precolonial Trading Systems of the East African Interior. In *Transformations in Africa. Essays on Africa's later past*, edited by G. Connah, pp. 186-203. Leicester University Press, London.

NEWITT, M.
1995 *A History of Mozambique*. Indiana University Press, Indianapolis.

ONDERSTAL, J.
1984 *Transvaalse Laeveld en Platorand*. Botanical Society of South Africa, Pretoria.

PARSONS, J. R.
2001 The Last Saltmakers of Nexquipayac, Mexico: An Archaeological Ethnography. Ann Arbor, Michigan.

PFAFFENBERGER, B.
1992 Social Anthropology of Technology. *Annual Review of Anthropology* 21: 491-516.

PHILLIPSON, D. W.
1977 The Later Prehistory of Eastern and Southern Africa. Heineman, London.

1985 *African Archaeology*. Cambridge University Press, Cambridge.

PLUG, I.
1988 Hunters and Herders: An Archaeozoological Study of Some Prehistoric Communities in the Kruger National Park. PhD Thesis, University of Pretoria.

PLUG, I. and PISTORIUS, J. C. C.
1999 Animal Remains from Industrial Iron Age Communities in Phalaborwa, South Africa. *African Archaeological Review* 16(**3**): 155-184.

PWITI, G.
2005 Southern Africa and the East African Coast. In *African Archaeology: a Critical Introduction*, edited by A. B. Stahl, pp. 378-391. Blackwell, Oxford.

RICE, P. M.
1981 Evolution of Specialized Pottery Production: A trial model. *Current Anthropology* 22: 219-240.

1987 *Pottery Analysis: A Sourcebook*. University of Chicago Press, Chicago.

ROUX, V.
2003 Ceramic Standardization and Intensity of Production: Quantifying Degrees of Specialization. *American Antiquity* 68(**4**): 768-783.

SCHIFFER, M. B.
1986 Radiocarbon Dating and the "Old Wood" Problem: The Case of the Hohokam Chronology. *Journal of Archaeological Science* 13: 13-30.

SCHIFFER, M. B. and SKIBO, J. M.
1989 A Provisional Theory of Ceramic Abrasion. *American Anthropologist* 91(**1**): 101-115.

SCHWELLNUS, C. M.
1937 Short Notes on the Palaboroa Smelting Ovens. *South African Journal of Science* 33: 904-912.

SCULLY, R. T. K.
1978 *Phalaborwa Oral Traditions*. PhD Thesis, State University of New York.

SINCLAIR, P. J. J., MORAIS, J. M. F., ADAMOWICZ, L. and DUARTE, R. T.
1993 A Perspective on Archaeological Research in Mozambique. In *The Archaeology of Africa: Food Metals and Towns*, edited by T. Shaw, P. J. J. Sinclair, B. Andah and A. I. Okpoko, pp. 409-431. Routledge, London.

SKIBO, J. M.
1992 Pottery Function: A Use-Alternative Perspective. Plenum Press, New York.

STARK, M. T.
1998 Technical Choices and Material Culture Patterning. An Introduction. In *The Archaeology of Social Boundaries*, edited by M. T. Stark, pp. 1-11.

2003 Current Issues in Ceramic Ethnoarchaeology. *Journal of Archaeological Research* 11(**3**): 193-242.

STAYT, H. A.
1968 *The Bavenda*. Frank Cass & Co., London.

STUIVER, M. and PEARSON, G. W.
1993 High Precision Bidecadal Calibration of the Radiocarbon Time Scale AD 1950-500 BC and 2500-6000 BC. *Radiocarbon* 35: 1-23.

SUNDSTROM, L.
1993 A Simple Mathematical Procedure for Estimating the Adequacy of Site Survey Strategies. *Journal of Field Archaeology* 20: 91-96.

SUTTON, I.
1983 Some Aspects of Traditional Salt Production in Ghana. *Anales Universite d'Abidjan* 1(**11**): 7-23.

SUTTON, J. E. G. and ROBERTS, A. D.
1968 Uvinza and its Salt Industry. *Azania*. 3: 45-86.

TALMA, A. S. and VOGEL, J. C.
1993 A Symplifiied Approach to Calibrating $^{14}$C Dates. *Radiocarbon* 35(**2**): 317-322.

TERBLANCHE, H. P.
1994 Geselekteerde Tegniese Skeppinge van die Tsonga Vrou, Met Spesifieke Verwysing na die Tsongakraal-Opelugmuseum. MA Dissertation, University of Pretoria.

TORRENCE, R.
1986 *Production and Exchange of Stone Tools*. Cambridge University Press, London.

VAN DER MERWE, N. J. and SCULLY, R. T. K.
1971 The Phalaborwa Story: Archaeological and Ethnographic Investigation of a South African Iron Age Group. *World Archaeology* 3(**2**): 178-196.

VAN ROOYEN, N. and BREDENKAMP, G.
1996 Mopane Bushveld. In *Vegetation of South Africa, Lesotho and Swaziland*, edited by A. B. Low and A. G. Rebelo, pp. 20. Department of Environmental Affairs and Tourism, Pretoria.

VAN SCHALKWYK, L. O.
1994 Mamba Confluence: A Preliminary Report on an Early Iron Age Industrial Centre in the Lower Thukela Basin, Natal. *Natal Museum Journal of Humanities* 6: 119-152.

VAN WYK, P.
1984 Veldgids tot die Bome van die Nasionale Krugerwildtuin. C. Struik, Cape Town.

VOIGT, E. A. and PETERS, J.
1994 The faunal assemblage from the Early Iron Age site of Mamba I in the Thukela Valley, Natal. *Natal Museum Journal of Humanities* 6: 145-152.

WHITE, J. C. and PIGOTT, V. C.
1996 From Community Craft to Regional Specialization: Intensification of Copper Production in Pre-state Thailand. In *Craft Specialization and Social Evolution: In Memory of Gordon V. Childe*, edited by B. Whailes, pp. 151-175. University of Pennsylvania, Philadelphia.

WHITELAW, G.
1993 Customs and Settlements in the First Millennium AD: Evidence from Nanda, an Early Iron Age site in the Mngeni Valley, Natal. *Natal Museum Journal of Humanities* 5: 47-81.

1994 KwaGandaganda: Settlement Patterns in the Natal Early Iron Age. *Natal Museum Journal of Humanities* 6: 1-64.

1994/1995 Towards an Early Iron Age Worldview: Some Ideas from KwaZulu-Natal. *Azania* 29-30: 37-50.

1996 Lydenburg Revisited. Another Look at the Mpumalanga Early Iron Age Sequence. *South African Archaeological Bulletin* 41: 75-83.

WHITELAW, G. and MOON, M.
1996 The Ceramics and Distribution of Pioneer Agriculturists in KwaZulu-Natal. *Natal Museum Journal of Humanities* 8: 53-79.

WILLIAMS, E.
1999 The Ethnoarchaeology of Salt Production at Lake Cuitzeo, Michoacan, Mexico. *Latin American Antiquity* 10(**4**): 400-414.

WITT, J.
1966 Primitive Salt Production in the North-Eastern Transvaal. *Scientific South Africa* 3(**6**): 21-24.

YOUNG, G.
1977 The Essence of Life: Salt. In *National Geographic Magazine*, pp. 381-401. vol. 152.

APPENDIX A

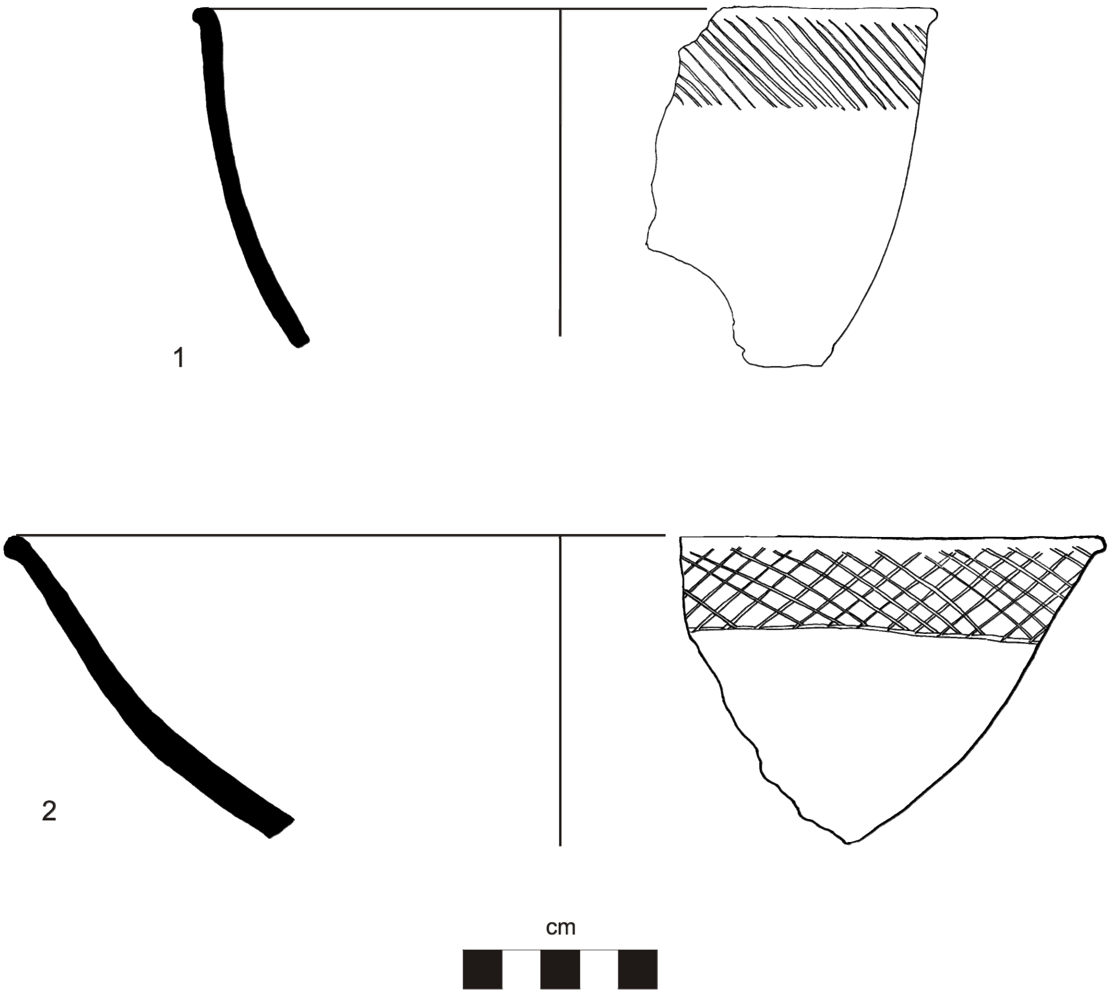



Figure 59: Letaba Class 3 vessels.

