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

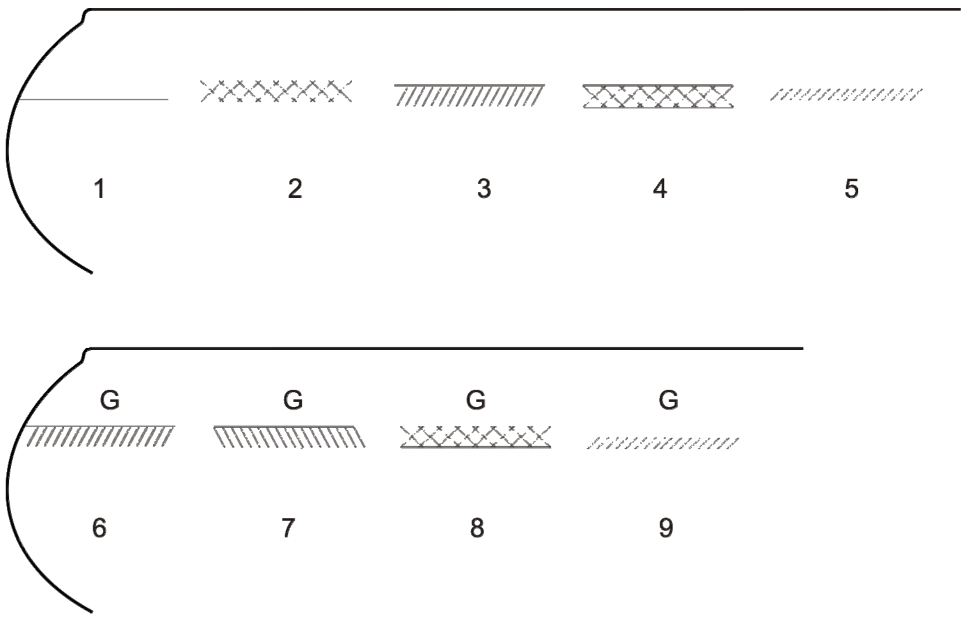
Letaba ceramics characterize the most recent phase of salt production at Baleni. The Baleni Letaba assemblage contained 41 vessels distributed in three type classes (refer to figures in Appendix A).

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).

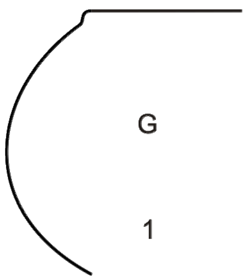
Letaba vessels were excavated in all levels of BAL02 and in Events 1 and 2 at BAL03. The vessel profile, decoration motifs and placement is similar to assemblages from other Lowveld sites such as Harmony village and saltworks (Evers 1974), the top levels of the Eiland Saltworks (Evers 1981) and the later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

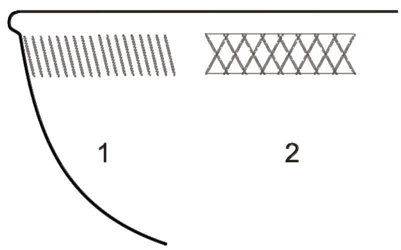
Class 1



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).

