Charring patterns on reconstructed ceramics from Dunefield Midden: implications for Khoekhoe vessel form and function

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Abstract
Ethnographic observations from ceramic-using cultures around the world highlight a direct connection between ceramic vessel form and function. In southwestern southern Africa archaeological assemblages containing ceramic vessels associated historically with Khoekhoe pastoralists are heavily dominated by pots that conform to a very uniform shape – namely, amphora-like vessels with restricted necks and pointed bases. This paper uses charring patterns evident on the reconstructed ceramic assemblage from the late Holocene/pre-colonial Later Stone Age (LSA) site of Dunefield Midden, and additional ethnographic, ethnohistoric and experimental data, to identify which morphological attributes were adopted to facilitate the use of these vessels in cooking. It concludes that the observed charring patterns were caused by a cooking technique whereby the vessel bases were settled directly into the ‘soft’ cooking hearths at Dunefield Midden, and that the use of pointed bases represents a technological adaptation well suited to the Khoekhoean lifeway, one characterised by a high degree of mobility in largely arid landscapes.

1 Introduction
Pottery has been posited as an integral part of the LSA ceramic, or southern African ‘Neolithic’ cultural package (cf Sadr 2003), having arrived in the southern and southwestern Cape at roughly the same time as sheep (Avery 1975; Schweitzer 1979; Deacon et al 1978; Smith 1987; Sealy & Yates 1994; Henshilwood 1996). While the question has often been asked – for which tasks was the adoption of pottery so important? – it has seldom been addressed comprehensively. In fact, the functions for which various pottery forms were employed are an under-researched and poorly understood aspect of southern African LSA ceramic studies. Most recent work has instead tended to focus on the origins and timing of the introduction of pottery into different areas of southern Africa (Robertshaw 1978; Klein 1986; Smith 1987; Mazel 1992; Sadr 1998, 2003), establishing ceramic sequences in various regions (Sadr & Smith 1991; Sampson & Vogel 1995; Bollong & Sampson 1996; Sampson 1996; Sadr & Sampson 1999) and analysing temper compositions of potsherds as a means of distinguishing between the different ethnic identities of vessel manufacturers (Pineda et al 1990; Bollong et al 1993; Bollong et al 1997b). These approaches are all important for reconstructing post-2000 BP regional culture histories and understanding variability in LSA ceramic repertoires, but a working knowledge of why and how pottery was technologically advantageous to Khoekhoean (and eventually to at least some Bushman) groups’ economies is the key to determining the reasons for the initial adoption of ceramic technology.

Until now, the issue of functional variability in Later Stone Age ceramic assemblages has been largely ignored in southern Africa. This is true even of better-researched southern African Iron Age ceramics, as exemplified well by Whitelaw (1998:3) who in a regional overview states that ‘Archaeologists in southern Africa have done little work on establishing the precise function of vessels. In this section then, I focus on style’. This problem is even more pronounced in the western part of the sub-continent, where a substantial comparative ethnography for ceramic-using Khoekhoe or Bushmen groups unfortunately does not exist, as it does, for example, for the southern Bantu. Where such an ethnography could be at least partially developed, for
example among the modern descendents of the ‘Little Namaqua’ in Namaqualand (Webley 1982, 1986), ceramics have been replaced in modern times by wood, metal and plastic.

Likewise, analyses of LSA ceramic residues have suffered from a lack of adequate attention. The only studies to date come from a handful of geographically limited sites. This is surprising considering the successes those researchers who undertook these functional analyses have enjoyed. Bollong et al (1993), for example, positively identified δ13C values consistent with springbok meat from residues on grass tempered ceramic sherds from the upper Seacow River valley. Similarly, fatty acids similar in composition to seal blubber have been detected by Patrick et al (1985) on sherds from sites in the Western Cape using gas chromatography, and more recently by Copley et al (2004) using the same technique in combination with isotope mass spectrometry.

Ethnographic evidence from around the world shows us that vessel function is intimately related to vessel form (eg, Foster 1955; David & Hennig 1972; Rye 1976; Reina & Hill 1978; DeBoer & Lathrap 1979; Nelson 1985; Kramer 1985; Arnold 1985; Arnold 1991). Specific vessel shapes are particularly significant here, as they often possess combinations of attributes created to facilitate the task for which the vessel is employed, such as cooking or carrying and/or storing liquids. In this light, it is interesting to note that the range of recorded Khoekhoe ceramic vessel shapes is strikingly limited: by far the most common form is amphora-shaped pots with restricted necks and pointed bases. We do know from ethnohistorical and archaeological observations in the Western Cape and further inland that other vessel types such as bag-shaped pots as well as bowls were used. Dunn (1931:11), for example, notes that, ‘Besides the large ones used for cooking, or for holding water, were smaller ones like basins for holding food or for drinking from’. Yet in Rudner’s (1968) epic ceramic survey of the southern African coastline from Namibia to East London in the Eastern Cape Province, these forms were represented by only a handful of examples. Amphora shaped pots, by contrast, consistently dominated assemblages by over 95 per cent. If form does largely reflect function, as the ethnography strongly suggests, then two questions can reasonably be asked. First, for which functions was this relatively homogenous vessel shape so widely adopted? The above-mentioned chromatographic and isotopic studies, though limited in scope, have all served to highlight cooking as a principal function of Khoekhoe pottery. Although other functions, such as storage and transport, were evidently performed using these vessels, cooking was clearly central. With this in mind, the second question follows: which attributes of the typical amphora-like Khoekhoe vessel shape provided the adaptive advantages that facilitated cooking?