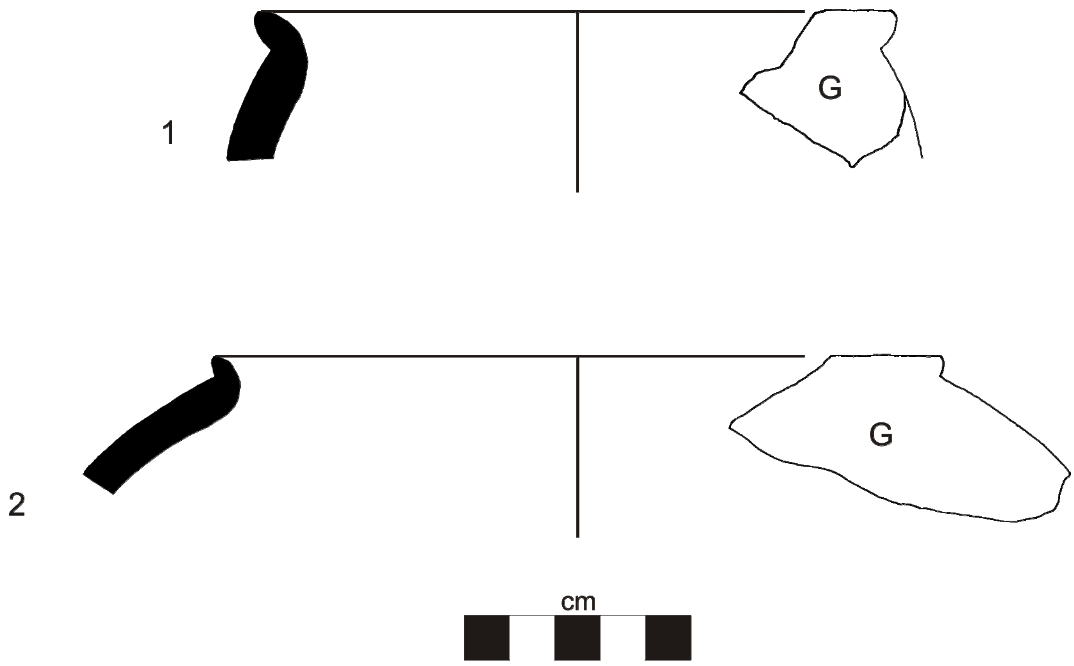



Figure 60: Letaba Class 2 vessels.

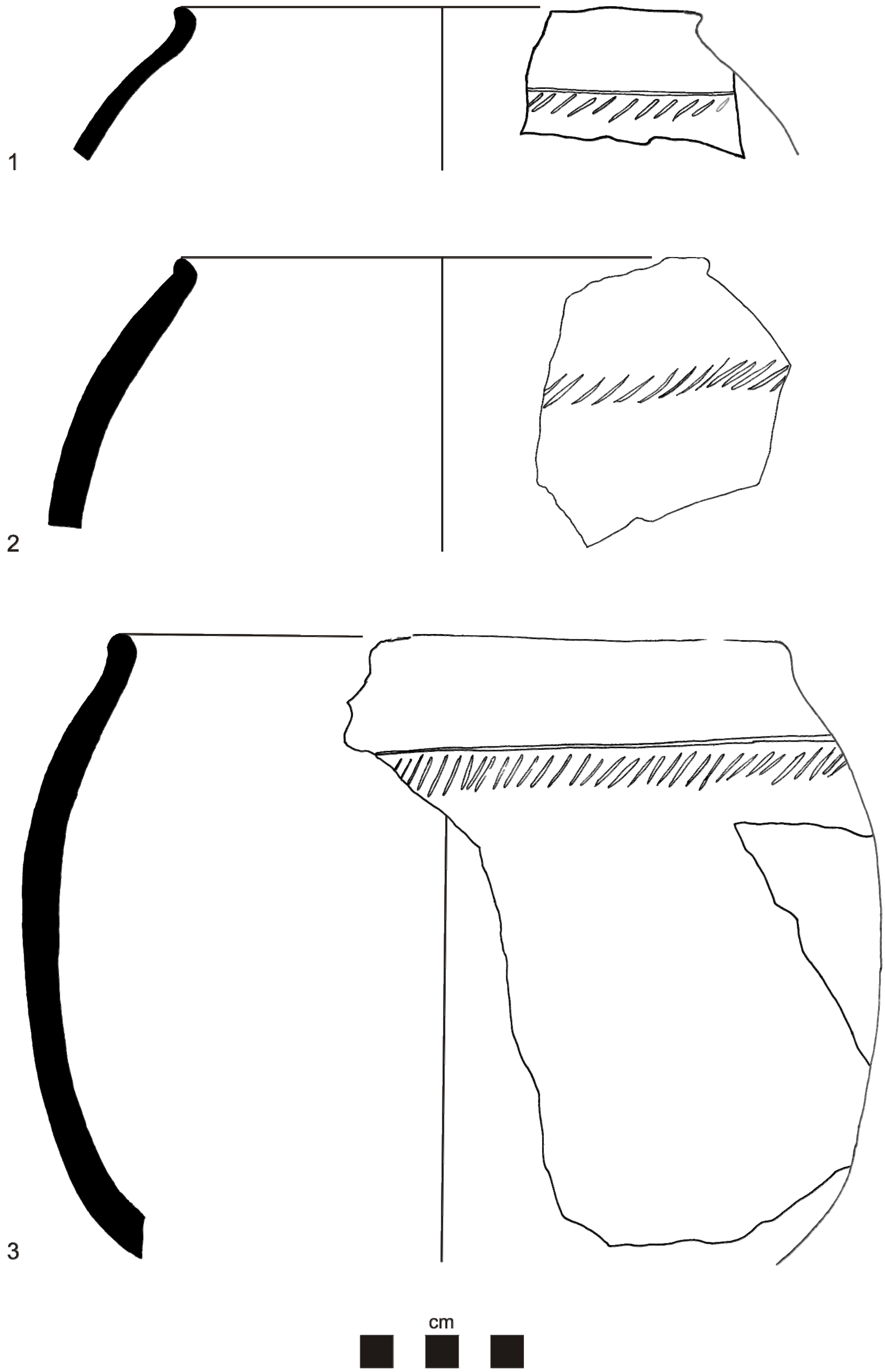



Figure 61: Letaba Class 1 vessels.

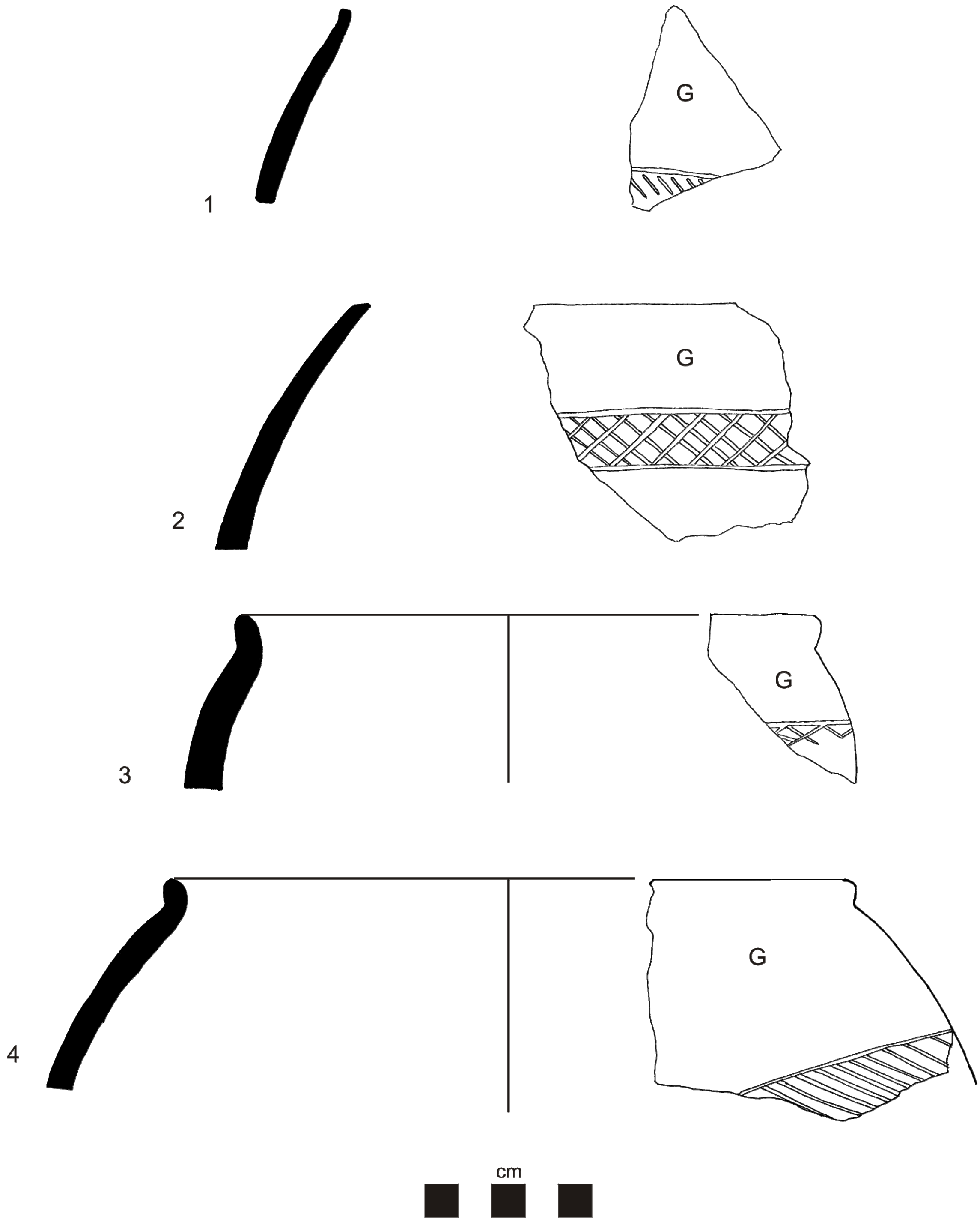



Figure 62: Letaba Class 1 vessels.