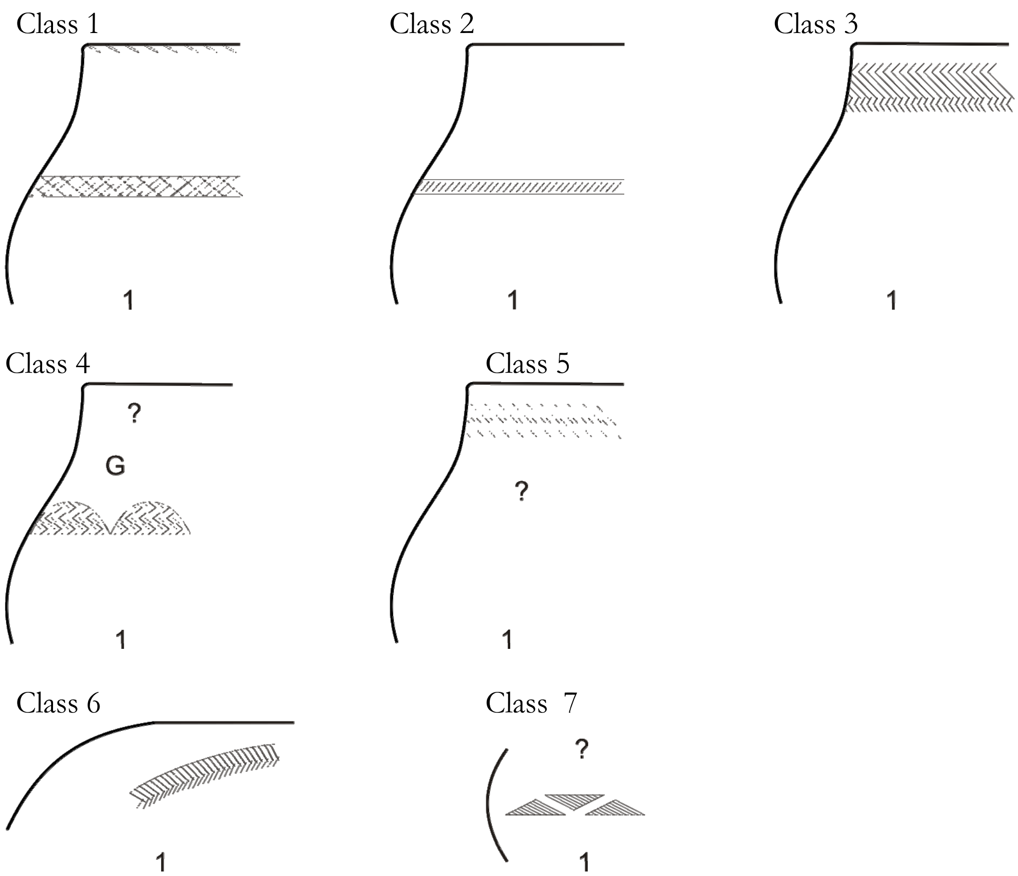
The Baleni Eiland Classes, contain typical attributes of the Eiland ceramic phase (see Klapwijk and Evers 1987). Typologically, Eiland assemblages are characterised by finely executed herringbone and arcade motifs, cross hatching and graphite or ochre burnish placed on the rims, and necks of slightly 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 1777 - 1797	1525 - 1560 1630 – 1685 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).