To begin to address these related questions this paper explores the adaptive technological relationship between cooking as a generalised operation on the one hand, and Khoekhoe vessel shape on the other. To this end, data are presented from the recently reconstructed ceramic assemblage at Dunefield Midden (DFM). DFM is a late Holocene/pre-colonial LSA open-air site situated on the coastal sandveld of Eland’s Bay, Western Cape Province, South Africa (figure 1). On all of the most completely reconstructed pots at DFM, as well as the majority of those that could be only partially refitted, substantial charring is evident on both the exterior and interior vessel walls, commonly accompanied by visibly adhering residues. As with other LSA ceramic assemblages in the southwestern part of the subcontinent, cooking is suggested as the chief function of the pots. This charring, moreover, forms a consistent pattern throughout the assemblage. It is suggested here that this patterning is a product of the cooking technique employed by the occupants of DFM – one whereby the bases of their vessels were being nestled directly into the coal and ash beds of their cooking hearths. In light of the questions this paper addresses, a combination of ethnographic and ethnohistorical observations is integrated with preliminary experimental data on replicated Khoekhoe pots to test the proposition that pointed bases of typical Khoekhoe vessels facilitated cooking.

2 Dunefield Midden

DFM, located approximately 180 km north of Cape Town, is situated c 600 m from the sea at the base of a Holocene dune cordon. This is one of many sites in the high, active dunefield that forms the coastal landscape surrounding Eland’s Bay. The region falls within the winter rainfall area of southern Africa, receiving 70 per cent of its rain between April and September. Average rainfall per annum is less than 200 mm (Miller 1987) and freshwater availability in the area of Eland’s Bay is markedly low. The February average maximum
temperature is 21.1°C; the July average minimum is 10.0°C (temperatures taken at Cape Columbine) (Miller 1987).

Eland’s Bay is situated at the interface between two of southern Africa’s major ecological zones, or biomes – the succulent Karoo biome to the north and the fynbos biome to the south (Rutherford & Westfall 1986; Mitchell 2002). Local vegetation is strandveld, providing a sparse patchy cover of sclerophyllous shrubs and grass. As a result, the dunes are highly susceptible to wind erosion, particularly in the summer months when the Atlantic anticyclone blows from the southeast (Visser & Toerien 1971).

Prior to excavation DFM was covered in places by upwards of 2 m of pale whitish sand of aeolian origin ‘totally without archaeological content’ (Parkington et al 1992). The site is sandwiched between this and the underlying matrix – an older yellowish/brown waterlain sand deposit with a high content of quartz pebbles (Ibid). This layer, dated by a suite of $^{14}$C dates between 600–700 BP, forms the living floor on which DFM’s occupants operated and subsequently left their material traces; it thus comprises DFM’s sole stratigraphic level (although there appears to be some limited overprinting on the southern part of the site).

The site’s basic structure comprises a number of features with interspersed and associated bone and artefact distributions. Features include dumping areas, ashy patches, hearths and roasting pits (Parkington et al in prep). The largest and most conspicuous feature...
is a massive heap of shells, mixed with bone fragments and ash, spanning the western periphery of the campsite. As such, DFM has been characterised primarily as a shell midden site, although these are by no means the sole faunal elements. A range of other fauna is abundant and particularly well preserved; the principal species, from most to least abundant, are seal, tortoise, small bovid, bird, eland, dassie, fish and other microfauna (Parkington et al 1992). Cultural remains include stone tools, ceramics and ostrich eggshell beads and fragments.

DFM is a particularly promising site with which to gain a fuller understanding of southern African LSA ceramic form and function because of the extent of the excavation and the short-lived period of occupation. The excavations exposed 860 m² of a horizontal surface on which was deposited the residue from an occupation in the late Holocene by a group who camped for no more than several months on the coast. (The economic and social identity of this group as foragers or herders is discussed below.) This relatively undisturbed living floor is unique in southern Africa because it represents a single occupation event and provides a wealth of spatial information about its prehistoric inhabitants. A large ceramic sample has been recovered, including whole vessels, which provides an unparalleled opportunity to examine such behavioural features as the range of vessel forms, sizes, decorative attributes, fabrics, surface treatments, and crucially, the associated evidence of vessel use in the form of residues and use-wear (Stewart in prep).