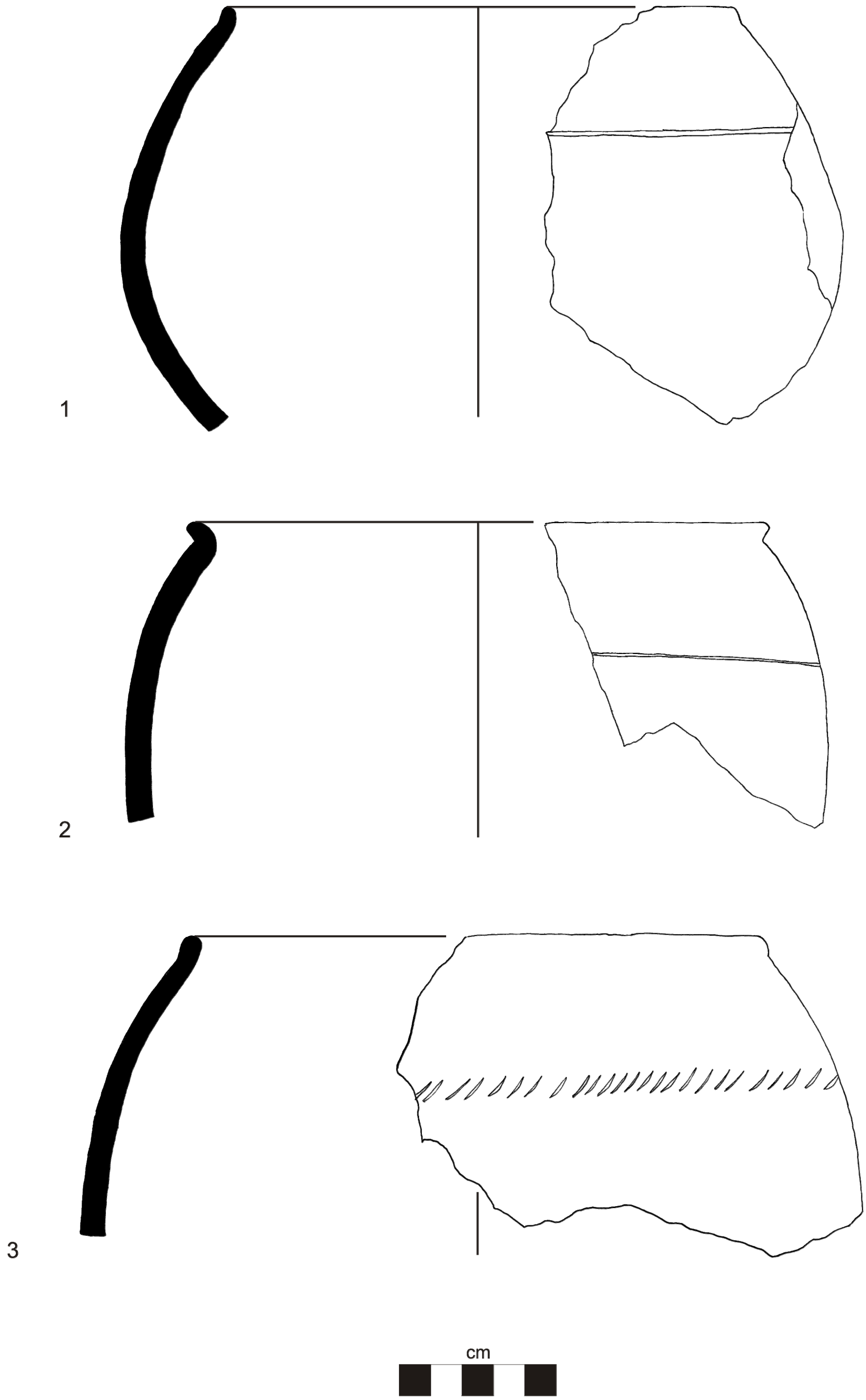



Figure 63: Letaba Class 1 vessels.

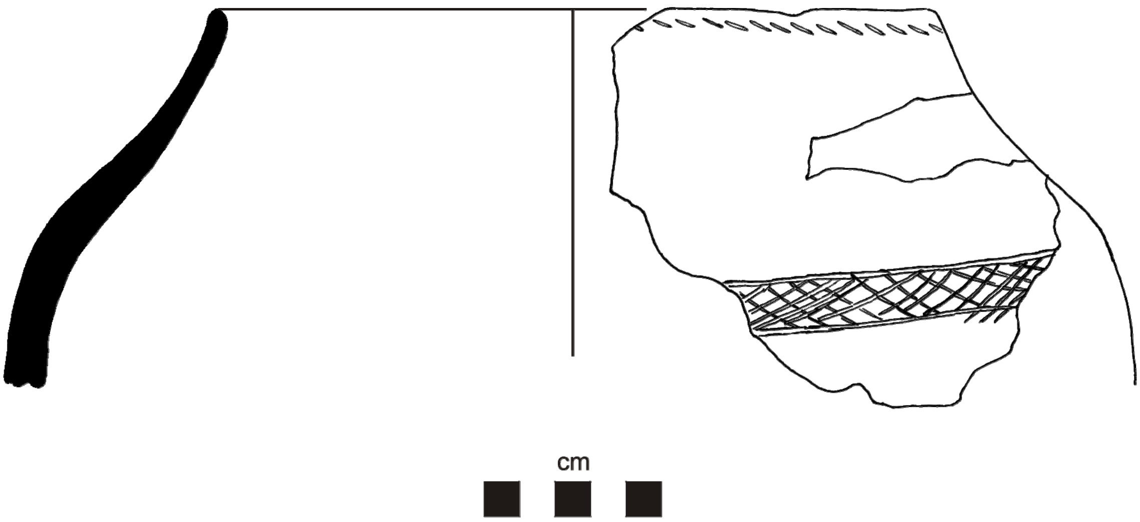



Figure 64: Eiland Class 1 vessel.

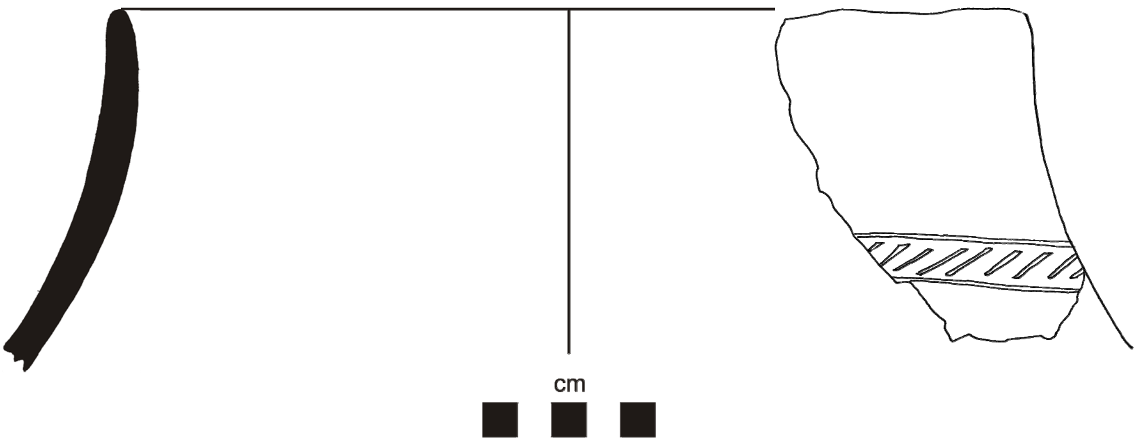



Figure 65: Eiland Class 2 vessel.