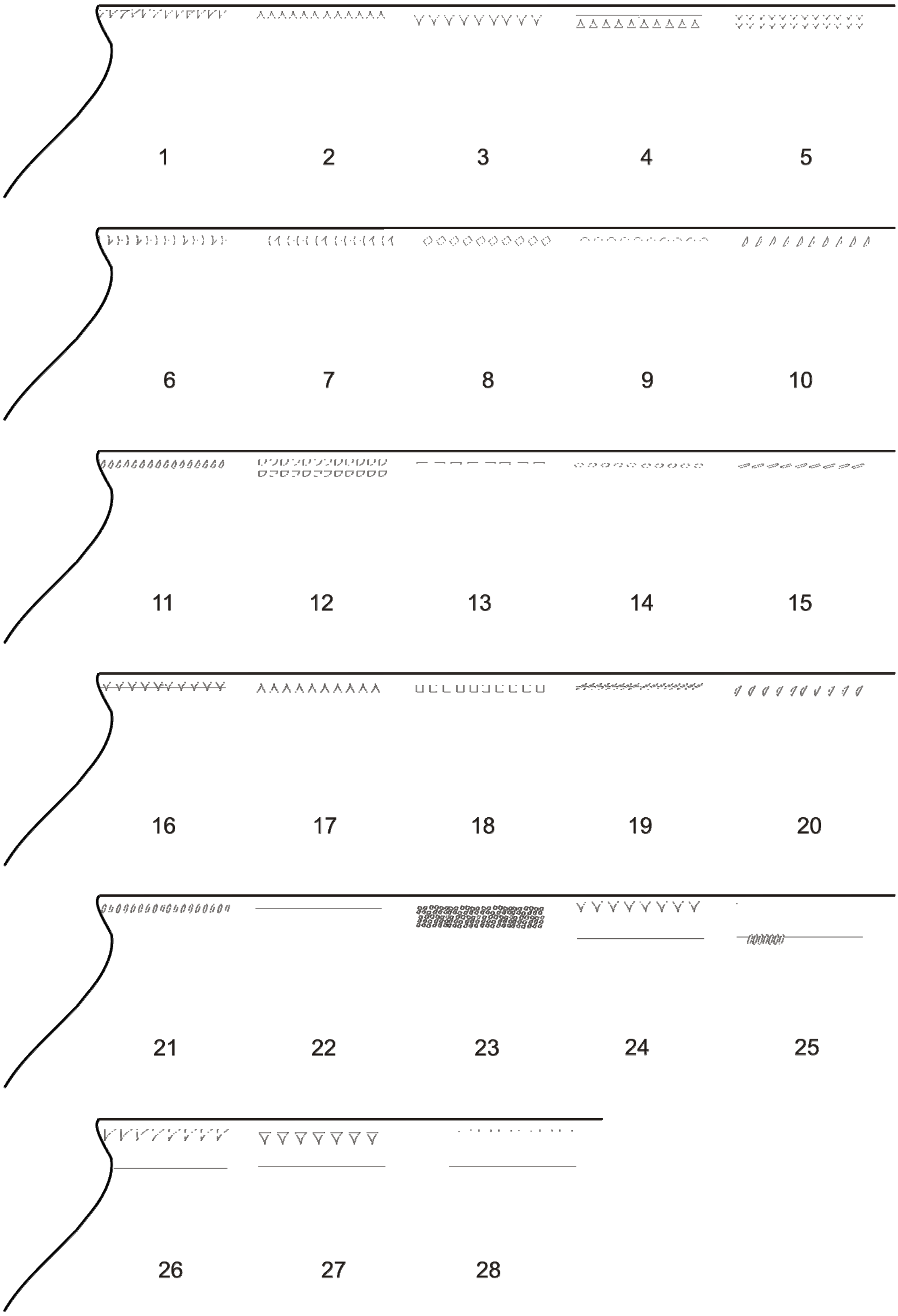
Class 5 Undecorated pot with everted rim.

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).