2.1 Hunters or herders?

At this point it is too early in the analysis of the DFM material to make any definitive statements about the exact nature of the occupants’ economy and related social structure, but it can be said that it seems to represent a mixed hunter-gatherer/herder archaeological signature. In either case, the occupants were using whole pots. This observation yields three possible social models that can be explored in the future. One is that the inhabitants of DFM were hunter-gatherers, perhaps closely related or equivalent to the historically recorded ‘Soaqua’ groups (cf Parkington 1984; Parkington et al 1986), who had developed a form of ceramic production and decorative techniques closely resembling that of their Khoekhoen neighbours with whom they probably competed for resources and perhaps occasionally served on a client basis. In the second model, the DFM hunter-gatherers were engaged in a trading network with nearby pastoralists from whom they acquired vessels in exchange for goods easily procurable within their economic (hunter-gatherer) niche (perhaps with a particular focus on seals?). The third model posits a group that inhabited DFM as primarily herders. A herder occupation may explain several odd archaeological patterns, such as the intermediate ostrich eggshell bead diameter sizes, enormous amount of seal remains, copious chew marks on seal bones perhaps indicating the presence of dogs (Klein & Cruz-UrIBE 1994), and large quantities of ceramics that when reconstructed form a number of whole vessels. Furthermore, the co-occurrence of a lithic assemblage dominated by backed bladelets (Orton 2002), and a fauna dominated by seal and shellfish remains may be taken to mean that DFM represents the remains of a special purpose hunting/collecting station provisioned by herders for exploiting marine resources along the adjacent Eland’s Bay coastline (cf Klein & Cruz-UrIBE 1994).

It should be kept in mind, however, that these scenarios need not be seen as mutually exclusive possibilities. Sadr (1998, 2003, 2004) has recently made a tantalising case, looking to the archaeology of numerous sites in the western portion of the subcontinent, for different degrees of emphasis on hunting and herding as two complementary adaptations in what was very probably a much more fluid range of economic behaviours than previously envisaged. Further spatial research is needed to clarify this issue as it pertains to the economic and social system of DFM’s inhabitants.

2.2 The DFM ceramics: form and function

After just over a year of comprehensive conjoining exercises, a minimum number of vessels (MNV, n=19) is now established for DFM, although a slightly higher count of 24 or 25 is likely. Four vessels are reasonably complete: one (vessel 18) is whole; two others (vessels 4 & 17) are over 75 per cent reconstructed; while another (vessel 19) is roughly 40 per cent complete (figure 2). All four are lugged, narrow-necked, and have conical or sub-conical bases. All other refitted sets in the assemblage conform more or less to this shape, so it is a near certainty that every vessel from the site had the same form.

As noted above, the most obvious clue to vessel function at DFM is the nearly ubiquitous occurrence of charred residues adhering to the walls, both interior and exterior, of most of the vessels. Where actual
residue is absent, substantial black or even light grey discolouration of the sherds suggests that the vessel was (probably repeatedly) exposed to open flame. On each of the four most completely reconstructed vessels, moreover, the discolouration and/or residue on both surfaces forms a consistent pattern: a broad band of charring with patches of residue beginning about one-fifth of the vessel height above the base, and running upwards to where the shoulder curves inwards just before it meets the neck (figure 3). This is also apparent to a lesser extent on many of the other less complete refitted sets, such as three neck/shoulder reconstructions, as well as three body-less bases. Evidently the same parts of different pots (ie, the central
bodies) were being burnt, while other parts (ie, the bases and necks) were remaining relatively pristine. Both the largest and the smallest two vessels at DFM exhibit this pattern of charring, so it occurs independently of vessel size. The presence of this band on sherds from all parts of the site rules out the accidental scorching of vessel fragments in active hearths or roasting pits, or by natural bush fires.

The combined evidence suggests that the most completely reconstructed vessels at DFM were used for cooking, and that the rest were probably used for the same purpose. This is in agreement with numerous historical accounts of European travellers who observed Khoekhoe groups using such pots for cooking, both along the Cape and further in the interior (Albrecht 1810; Dunn 1931; Schapera 1933; Forbes 1986; Raper &

Figure 3 The charring patterns on the vessel interiors of the four most completely reconstructed vessels at DFM. Clockwise from top left: vessel 19, vessel 4, vessel 18 and vessel 17
Boucher 1988; Smith & Pheiffer 1992; Bollong et al 1997a). How then can this recurring charring pattern be explained? Is it tied to the conspicuous uniformity of Khoekhoe vessel shape? Taking into account the ethnographic correlation between form and function, yet being careful to avoid meaningless generalisations, it is reasonable to search the ethnographic literature for what could potentially be a socially informative relationship between cooking (as a vessel function) on the one hand, and lugged, narrow-necked pots with pointed bases (as a vessel shape) on the other.

3 Ethnographic evidence

Ethnographic observations from many diverse ceramic-using cultures note that pots shaped like Khoekhoe wares are commonly used to transport and/or store liquids (eg, Thompson 1958; David & Hennig 1972; Arnold 1978a, 1978b, 1985). Restricted necks, designed to prevent spillage, are perhaps the most obvious feature associated worldwide with liquid-carrying (as well as storage) vessels (Freestone & Gaimster 1997). Lugs are also designed to facilitate transport, and are thus a similarly widespread feature of liquid-carrying vessels, particularly among societies characterised by a relatively high degree of mobility or those that are situated long distances from certain resources (usually water sources). In Nurar, Pakistan, for example, water-carrying vessels are invariably made with lugs by which they can be lashed to camel saddles (Rye & Evans 1976). Closer to the region of discussion, many modern pastoralist and hunter-gatherer ceramic-using groups of Kenya use lugged water- and honey-carrying vessels, including the Okiek (Blackburn 1973), Endo (Welbourn 1989), Pokot, Il Chamus (Brown 1989a, 1989b) and Samburu Dorobo (Brown 1989c). As Blackburn (1973:61) notes, for example,

Since the Okiek are semi-migratory they occasionally transport their possessions. It is for this reason that most Okiek pots have handles which can be threaded with the bark of a sapling to make a makeshift rope for carrying the pot.