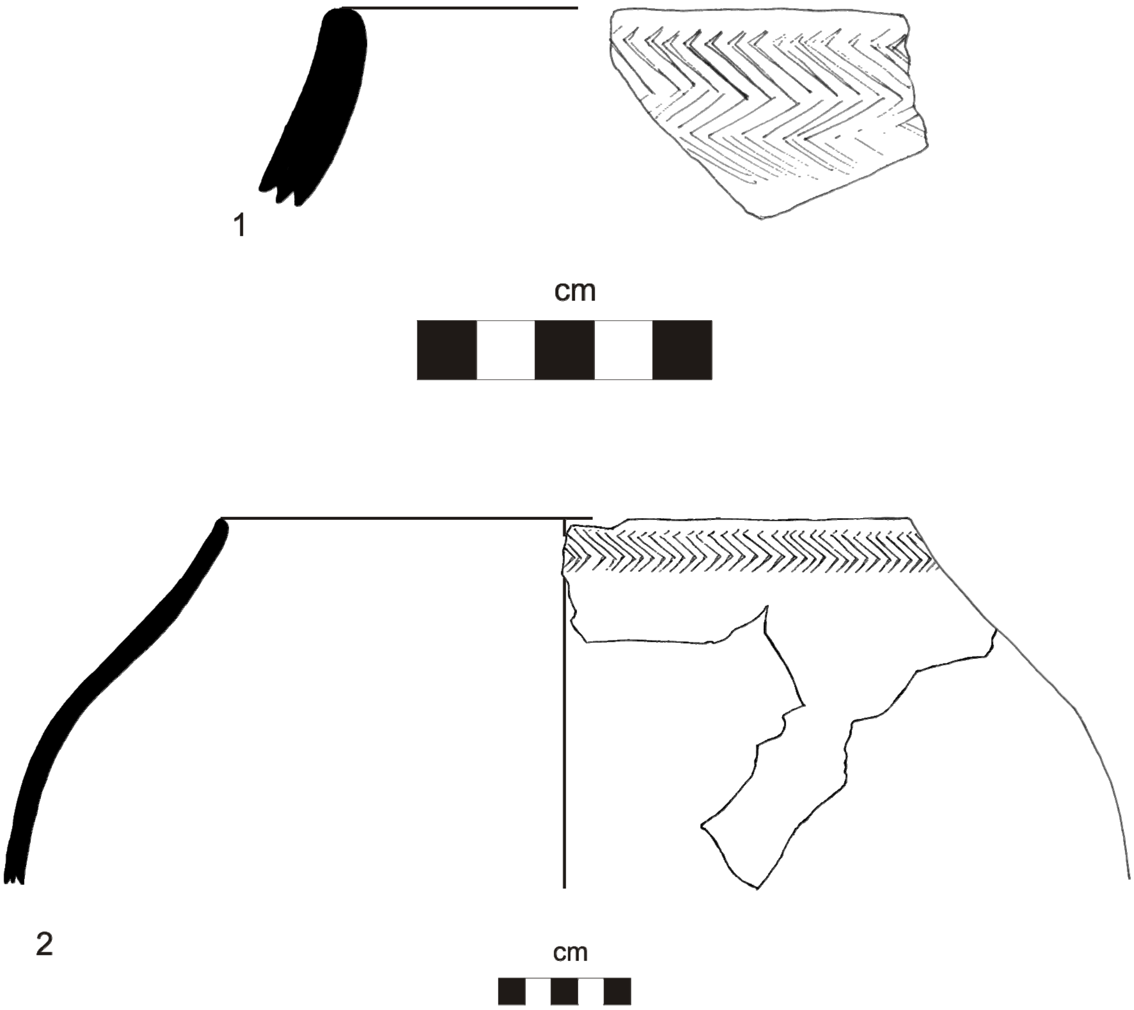



Figure 66: Eiland Class 3 vessels.

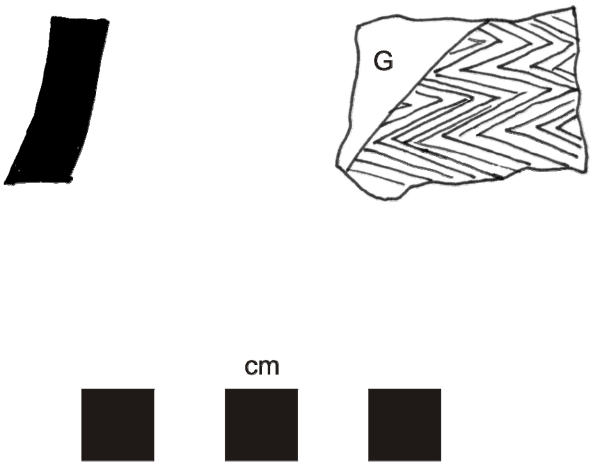



Figure 67: Eiland Class 4 vessel.

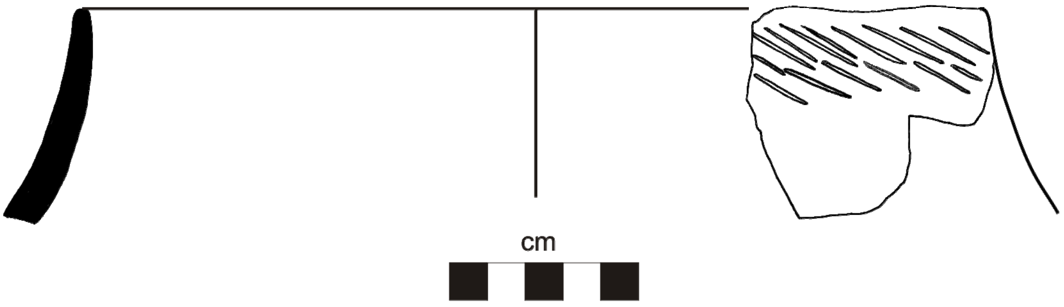



Figure 68: Eiland Class 5 vessel

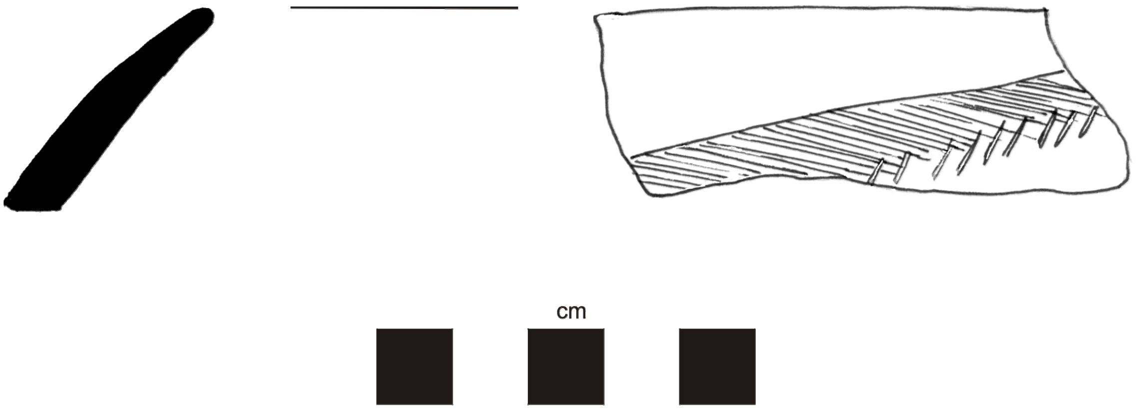



Figure 69: Eiland Class 6 vessel.

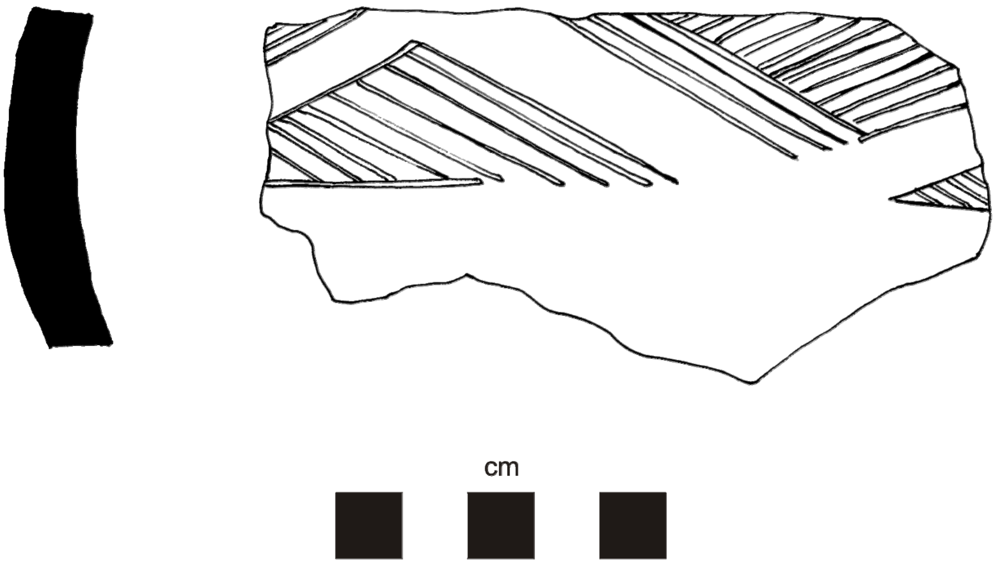



Figure 70: Eiland Class 7 fragment.