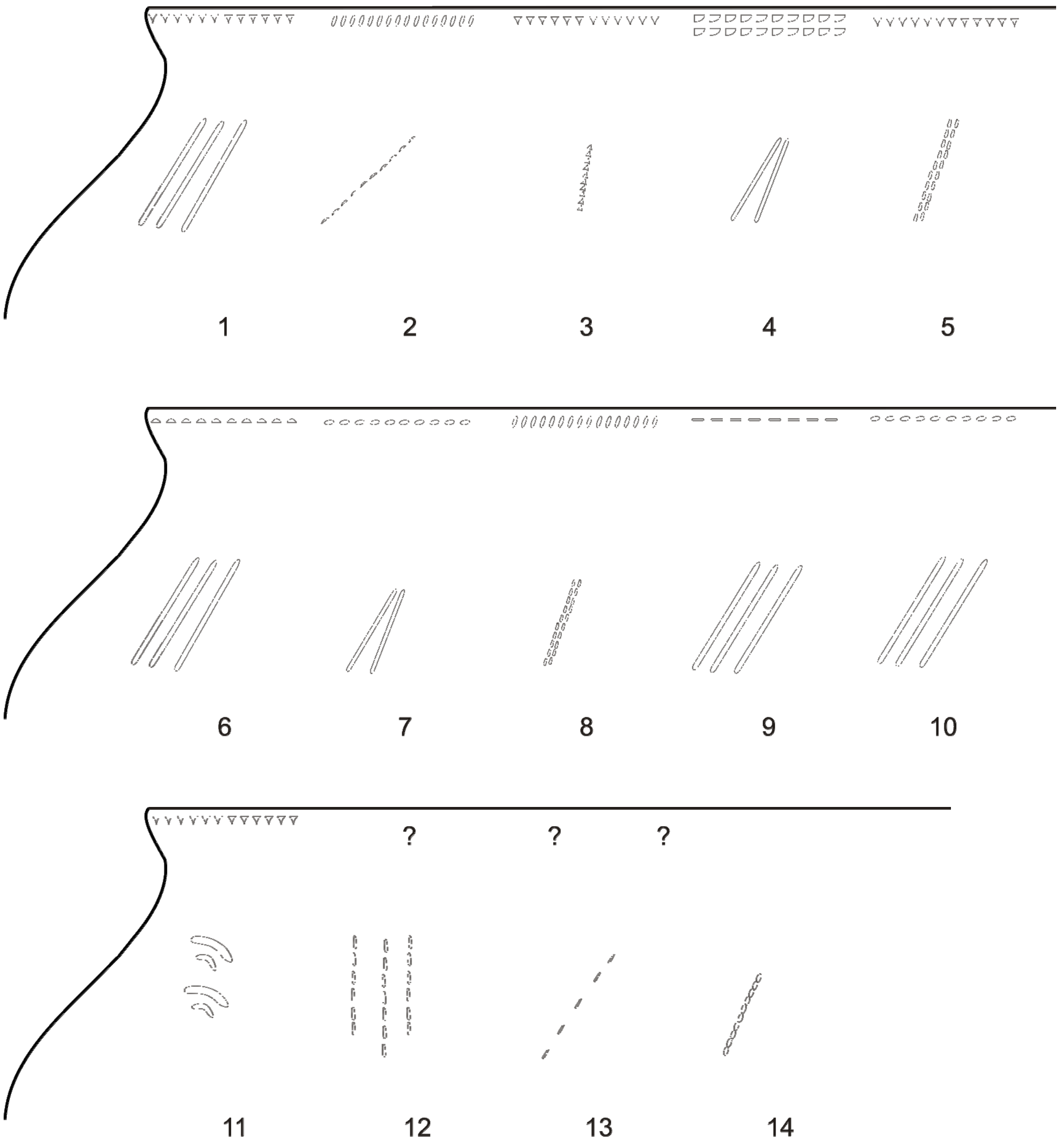
Ceramics from both phases were excavated at Baleni. The only true Silver Leaves type vessels are Class 4. This type only occurs at BAL04, and account for 30% of the overall assemblage from this site. This assemblage is, however, very small and contains only 15 vessels. The remaining vessels from BS04 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.

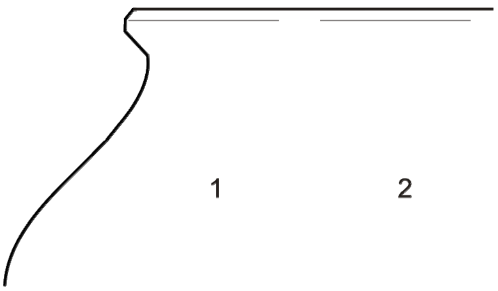
Class 1



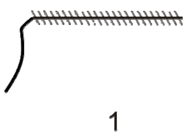
Class 2



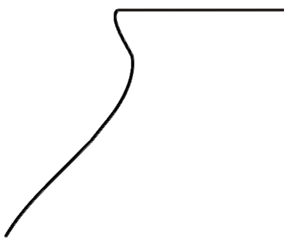
Class 3



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±85 282±85 327±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.