Though seemingly less often so than constricted necks and lugs, conical or sub-conical bases are also sometimes adaptations used for carrying goods, as with Roman amphorae.

Occasionally, vessels with all three features inherent to typical Khoekhoe vessels – lugs, narrow mouths and pointed bases – can be found in modern ethnographic settings, each contributing to a unified adaptive form which eases transport. In Guatemala, for example, carrying water long distances is facilitated by vessels with restricted necks to prevent spillage, lug-like handles used for suspension from the head by means of a tumpline and a pointed base which can be easily rested upon the hip or back during long trips by foot (Reina & Hill 1978). This shape also increases the volume of the vessel, thus cutting the number of trips necessary to the water sources. In different parts of the country, moreover, these vessels assume slightly different morphological permutations of features, such as varying neck length, number and size of handles, angle of the base etc. These differences depend on factors such as specific groups’ motor habit patterns (in this case, carrying preference), distance to water sources and local topography (ibid). The overall form, however, remains essentially the same.

Cooking pots in many cultures, by contrast, sometimes have handles, but much more often have relatively wide mouths and rounded bases. Handles obviously facilitate pot manipulation both during cooking and upon serving, while the predominance of rounded bases is due, at least partly, to the minimisation of thermal gradient that this shape affords (Rye 1976; Arnold 1985). With respect to the latter, the heat transferred through contact with a cooking fire spreads more evenly along a surface with no sharp changes in direction. They are thus better suited to tolerate thermal shock and thermal expansion (Rice 1987). However, rounded bases are often seen as simply more convenient cooking pots than other forms. The Okiek, for example, prefer round bases for cooking because ‘The flat bottomed aluminium pot cannot be wedged among the three [hearth] stones as securely as a round-bottomed [earthenware] pot’ (Blackburn 1973:63). Similarly, historic rounded-based Zulu cooking pots or ikhanzi were shaped as such to accommodate their placement on ‘three cooking stones’ (Krige 1936:397). Thus, if cooking on hearth stones is the standard technique employed, rounded bases are commonly produced to the exclusion of other forms.

It therefore seems that the shape of the vessel base is actually determined to a large degree by any given society’s preferred method of cooking. This has obvious implications for understanding the potential advantages of the Khoekhoe vessel shape. If cooking was indeed a primary function for which these conically based vessels were produced, as the bulk of the evidence suggests, then what cooking method might necessitate the choice of this shape? Ethnographic data show that...
cooking pots with pointed bases are often designed to facilitate nestling the vessels directly into the embers of the hearth. This is well illustrated by the pottery-using Amahuaca of eastern Peru. The Amahuaca, who make up the community of Chumichinia, prefer a flat-bottomed cooking vessel because this can be easily placed over hearths built in their platformed dwellings (Dole 1974). Most Amahuaca, however, do not live in platformed houses, but rather have residences with earthen floors. In the majority of the villages cooking pots are instead characterised by:

...a pointed base, out-slaning sides and constricted neck. This shape is an adaptation to the Amahuaca method of cooking which consists of placing firewood around a conical depression in the dirt floor in which the vessel is placed. Since stone or non-combustible material is scarce in the tropical rain forest, cooking pots can not [sic] be easily raised above the fire. This shape thus eliminates the need for rocks or ceramic pot supports to raise the cooking vessels above the fire (Arnold 1985:150).

We can see from this example that the preferred method of cooking is intimately related to available natural resources. It is evident in this case that producing a cooking vessel with a conical base that can be pressed into a hearth directly can serve to sidestep the need to appropriate suitable raw materials with which to construct a hearth structure. This may have been an attractive adaptive feature for the Khoekhoen, whose principal environment was the arid, largely treeless western half of the subcontinent. It is precisely in the driest regions where surface scatters reveal Khoekhoe pottery densities at their highest, most notably in the form of pottery-bearing shell middens which archaeologically dominate southern Africa’s western shoreline from southern Namibia to the Western Cape (Rudner 1968). Indeed, some regions, such as Namibia’s !Khuiseb delta, were only substantially settled after the acquisition of ceramic technology. As Kinahan (1991:115) notes, ‘...the dating of shell middens suggests that intensive occupation of the coastal dunes might only have begun about 2000 years ago, with the introduction of pottery’. The strong association between these environmental settings and the multi-regionally homogenous conical vessel form suggests that a practical, adaptive relationship exists between the two. Indeed, it seems logical that settling a vessel base into the sandy substrate of the Namaqualand coast, for example, or even that of the interior Karoo (certain parts of which, again, contain very dense ceramic accumulations) (Sampson 1985; Sadr & Sampson 1999) would offer a convenient alternative to building a cooking structure. A shape that made cooking quick and easy would appeal to what were clearly highly mobile people relative to most other ceramic-using societies.