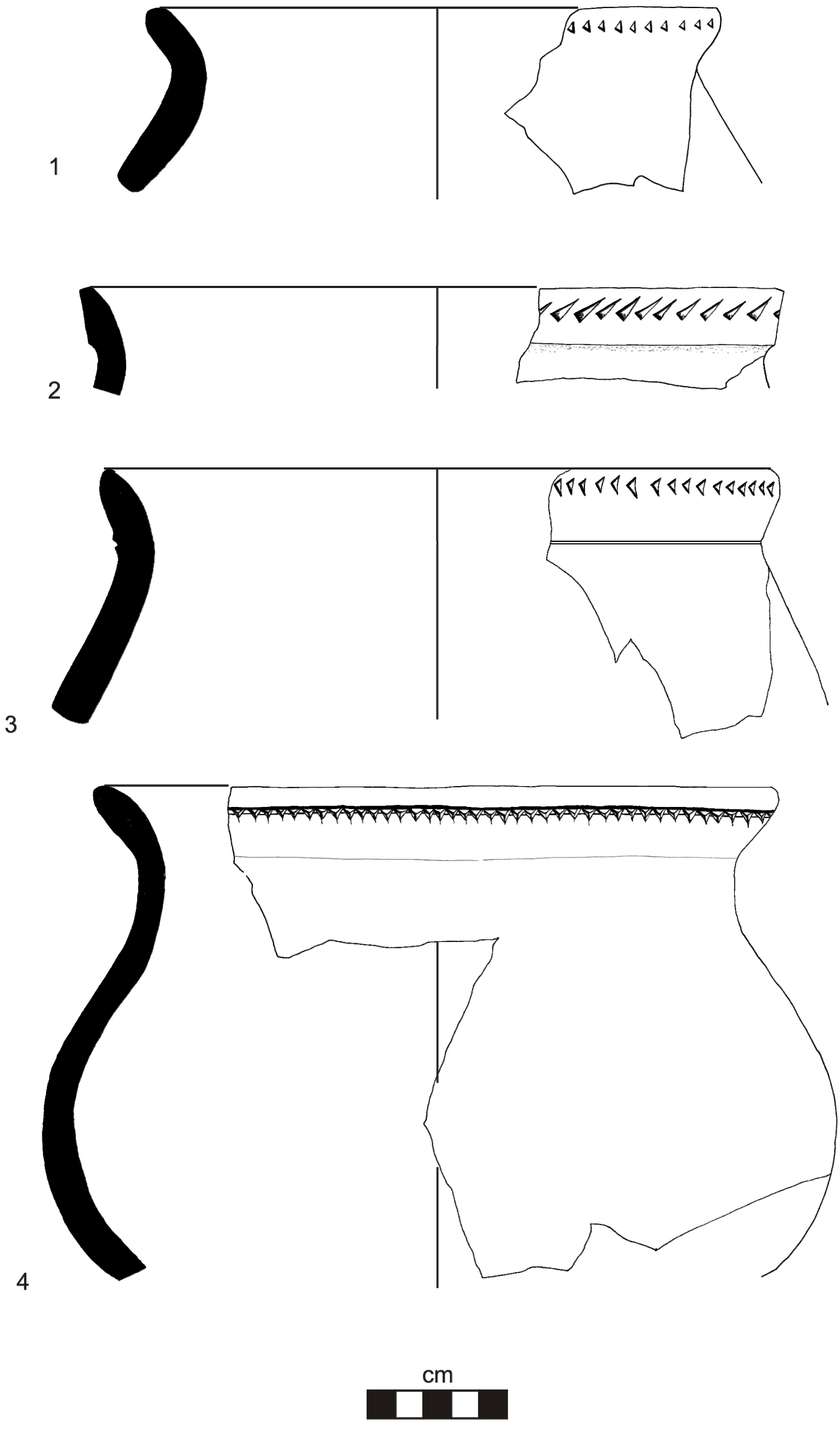



Figure 71: Mzonjani Class 1 vessels from BAL01.

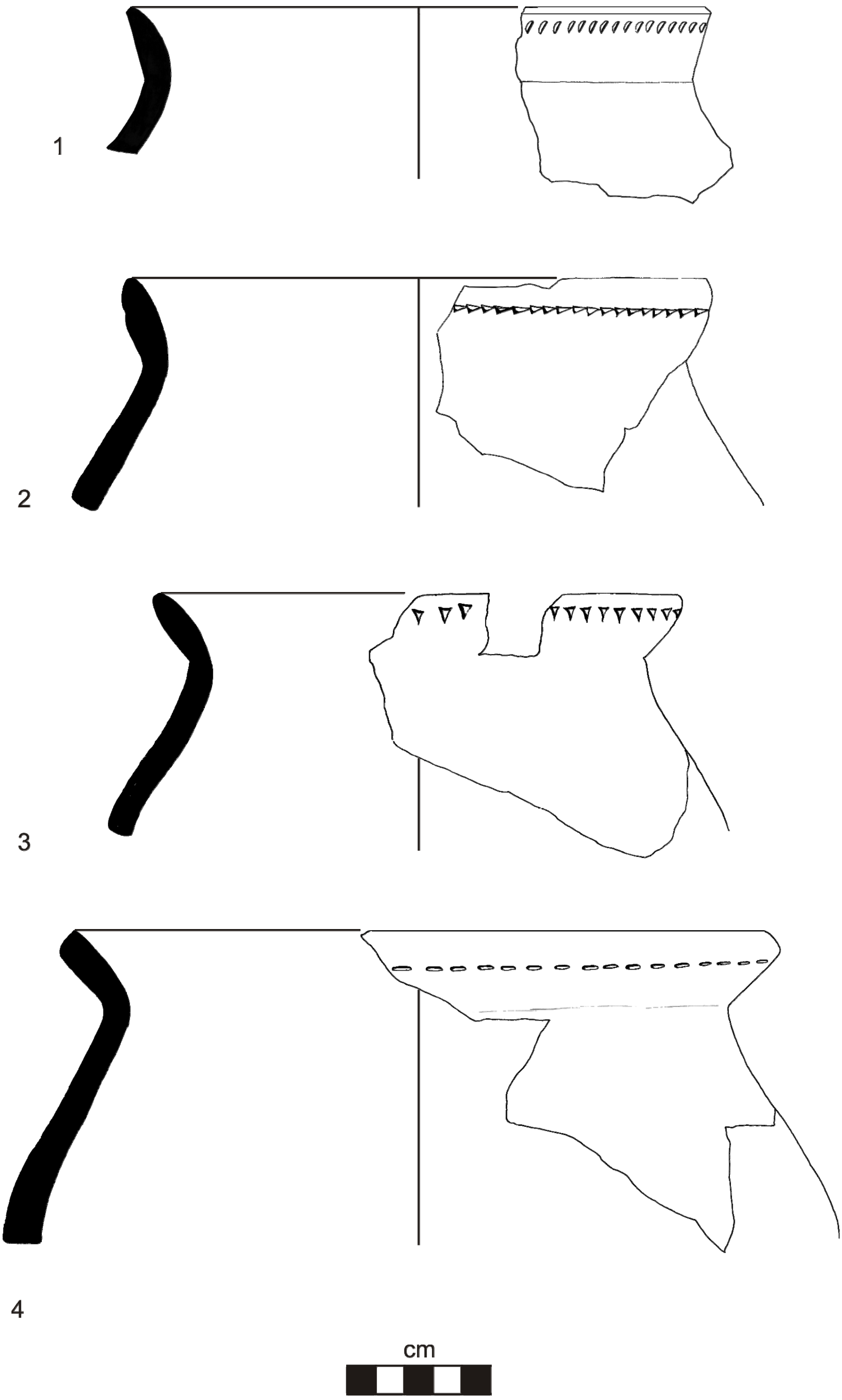



Figure 72: Mzonjani Class 1 vessels from BAL01.

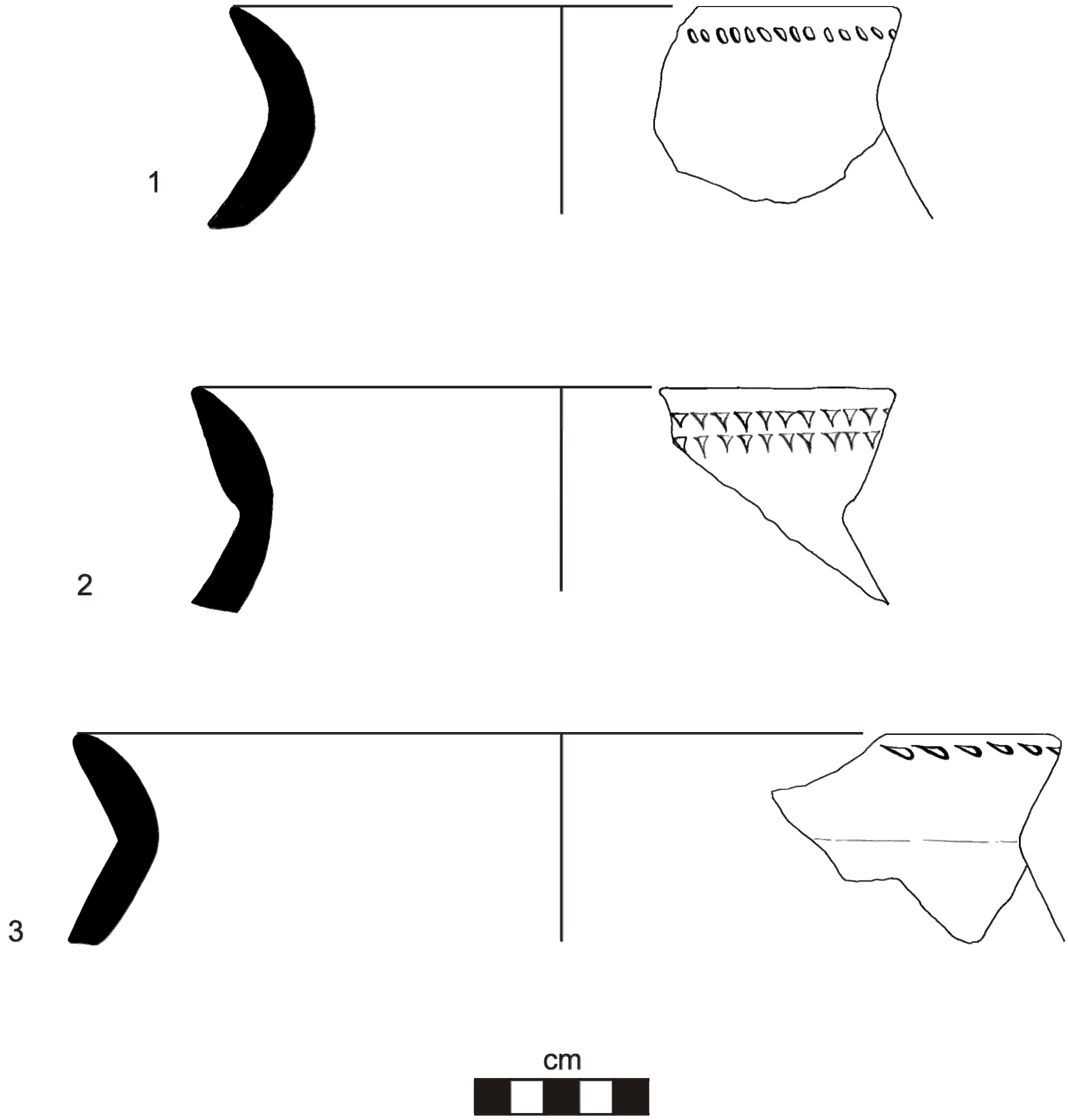



Figure 73: Mzonjani Class 1 vessels from BAL03.