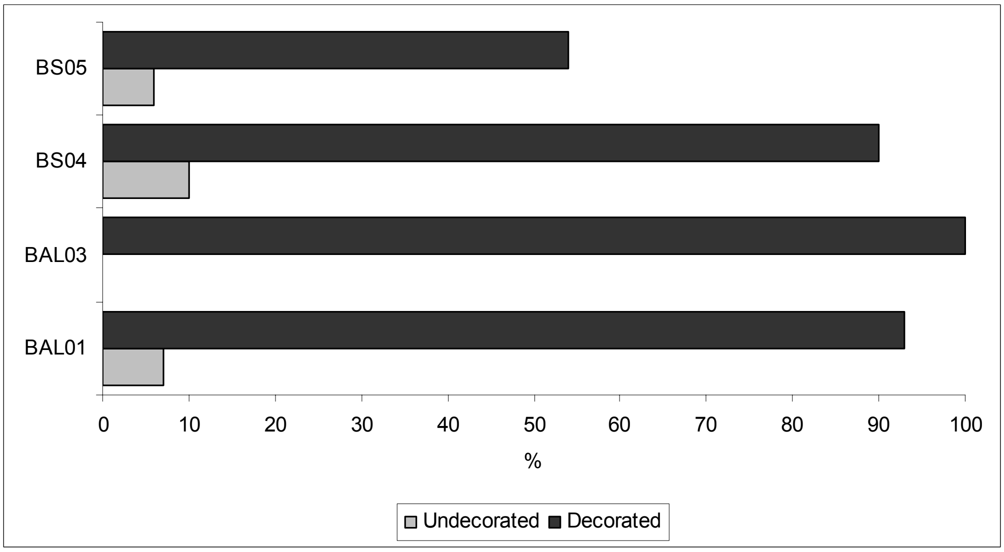


Figure 46: Distribution of decorated against that of undecorated vessels.

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

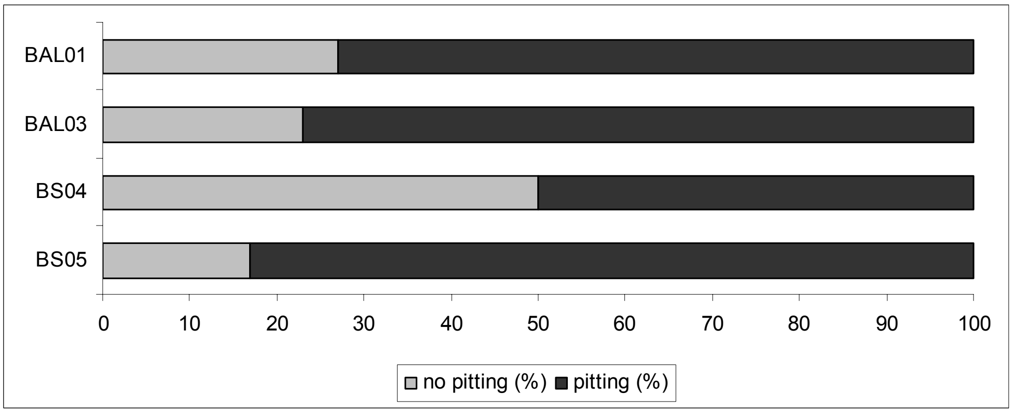


Figure 47: Comparisons between pitted vessels and vessels without pitting in the assemblages.

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.

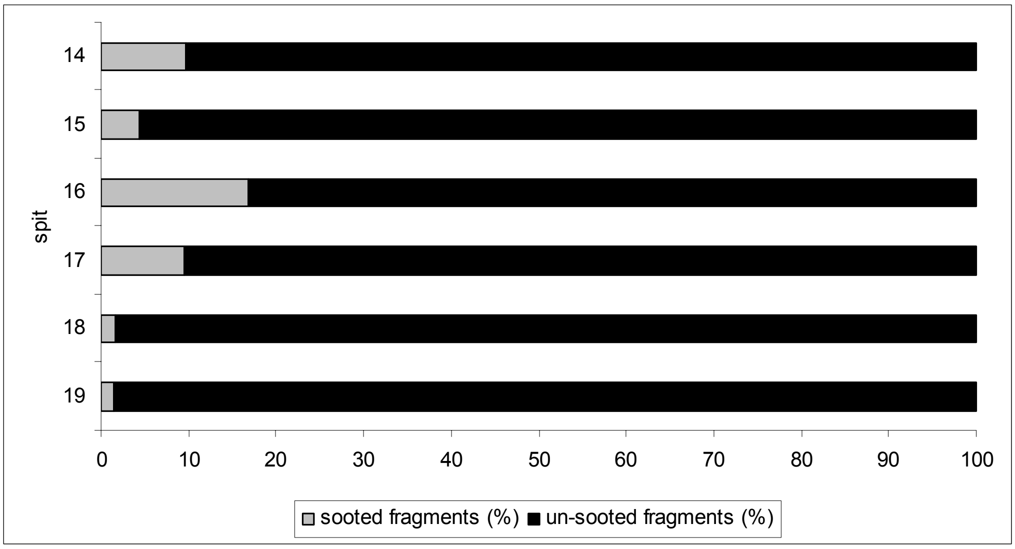


Figure 51: Percentage of ceramic fragments with soot, per spit from BAL03.