The hypothesis proposed here is that the conical base cooking vessel form was an adaptation to the preferred Khoekhoe cooking technique whereby the vessels were pressed directly into the cooking hearths. This interpretation is supported archaeologically by the patterns of charring evident on the reconstructed ceramic assemblage at DFM. Before discussing the data from the replication experiment, a brief review is given of the few ethnohistorical accounts available that actually document ceramic vessel cooking methods used by southern African ceramic LSA peoples in contact times. Although scant, at least two reliable accounts support the cooking hypothesis and supplement the ethnographic observations offered above and the experimental data given below.

4 Ethnohistorical accounts of cooking techniques

Like the particulars of the foods themselves, ethnohistorical references to the methods by which foods were cooked are scarce. In a comprehensive survey of all historical documentation pertaining to observations of Khoekhoen and Bushman Pottery in the Cape Colony, Bollong et al (1997a) found only three references to cooking methods. One, a description by Dunn (1931) of Khoekhoe ware being used at a campsite near Zendeling’s Drift, contains a number of valuable statements including a comment regarding vessel use. He notes that Khoekhoe vessels vary in shape

...ranging up to a capacity of three gallons or more; smaller ones were used for drinking purposes. The cooking pots had a conical bottom, so that they could be set between three stones when in use... (Dunn 1931:87–88)

It is unclear whether Dunn means that the vessels were set between three stones during the actual cooking process or afterwards when food was being consumed from them (or both). The former seems a more plausible interpretation, and if this is indeed what Dunn meant then he provides an association between conical-based pots and this method of cooking. If the latter is the case, Dunn’s description echoes a painting by Daniell (1804–1806), entitled Boschjensmans frying locusts, in which
a Bushman camp is depicted with a large spherical cooking pot resting on two stones. The third stone, completing the tripod, is implied but obscured behind the vessel from the artist’s perspective. The vessel is clearly not positioned over a hearth. In any case, the passage in which the above statement by Dunn occurs was likely not the product of direct observation, but rather speculation based on observations of vessel form from surface sherds. As Bollong et al (1997a:276) note, ‘Dunn seems not to have consulted any local Khoi servants when attempting a general description of Khoi ware’. If this is true, both of the above interpretations are open to question.

The other two instances of cooking methods highlighted by Bollong et al (1997a) both involve Bushman groups and include comments made by Wilhelm Bleek’s informant, //Kabbo, and a brief passage on the subject by the English traveller JE Alexander (1838). Both sets of observations are unfortunately very vague. With respect to the former, after offering a detailed account of (flat-bottomed) Bushman vessel manufacture, //Kabbo goes on to say, ‘the pot had stood upon the fire; he took the pot off the fire’ (Bleek & Lloyd 1911:123–124). Bollong et al (1997a:280) take these comments as proof that ‘…the base rested directly on the embers of the fire’. While this is a tempting interpretation, however, it is by no means self-evident from such an ambiguous statement. For example, we need not expect //Kabbo to have said, ‘the pot stood upon stones which stood upon the fire’, or some such specification. Alexander’s (1838) comment is equally difficult to interpret accurately. Having come across an elderly Bushman and several young children north of the Orange River, he notes, ‘… a third [child] was attending to a small conical shaped earthen pot which, full of some green leaves, was cooking on the fire’ (Alexander 1838:231). Again, although this may suggest that the pot stood directly upon the hearth, its exact placement is essentially unclear and, therefore, so too is the cooking method employed.

Another potentially informative, but again highly ambiguous comment comes from Vedder’s (1938) description of a typical Herero settlement in what is present-day Namibia. Although a Bantu-speaking people, the Herero made pottery similar in shape to that of the Khoekhoe, and thus perhaps also employed a similar cooking technique. Vedder (1938) says, ‘It was women’s work to make earthenware pots, with narrow necks, wide middles and pointed bottoms, and to bake them in hot wood-coals’. On first reading, it seems likely that Vedder means the pots were fired, rather than cooked, in coals. If so, this description is reminiscent of a late seventeenth century account of Khoekhoe pottery making by Grevenbroek: after the vessel is formed and air-dried, ‘… the pot is stuffed with dry cow dung, provided with handles and placed on a bright fire’ (Schapera 1933:253). Vedder’s comment is particularly tricky to decipher considering both firing pots and cooking are tasks which fall within the female labour domain. If, however, we can take ‘bake them in hot wood coals’ to mean the process of cooking, then this seems to point to a method of cooking by which the conical base was dug into the hearth.

Another Namibian ceramic-using people, the Dama, a somewhat anomalous Khoekhoe-speaking Bantu society, historically made vessels very similar in form to neighbouring Khoekhoe groups including bag-shaped or necked vessels with pointed bases (Rudner 1957; Du Pisani & Jacobson 1985). Gurich (1891), whilst travelling through the Brandberg, described the technique by which the Dama used their vessels to cook grass seeds. Although his description hints at a cruder ceramic technology than the generally well-fired, thin-walled Khoekhoe wares, the overall vessel shape is equivalent:

…for cooking they use thick, large pots, which are made of coarse material and have scarcely been fired; these bulge in the middle and are placed in the ash with the lower pointed end (Gurich 1891:140).