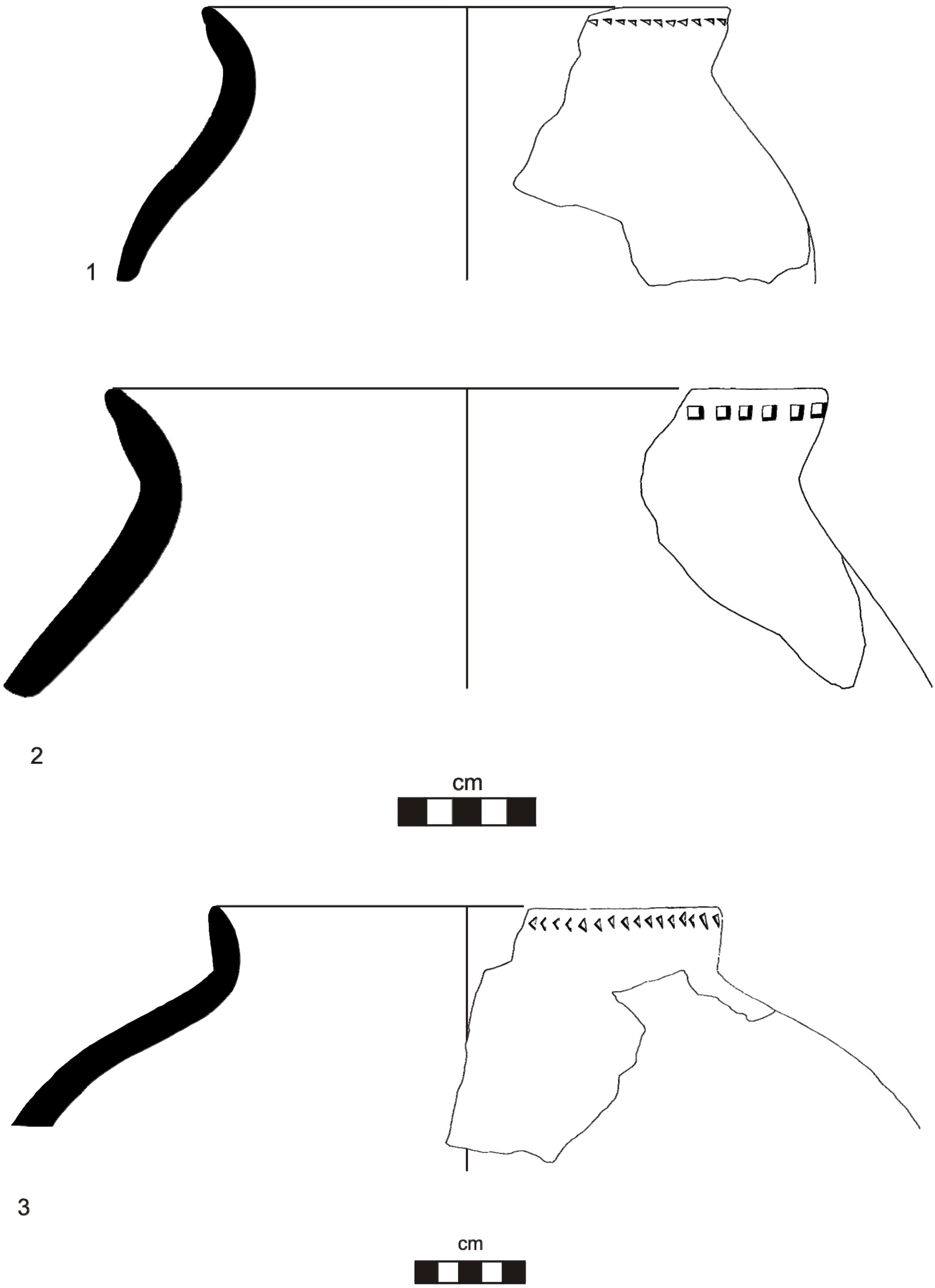



Figure 74: Mzonjani Class 1 vessels from BAL03.

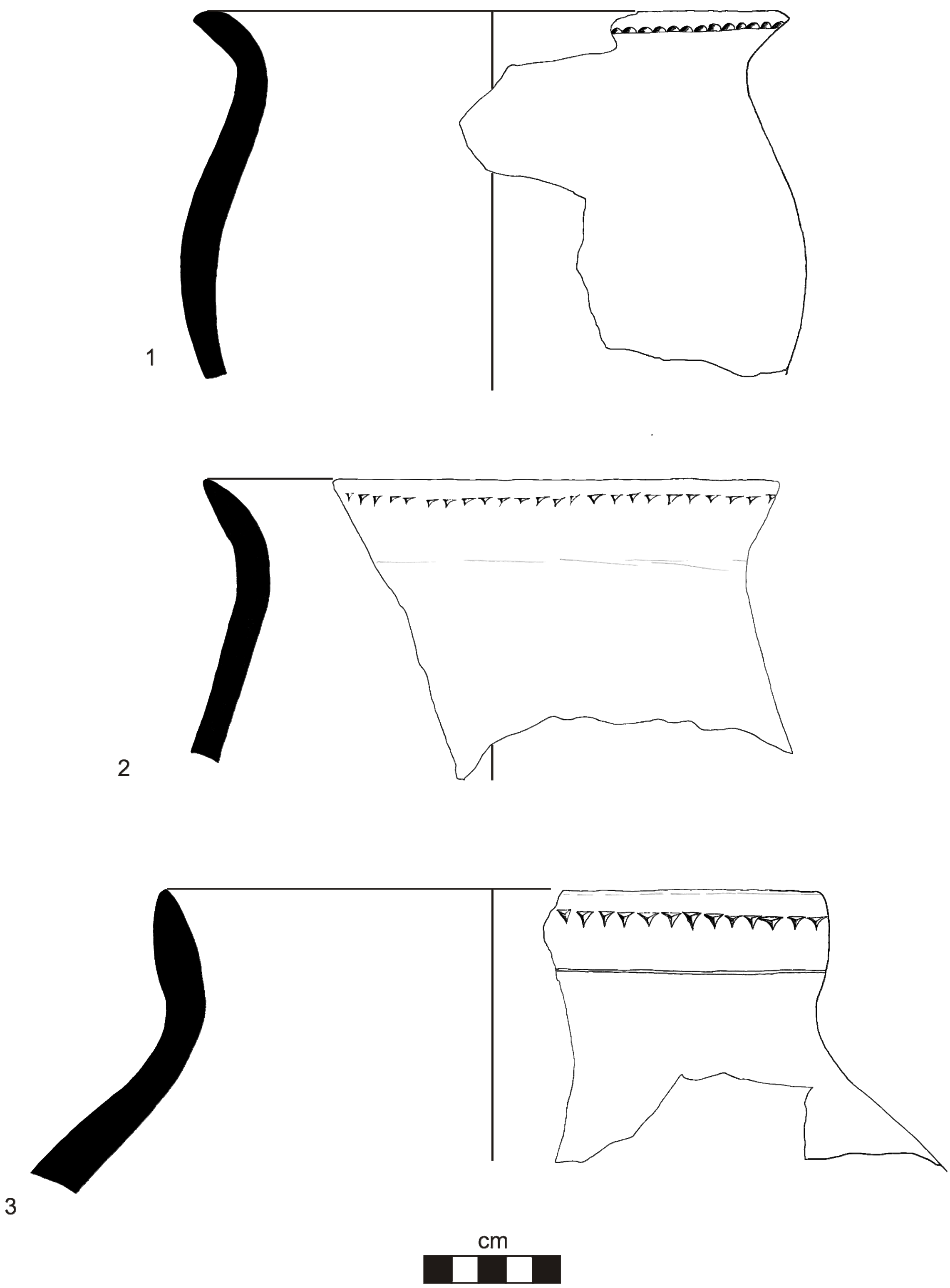



Figure 75: Mzonjani Class 1 vessels from BAL03.