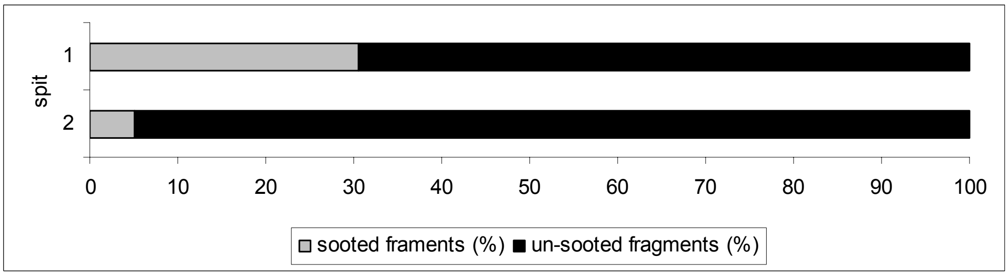


Figure 52: Percentage of ceramic fragments with soot on exterior, per spit from BAL01.

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.

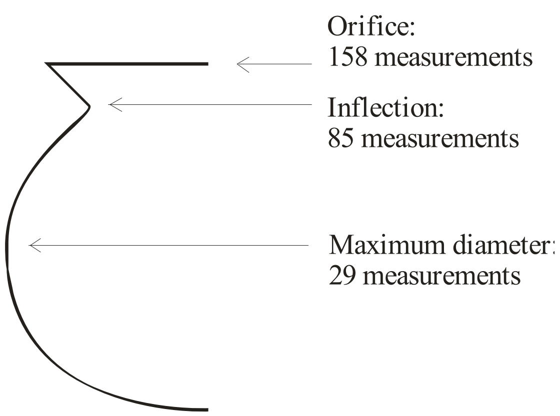


Figure 53: Vessel dimensions measured and the number of measurements taken.

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

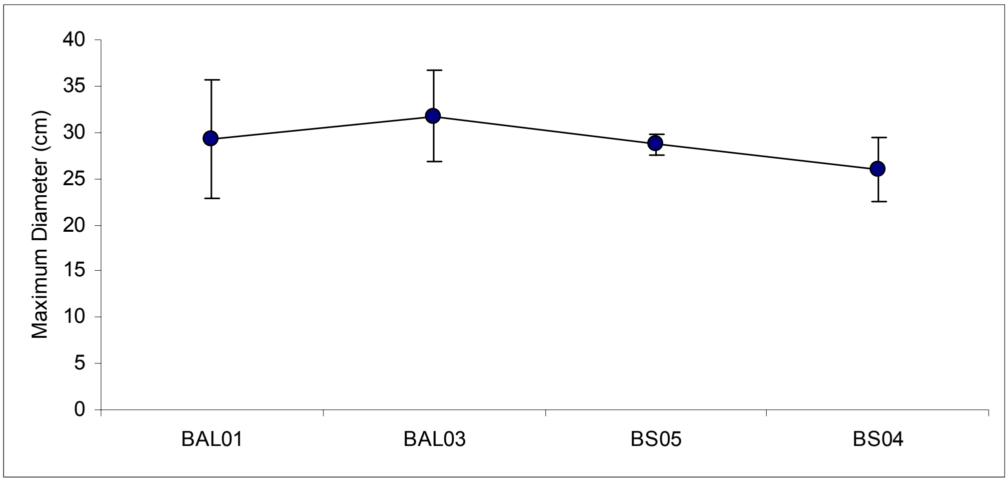


Figure 54: Intra-assemblage differences of maximum inflection diameter as shown by means and standard deviations.