With this comment Gurich provides a direct link between the conical-base form and related mode of cooking. Evidently the Dama took advantage of the pointed shapes of their cooking pot bases by settling them into the burning contents of the hearths.

By far the least ambiguous ethnohistorical reference to cooking techniques employed by the Khoekhoen themselves comes from an early-mid eighteenth century (1732–1741) German visitor to the Cape named Mentzel. Mentzel’s (1944) first-hand account, published in 1778, details the process of Cape Khoekhoe pottery manufacture. He begins with a statement that, in the course of admonishing the Khoekhoe vessel form as clumsy, ironically provides an invaluable clue as to the typical cooking method employed:

The women also make the cooking pots. These pots are so unsuitable and unwieldly that they are more round than flat-bottomed and cannot stand upright, but have to be put in the sand both when fire is made and on other occasions to prevent
them from falling over (Mentzel 1944:296). The fires to which he refers are clearly cooking (rather than firing) hearths; he gives the clear impression that he is speaking of finished, fired vessels rather than those in the leather-hard stage such as were mentioned by Grevenbroek and perhaps also by Vedder. That he notes the pots were 'more round than flat-bottomed' is likely an over-simplification. He surely would have encountered conical-base forms more often than not. In any case, it is clear from Mentzel's account that the Khoekhoen he observed at the Cape cooked by placing the base of the vessel, whether for support or not, 'in the sand'. This echoes Gurich's observations among the Dama. We therefore have a first-hand, explicit account of Khoekhoe cooking technique – one that entails direct insertion of the base of the vessel into the embers of the cooking hearth.

5 Experimental cooking

Experimental cooking was undertaken to determine which cooking technique was the most likely to have caused the patterned charring apparent on the reconstructed DFM vessels. As already noted, because these patterns are so alike on individual vessels regardless of vessel size or spatial positioning on the site, it was assumed that 1) the majority of the vessels were used for cooking and 2) that the same method of cooking was responsible for the pattern of discolouration/residue observed.

5.1 Methods

Replica Khoekhoe ceramic vessels were produced for the purpose at hand (figure 4). A main concern, of course, was to create vessels with physical characteristics – ie, shape, paste, size, features, etc – as closely akin as possible to the ceramic LSA models on which they were based. It must be remembered, however, that the ultimate goal was to generate as much charring of the vessels as possible in a very short amount of time. In other words, an effort was made to reproduce in a single day what perhaps took many weeks, and more probably many months, to accumulate. With this in mind, certain choices were made regarding the physical makeup of the pots that would serve to augment the vessels' susceptibility to heat, and thus much more quickly reproduce the 'normal' charring process resulting from episodes of repeated cooking in prehistory.

Three pots were chosen among eight to use in the experiment; all three have sub-conical bases. The other five were kept for future experimentation with analyses of charred residues. It is recognised that a larger replica sample on which to perform the experiments would have given more statistically meaningful results, but funding constraints made this difficult. The experiment was undertaken on a beach near Cape Town. To further

Figure 4 The three experimental replica Khoekhoe vessels. From left: Vessel SUSD, Vessel NSLD and Vessel TPD
ensure maximum residue adhesion, an assortment of animal (lamb, beef, pork and chicken) fat and bone with which to cook was acquired from local butchers. The pots were filled about half way with a mixture of the animal products and water. Three small fires were made with dry, fast-burning firewood. The fires were approximately 50–70 cm in diameter; this is the roughly the average size of most of the features at DFM which have been designated as domestic hearths (Parkington et al in prep). A different cooking technique was applied to each of the three vessels. These are as follows:

- **Vessel SUSD**: One vessel was suspended over a fire from a height that varied from 3–5 cm, depending on the state of the burning wood. (The presence of lugs in post 850 AD assemblages suggests that suspension may have been one cooking technique.) To suspend the vessel, wire was wrapped around the handles and attached to an iron pipe, which rested between two wooden trestles. These materials were used out of convenience, and are obviously not reproductions from archaeological finds. The flames were allowed to, and usually did, make direct contact with the vessel base. The vessel base did not, however, come into contact with the coals.

- **Vessel TPD**: Another vessel was placed on a tripod of three stones situated on a base of coals, and as such was called Vessel TPD. The base of the vessel made direct contact with the coals yet did not penetrate the sub-surface of sand.

- **Vessel NSLD**: A final vessel was nestled into and through the coals, penetrating the underlying sand to a depth of c 5 cm. No supports, such as rocks, were provided – the vessel stood very firmly by itself in the sand, ash and coals.

The three pots were left to cook for a period of nine hours. The fire was continually stoked and re-supplied with fresh wood as needed. At no time were the pots moved; their positions remained constant with the exception of Vessel SUSD, which often swayed in the light southeasterly coastal breeze. Similarly, the contents of the pots were not stirred or in any way disturbed so that the residues would settle more quickly on the vessel interiors. Flat beach cobbles were rested over the vessel rims to trap the heat and thus again expedite the cooking process.