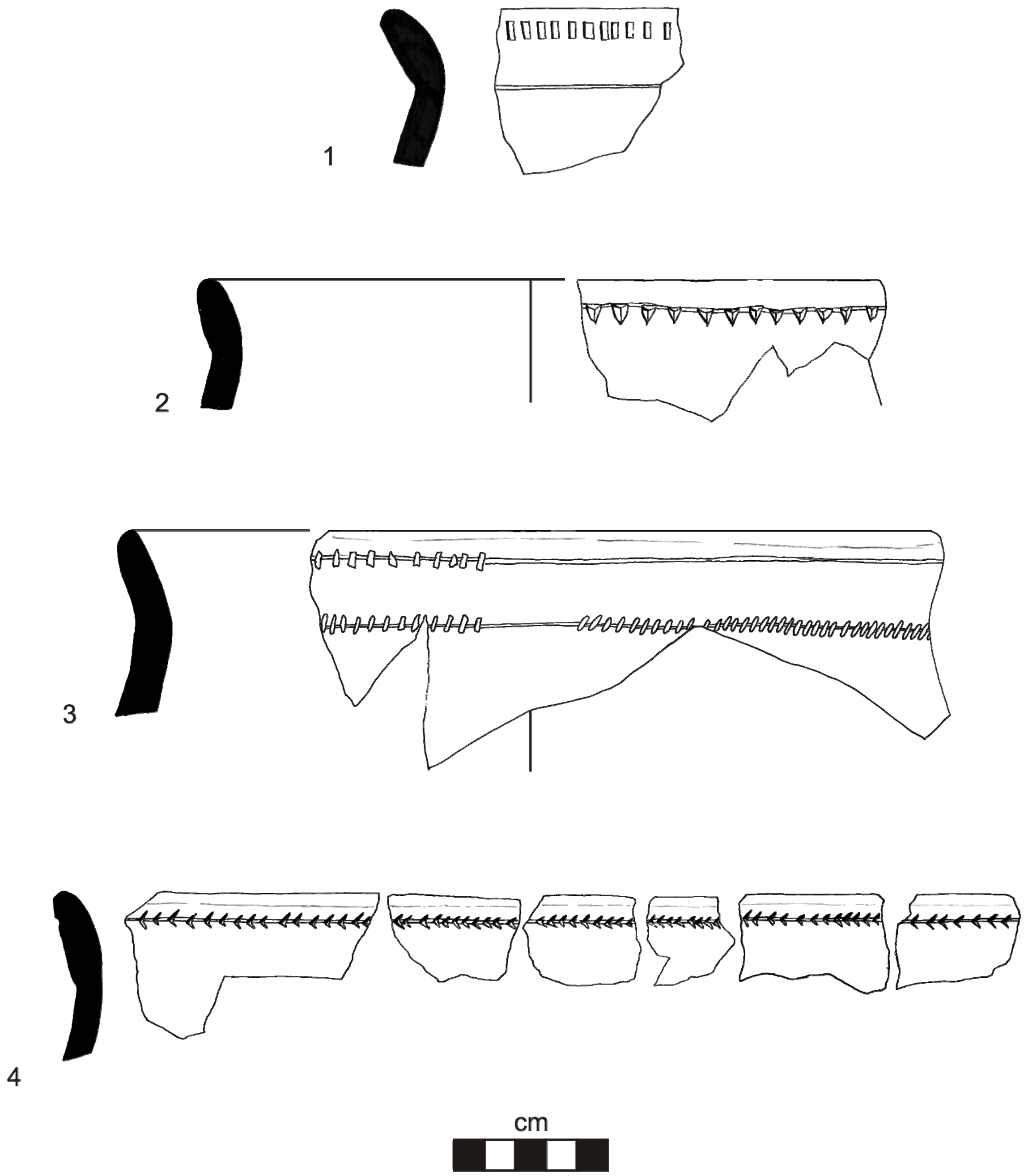



Figure 76: Mzonjani Class 1 vessels from BS05.

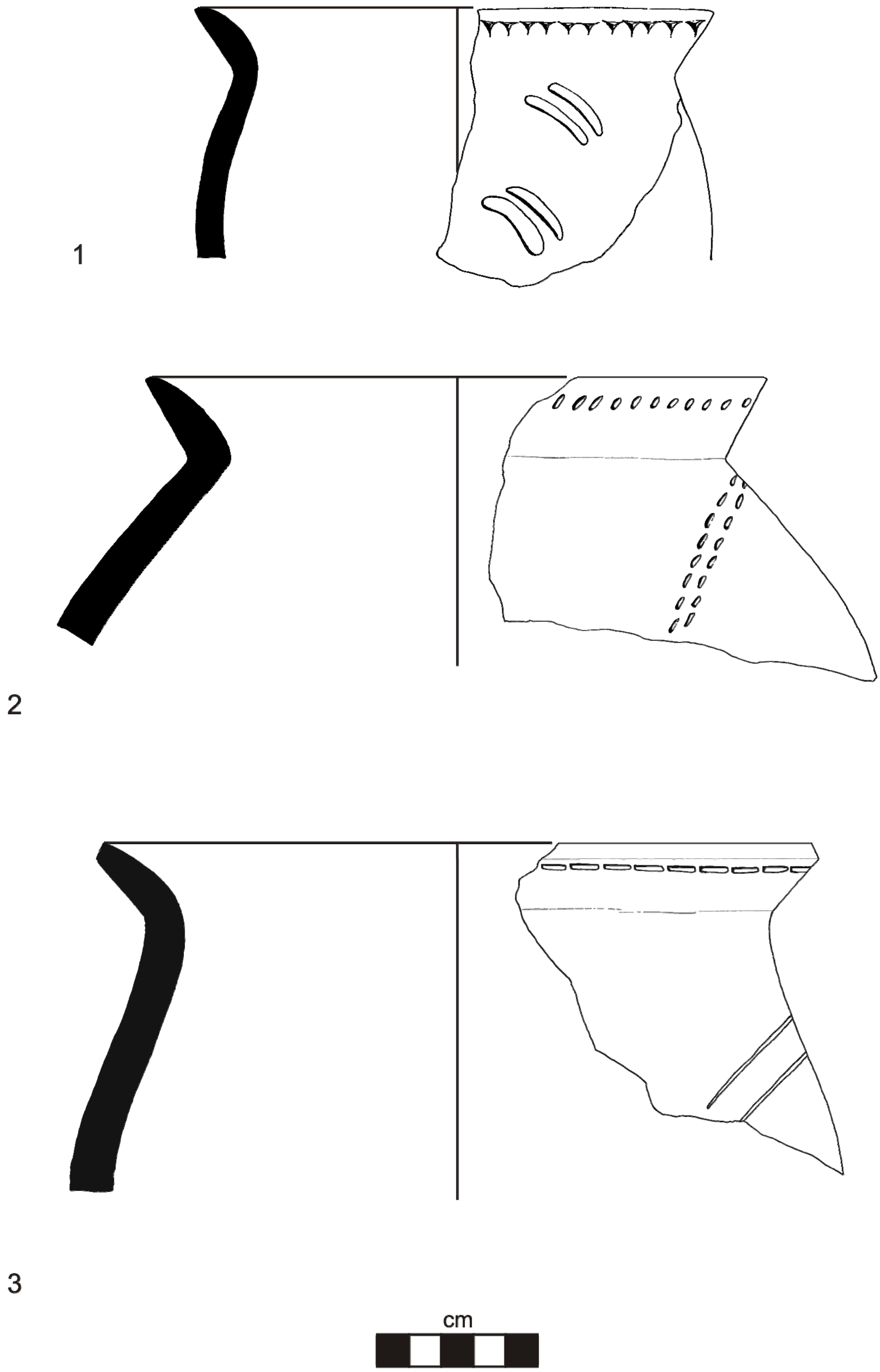



Figure 77: Mzonjani Class 2 vessels. 1 from BAL01, 2 and 3 from BAL03.

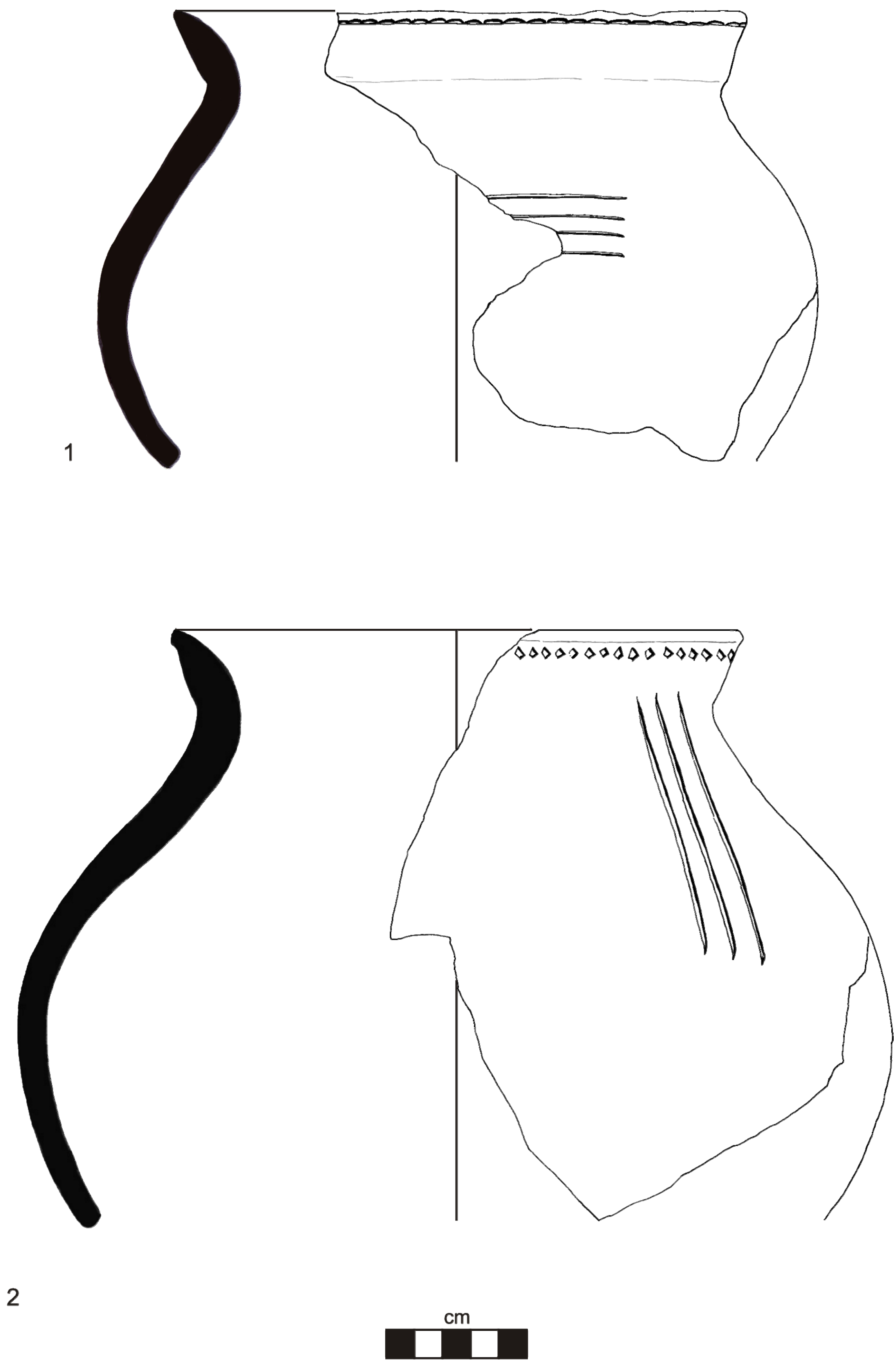



Figure 78: Mzonjani Class 2 vessels from BAL03.