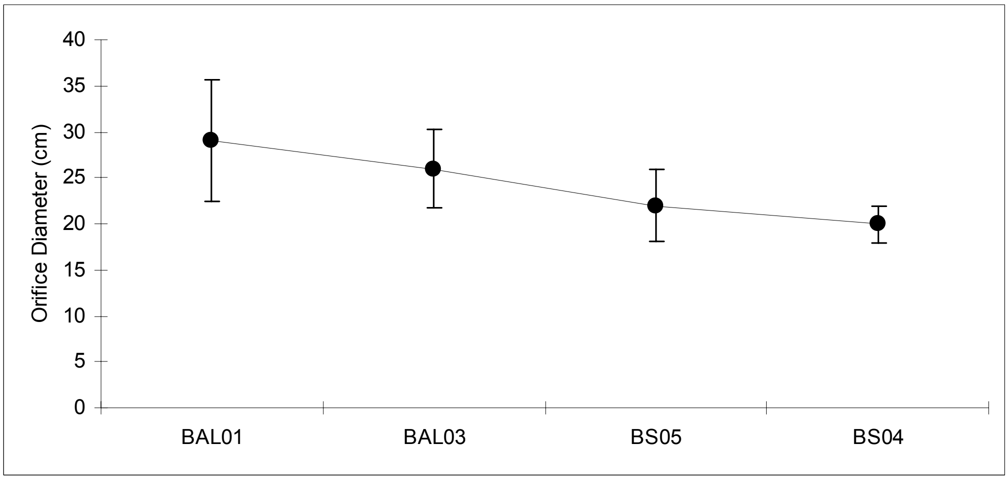


Figure 55: Intra-assemblage differences of orifice diameter as shown by means and standard deviations.

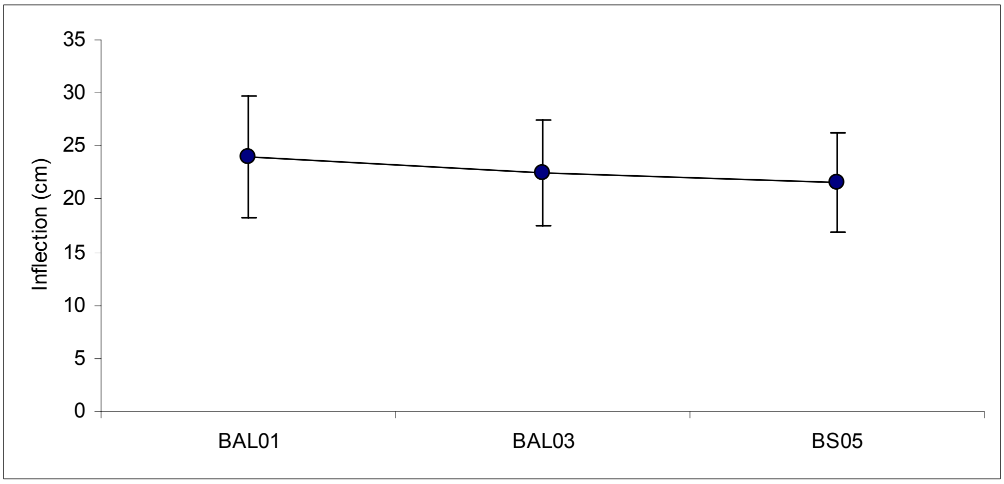


Figure 56: Intra-assemblage differences of inflection diameter as shown by means and standard deviations.