### 5.2 Results

#### 5.2.1 Vessel SUSD

The state of the food and resulting charring after cooking with Vessel SUSD showed that this cooking method was by far the least effective of the three. This was the only vessel that still had water left in it after the extended cooking period. Moreover, much of the animal fat remained somewhat intact, the vessel having not reached temperatures necessary to liquefy it. Part of the problem may have had to do with the wind diverting the flames sideways, away from the vessel base. However, the wind was minimal on this particular day; the flames regularly made contact with the base and were often high enough to lick half way up the vessel walls (figure 5). The primary difference was that unlike the other two samples, the base of Vessel SUSD never came into contact with the much higher temperatures of the coal bed.

Most significantly for our purposes, the pattern of charring on Vessel SUSD was very different from that of the vessels at DFM. While the vessel exterior was relatively well coated in carbon stain from the base to just below the shoulder, very minimal residue adherence and, indeed, even discolouration, actually occurred on the interior of the vessel. Where it did occur, the carbon staining was never anywhere enough to turn the inside black. Instead, the clay took on a deeper shade of red. This reddish discolouration was confined solely to the area of the base, running up the walls to a height of only 5 cm.

#### 5.2.2 Vessel TPD

In direct contrast to Vessel SUSD, the state of the cooked food within Vessel TPD indicates that the tripod technique was the most effective in terms of the temperatures reached and the speed with which they were attained (figure 6). Within two hours of placing the pot on the fire, loud pops and sizzles began issuing from the animal products inside. This continued until about an hour before the pot was removed from the tripod when it became clear that all of the contents of the vessel had completely liquefied. Upon dumping the contents, all that was left in solid form were highly carbonised bone fragments. Some of the fat had turned into a thick, candle-like wax. The rest was entirely liquefied into a thick, black, tar-like charred substance that completely coated the interior walls.

After the tar-like carbonised material had been removed from the inside of the pot, it became clear that, like Vessel SUSD, the pattern of charring on the interior walls was very different to that encountered at DFM. The even diffusion of the heat and high temperature caused the entire lower two thirds of the vessel interior to become thickly encrusted with charred residue. The charring runs from the very bottom of the base to a height of 25 cm, or just below the vessel shoulder. The exterior of the vessel is also carbon stained, albeit much more unevenly than the interior; it reaches up to
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Figure 5 Flames licking the exterior walls of Vessel SUSD

Figure 6 Vessel TPD two hours into the cooking process; the base is already blackening
the shoulder in places (25 cm), but only half way up the exterior wall in others (9–10 cm).

5.2.3 Vessel NSLD
The food in Vessel NSLD cooked more extensively than Vessel SUSD, but considerably less so than Vessel TPD. Much of the bone was intact, and a considerable amount of the fat remained a solid form. That said, the food was very thoroughly cooked through, and all of the liquid had evaporated by the end of the cooking session. Like Vessel TPD, popping and sizzling of the

Figure 7 Vessel NSLD with Vessel TPD in the background, four hours into the cooking process

Figure 8 Vessel NSLD (right) six hours into the cooking process. Note the similarity in the exterior charring pattern on the bottom half of the vessel with that of a Khoekhoe vessel from the Eastern Cape (left) (curated in the Albany Museum, Grahamstown)
The carbon staining on the exterior walls of Vessel NSLD is much less extensive than that on the DFM vessel exteriors. The difference is particularly obvious around the bottom half of the Vessel NSLD exterior where the staining is much less abundant and more mottled, occurring in isolated patches and thin bands. At DFM the vessel exterior bottom sections are commonly blacker, although considerably less so than the walls. However, had the vessel been exposed to repeated episodes of burning over weeks, months or longer, as the DFM vessels probably were, the extent of carbon staining on the vessel bottom would likely be much greater. The area ranging from the vessel midline to just above the shoulder, on the other hand, is quite heavily and evenly stained, as are portions of the neck and rim (figure 8). This is more in keeping with the exterior patterns at DFM.

Most importantly, the pattern of charring on the interior walls of Vessel NSLD much more closely matches that observed on the more completely reconstructed vessels from DFM than do the other two in the experiment. Evidence of burning begins 5 cm up from the base (precisely where the vessel met the sand sub-surface) and runs upward to roughly 2 cm above the vessel’s midsection, forming a band of discolouration and/or charring c 15 cm thick. By contrast, both the base and upper half of the vessel are largely ‘clean’, as is the case at DFM.

While there are differences between the interior charring pattern of Vessel NSLD and that of the DFM assemblage, again I believe these are circumstantial and largely a reflection of the comparatively limited time this vessel has spent exposed to heat. These differences are two-fold.

1. The first 5 cm of burnt interior wall above the ‘clean’ base section has very little blackened, charred material adhering to it. Instead, the clay has dramatically changed colour from the typical earthenware terracotta to a much lighter whitish grey. This section was in direct contact with the coal bed; the discolouration, therefore, is the result of a high degree of carbonisation of the clay. Still, the lack of adhering charred residues is puzzling. It is suggested, however, that the cooler, sand-submerged base directly beneath this area kept it cool enough to prevent charring and consequential encrustation of the contents. A similar band of light discoulouration directly above the base has not been observed on any DFM vessel.