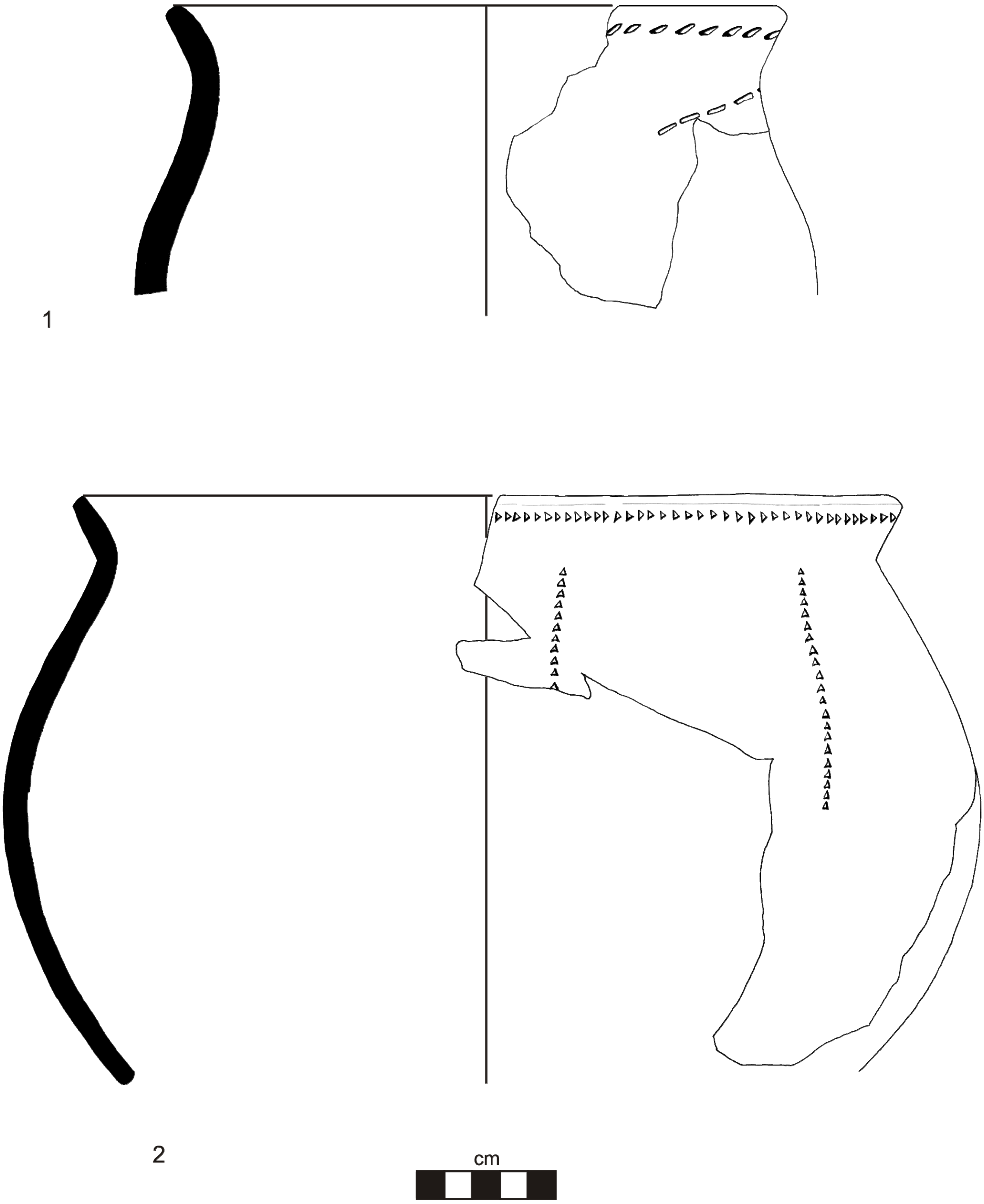



Figure 79: Mzonjani Class 2 vessels, 1 from BS05 and 2 from BAL03.

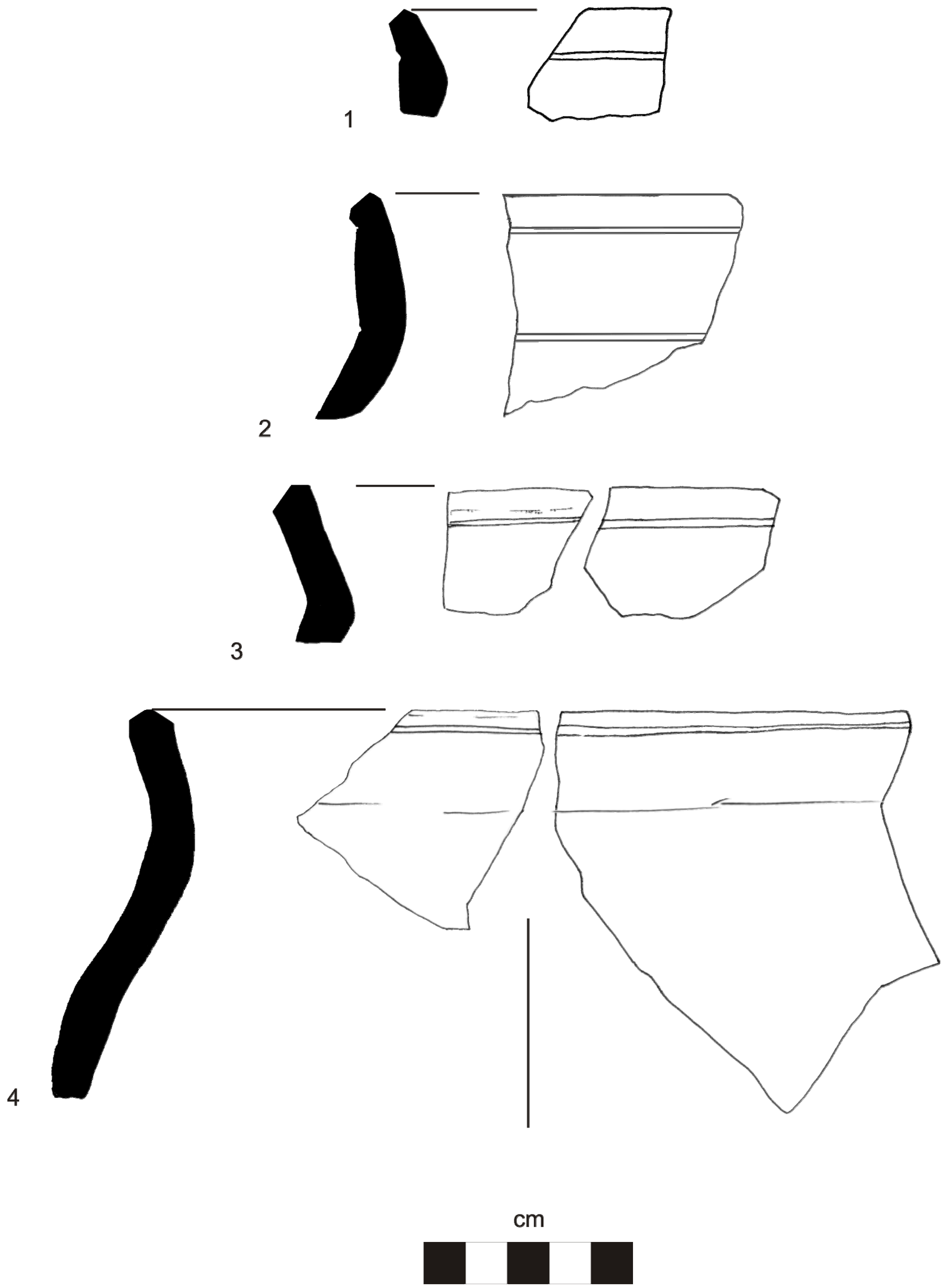



Figure 80: Mzonjani Class 3 vessels all from BS04.

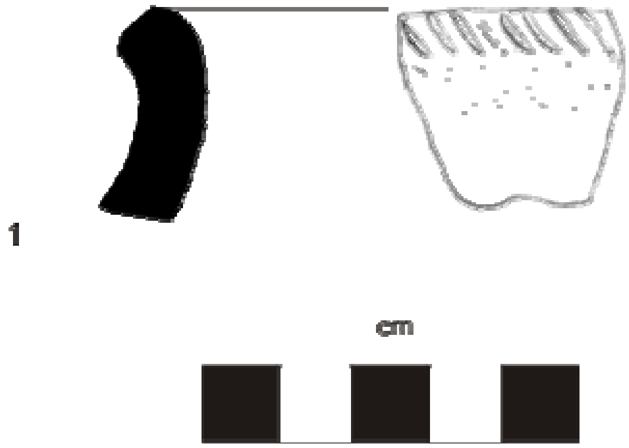



Figure 81: Mzonjani Class 4 vessel from BS05.