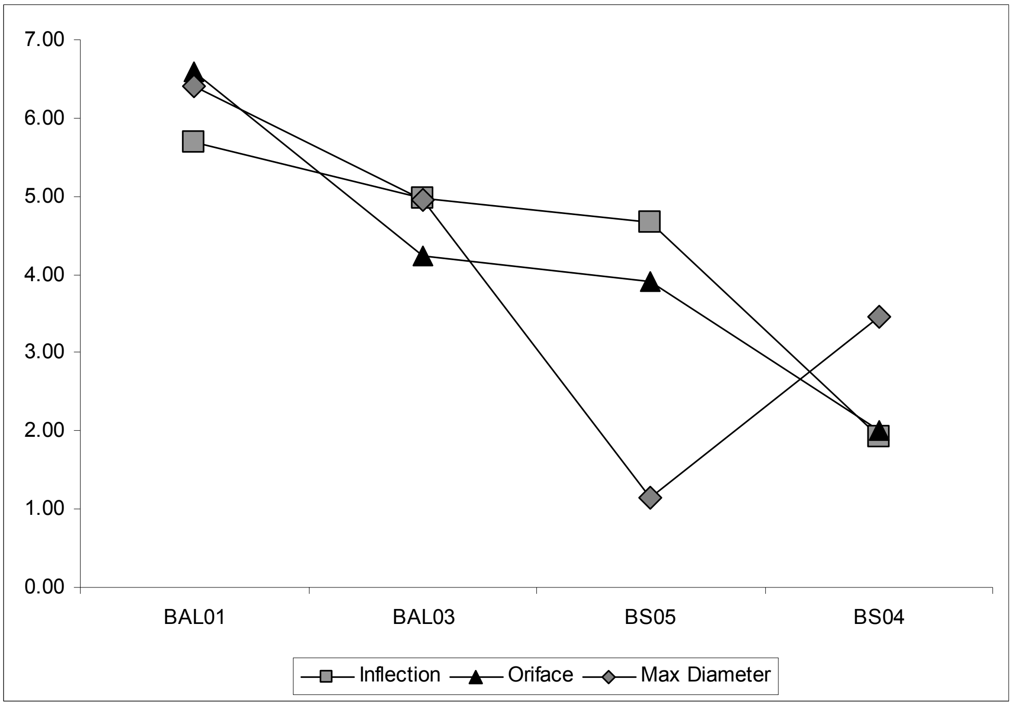


Figure 57: Standard deviations of measurements taken on Kwale ceramics from Baleni.

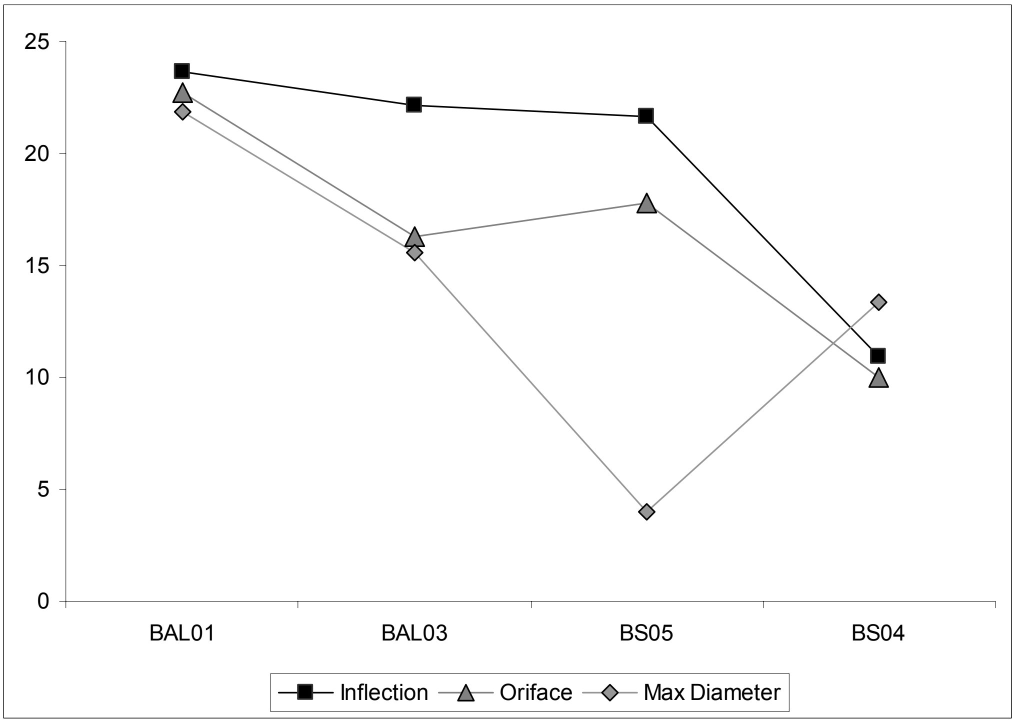


Figure 58: Coefficient of Variation of measurements taken on Kwale ceramics from Baleni.

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.