2. The charring within Vessel NSLD does not reach as high up the interior wall as it typically does in the DFM assemblage. As noted, the charring stops
opposed lugs, mouth diameters increase and vessels around AD 850 (single spout vessels are replaced by two). A change in the typical Khoekhoe vessel form occurs both geographically and temporally. When a major ceramic ware change takes place, the conical base is exceptionally stable bases. More than any other attribute of Khoekhoe vessels, the characteristic Khoekhoe conical-shaped base is intrinsically linked to the vessel function, and was thus retained even when other attributes were in the process of transformation. Over a half century ago, Schofield (1948) speculated about why Khoekhoe vessels are typified by this conical base form. His most illuminating explanation corresponds with the hypothesis presented in this paper and is supported by the above ethnographic, ethnohistoric and experimental data: ‘The pot with a pointed base can be easily pressed into the hot ashes of a fire, where it will boil more readily than a pot with a round or a flat base’ (Schofield 1948:66). In light of the evidence from the largely reconstructed ceramic assemblage at DFM — namely the prevalence of patterned charring on the vessel walls, and corresponding absence of discolouration or residues on the bases, shoulders and necks — this paper supports Schofield’s presumption. Armed with these insights, the next step in the current project is to develop statistically robust observations of charring patterns based on a larger sample of experimental firings and to combine these data with residue analyses on different DFM vessels, as well as different

These differences notwithstanding, the overall picture is one of marked similarity in charring patterns on the interior walls between Vessel NSLD and those at DFM (figure 9). The contents of Vessel NSLD were cooked by placing the vessel in a freestanding position; the base nestled into the sand underlying the hearth. It is therefore suggested that this was the cooking technique employed by the inhabitants of DFM.

6 Conclusion
Archaeologists need to analyse southern African LSA ceramic functional variability in more concrete terms. To this end, reconstructed vessel shapes can be significant indicators, particularly when examined in conjunction with techniques such as organic residue analyses. Arnold (1985) notes that vessel shape modifications commonly reflect both a desire for increased technological effectiveness of the vessel for the task at hand, and also a demand for more convenient forms that can accommodate users’ motor habits. As such, changes in shape often mirror changes in economy and shifting societal trends. Indeed,

Vessel shapes are behaviourally significant to a culture and provide important behavioural data about the society. Cultural change can be identified in a society when new shapes enter or leave the ceramic repertoire through time. New shapes suggest new utilitarian or religious uses for ceramics... (Arnold 1985:234)

The ethnographic data demonstrate very strong relationships exist between vessel shape, function and social change; this has significant implications for archaeologists. In this light, the homogeneity evinced in the classic Khoekhoe amphora-like vessel form is intriguing, and particularly the predominance of conical bases. More than any other attribute of Khoekhoe ceramic wares, the conical base is exceptionally stable both geographically and temporally. When a major change in the typical Khoekhoe vessel form occurs around AD 850 (single spouts are replaced by two opposed lugs, mouth diameters increase and vessels become generally larger) (Sadr & Smith 1991), the pointed shape of vessel bases remains completely unmodified. These morphological shifts were thought until recently to reflect corresponding changes in function from dairying (for the older spouted wares) to cooking (for the newer lugged wares). Through an analysis of organic residues from sherds recovered at Kasteelberg D, however, Copley et al (2004) have shown that, rather than dairying, cooking as a primary Khoekhoe vessel function actually precedes the increase in vessel sizes and adoption of lugs. We therefore have two chronologically distinct Khoekhoe vessel forms, both used chiefly for cooking, which differ in all other attributes bar one: a pointed base. Being mindful of the above-mentioned ethnographically observed relationship between form, function and societal change, this again supports the idea that the characteristic Khoekhoe conical-shaped base is technologically associated with cooking, and was thus retained even when other attributes were in the process of transformation (perhaps to accommodate changes in more marginal functions or smaller scale changes in cooking habits). More specifically, the preliminary experimental data described here suggest that by nesting the bottom of their vessels directly into the coals of the hearths, the inhabitants at DFM were able to take advantage of the conical base shape — a form that was perhaps designed to facilitate this cooking technique.

Over a half century ago, Schofield (1948) speculated about why Khoekhoe vessels are typified by this conical base form. His most illuminating explanation corresponds with the hypothesis presented in this paper and is supported by the above ethnographic, ethnohistoric and experimental data: ‘The pot with a pointed base can be easily pressed into the hot ashes of a fire, where it will boil more readily than a pot with a round or a flat base’ (Schofield 1948:66). In light of the evidence from the largely reconstructed ceramic assemblage at DFM — namely the prevalence of patterned charring on the vessel walls, and corresponding absence of discolouration or residues on the bases, shoulders and necks — this paper supports Schofield’s presumption. Armed with these insights, the next step in the current project is to develop statistically robust observations of charring patterns based on a larger sample of experimental firings and to combine these data with residue analyses on different DFM vessels, as well as different
parts of the same vessels. This functional approach will enable us to refine further our understanding of Khoekhoe intra-assemblage vessel variability based on this exceptional site.

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